Report No.:

Improving Accessibility to Transport for People with Limited Mobility (PLM)

A Practical Guidance Note

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Middle East and North Africa Region

Acknowledgements

In preparing this Guidance Note, the following documents were extensively reviewed and quoted:

- ❑ International Best Practice in Accessible Public Transportation for Persons with Disabilities, published by UNDP in 2010.

- ❑ Improving Transport Accessibility for All, published by the European Conference of Ministers of Transport (now the International Transport Forum) in 2006.

- ❑ Overseas Road Note 21 Enhancing the mobility of disabled people: Guidelines for practitioners, published by the Department for International Development (DFID) and TRL in 2004.

- ❑ Inclusive Mobility, published by the UK Department for Transport in 2002.

Many other sources of advice on accessible transport are cited in this Guidance Note. All sources are acknowledged and included in the bibliography in the associated volume of appendices to the document.

CONTENTS

1. INTRODUCTION

This document has been developed for use by World Bank Task Team Leaders in designing and implementing transport projects in the developing world. It aims to provide practical guidance on how best to include consideration of accessibility for people with limited mobility (PLM). It draws on previous research, existing standards and guidelines and combines them with practical case study experience of delivering accessible transport in both developing and developed nations.

A. PEOPLE WITH LIMITED MOBILITY

"People with limited mobility" (PLM) is a deliberately broader term than "people with disabilities", as it includes other people who have transport difficulties but might not regard themselves as being disabled. These include, for example, older people who are frail, pregnant women, parents with small children, passengers with luggage, visitors or tourists and people with temporary impairments such as a broken leg. While disabled people are a primary focus, the definition of people with limited mobility (PLM) considered within this Guidance Note therefore also encompasses this broader range of users with mobility constraints and needs.

B. DISABILITY IN THE DEVELOPING WORLD

There are many definitions of disability, although those based on the "social model" rather than the older "medical model" generally have greater support today. One of the more widely used is one suggested by the United Nations - *"disability results from the interaction between persons with impairments, conditions or illnesses and the environmental and attitudinal barriers they face. Such impairments, conditions or illnesses may be permanent, temporary, intermittent or imputed, and include those that are physical, sensory, psychosocial, neurological, medical or intellectual."*

The UN estimates that between 6% and 10% of people in developing countries experience a disability – equivalent to some 400 million people worldwide (UN Enable, 2011). In developing countries disabled people are more likely to be among the poor, as exclusion from economic, education and healthcare opportunities due to difficulties in travelling around often prevents disabled people from breaking out of poverty. This applies to people who experience any of the range of physical, sensory, psychosocial, neurological, medical or intellectual impairments included in the UN definition.

The UN Convention on the Rights of Persons with Disabilities (UNCRPD) and its Optional Protocol, signed in May 2007, recognizes that obstacles and barriers to indoor and outdoor facilities should be removed to ensure equal access for all members of society; including people with disabilities. The convention has been ratified by over 100 countries worldwide, and as the convention moves forward, major institutions such as the World Bank need to continue addressing the needs of disabled people in developing countries.

C. INTERNATIONAL POLITICAL CONTEXT AND RATIONAL FOR ADDRESSING DISABILITY ISSUES

The UNCRPD is currently providing the catalyst for international agencies and national governments to improve the equality of public service provision for people with disabilities across a host of themes. However, since the end of the Decade of Disabled Persons (1983-1992), the drive to include people with disabilities in development efforts has gathered momentum through a move towards socially inclusive approaches to designing poverty reduction strategies for implementation in developing regions. In so doing many

international agencies have developed research and/or policies that not only promote a commitment to social inclusion in general, but to also target the inclusion of marginalized groups, specifically including people with disabilities.

At the time of writing this Practical Guidance Note the equality focus in many developing regions is often specifically upon improving the accessibility and inclusion of services and society for disabled people, and across genders. Approximately 80% of the world's disabled people live in a developing country, while 80-90% of disabled people of working age are unemployed and one third of school-age children do not receive education because they are disabled, or because they are caring for a disabled family member (Frye, 2011). In some developed countries and regions this has broadened further to include the promotion of age, transgender, sexuality and income equalities alongside those relating to disability.

The World Bank and WHO report on disability (World Health Organization and World Bank, 2011) confirms that "Across the world, people with disabilities have poorer health outcomes, lower education achievements, less economic participation and higher rates of poverty than people without disabilities". While this is partly because people with disabilities experience barriers in accessing services that wider society takes for granted, these difficulties are exacerbated in less advantaged communities. The value of inclusive policies that address disability issues is therefore significant, and realised through the impacts of disabled people's increased economic activity, social value, quality of life; reductions in demand for social welfare; as well as improved public awareness of the contribution that disabled people can make to national wealth and culture.

D. UNIVERSAL DESIGN AND UNIVERSAL ACCESS

In designing and delivering transport projects, the ideal is to embrace the "universal design" concept, and this is a theme that runs throughout this Guidance Note. This is the concept of creating environments that respond to the widest range of the population possible, including the full range of people with limited mobility. The aim of transport projects should therefore be to design and operate transport systems that are easy for everybody to use ("universal access"). Most measures that help people with limited mobility also help everyone else. For example, everyone benefits from pedestrian paths and streets without potholes, and from easy-to-read destination signs on buses.

E. TRIP CHAINS

An important concept that needs to be considered in achieving accessible transport for PLM is that of the "trip chain" (Ling Suen et al, 1998). A typical trip consists of many links (for example, home to starting bus stop, bus stop to vehicle, ride in vehicle, vehicle to destination bus stop, bus stop to entrance of destination building). If any single link in the chain is not accessible for PLM, then the trip often becomes impossible. In transport projects, every link in the trip chain therefore needs to be considered and designed or improved as necessary. Simply focussing on one part of the chain (e.g. accessible public transport vehicles) without considering other parts of the chain (e.g. the pedestrian footway to the bus stop) will not deliver accessible transport for PLM.

F. PURPOSE OF THIS GUIDANCE NOTE

Barriers to addressing the needs of PLM are often a product of a lack of information for transport professionals and facility designers, combined with limited resources. To assist client countries with implementing the principles and binding obligations of the UNCRPD, it is clear that World Bank Task Team Leaders (TTLs) need to understand how to build in accessibility for disabled people in the design and implementation of transport projects.

This Guidance Note therefore aims to aid World Bank TTLs when specifying and managing Bank funded transport projects in order to improve the accessibility of transport systems for People with Limited Mobility (PLM). It is intended to serve primarily as a point of reference for TTLs on how to include, and improve; the accessibility of PLM in Bank supported transport operations, as well as being useful for other organizations and government agencies. The document has been prepared by Integrated Transport Planning Ltd, with the support of expert advisers Tom Rickert of AEI and Philip Oxley, on behalf of the World Bank's Trust Fund for Environmentally and Socially Sustainable Development (TFSSD).

G. STRUCTURE OF THE GUIDANCE NOTE

Following this introductory chapter, Chapter 2 provides concise technical descriptions of different transport accessibility measures, of their costs, benefits and implementation issues, and of relevant standards and sources of further detailed design guidance. These are illustrated with case study examples. In Chapter 3 these accessibility features are gathered into ranked lists to which TTLs may refer in order to see which measures represent low cost options, and those which are likely to have the best benefit/cost relationships.

Chapter 4 sets out information on relevant regulatory and institutional framework issues. Case study examples are used to show the different roles and responsibilities of the various institutions that may be involved in delivering accessible transport systems for PLM and ensuring their continued sustainability once the involvement of donor funding agencies and delivery bodies ceases.

Chapter 5 summarises potential funding sources and mechanisms for providing accessibility improvements for people with limited mobility. These sources can in some circumstances provide additional finance to complement the main donor agency funding of a transport project. This chapter also covers the provision of financial assistance to disabled people in different ways to help them overcome financial difficulties due to the extra cost of meeting their special travel needs and low incomes experienced by many disabled people.

Finally, Chapter 6 (Operational Road Map) provides guidance on the process for designing accessibility into World Bank transport projects. Again, case study examples are used to illustrate how the process can work in practice.

The Appendices to the Guidance Note form additional information sources for World Bank TTLs to draw upon when planning and developing Bank-funded transport projects:

- Useful documents, websites and knowledge products for further information (Appendix A).

- Experts involved in the field of accessible/barrier-free transport (Appendix B).

- NGOs active in the field of accessible/barrier-free transport (Appendix C).

- Other global resources that support accessible/barrier-free transport (Appendix D).

2. ACCESSIBILITY MEASURES

This chapter provides brief technical descriptions of the range of measures that are available to help achieve accessibility to transport for PLM. It gives the likely cost range for each measure, together with an indication of the benefits and of any implementation issues. The chapter deals with 19 types of accessibility measure across five main groupings.

In considering costs within this chapter, the main emphasis is on <u>overall implementation costs</u> of the particular measure. However, where appropriate, comments are also included on the <u>marginal</u> cost of making features universally accessible when compared with the cost of implementing 'standard' or less accessible infrastructure or services.
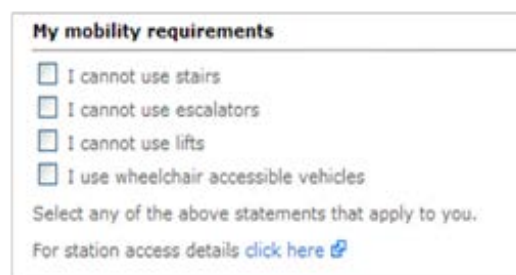
A. INFORMATION AND TRAVEL TRAINING

The information and travel training group of measures is primarily focused on the way that information about transport systems is communicated to people with limited mobility. Five types of measure within this group are described below.

i.   Pre-journey planning information

Pre-journey planning information is essential to enable PLM to check the accessibility of the available facilities and plan their route to ensure they are aware of any practical difficulties or physical obstructions that they may encounter during the journey (IDPTAC, 2000). It is available in a range of formats, including printed leaflet, website and telephone.

Printed information should be produced using clear fonts, larger text sizes, symbols and simple layouts with contrasting colors. This is particularly beneficial to people with sight and cognitive impairments.

Literacy and technology levels should be considered when deciding on the type of pre-journey planning information. In some developing nations very few people will have access to internet-based journey planning. Universal design principles should be applied to online information to ensure that it is accessible. This includes considering the color contrasts, allowing the website to be displayed in a large font, meeting international website access standards such as the W3C Web Accessibility Initiative.

Screenshot from Transport for London journey planner

Pre-journey planning information can include basic details of destinations, origins and timings; and more detailed information such as specific hazards, accessibility challenges and accessibility features. For example, details about the presence of lifts, escalators, steps and stairs; the availability of personal assistance; step-free access onto public transport modes; and the availability of fare concessions could be presented.

Transport staff responsible for booking or involved with customer service should receive training so that they have knowledge about the facilities and services which are available for PLM.

Case study example: passenger transport information, Germany

Geofox, the Hamburg HVV passenger information system is an example of a comprehensive service covering a major city. The system provides detailed information on structural characteristics at rapid transit rail stations, larger bus stations and interchange points, and on the design of vehicles. It also enables a disabled traveller to select options that meet his or her particular requirements, for example to make a journey which only uses low-floor bus services or stations with obstacle-free access to platforms.

Geofox is available to the public in four ways: on the Internet, as an SMS service, at self-operated information terminals and as a CD-ROM. In all cases these have been developed by national government or city government departments with responsibility for commissioning and operating transport infrastructure (ECMT,2006).

Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Printed information- Booklets, leaflets, timetables	Low cost – typically $1000 for 10,000 leaflets	Require transport operators to carry out access audits of transit facilities and vehicles in order to provide content in relation to the accessibility of the transport system.	Facilitates easy journey planning for all transport users, particularly useful for unfamiliar journeys and those involving interchanges. Also provides information for other users.
Telephone information services	Medium to high set-up costs, with need to consider ongoing running costs (local staffing costs are a major element).		Enables PLM to plan journeys according to available accessibility features and their specific needs. Also reduces need to staff information points at stops and stations because planning can be done at home
Developing a comprehensive citywide journey planner and information system	High overall system cost (can be up to $5 million) Needs to be maintained and updated, leading to some additional costs.		Encourages greater use of 'mainstream' public transport systems by PLM; but dependent on access to internet which is unlikely to be available to many. However resource can be used by all members of the public.

Implementation issues

A common challenge associated with producing accessible pre-journey planning information for PLM relates to the need to maintain information as the environment changes through urban renewal, the development of new transport systems, and the retro-fitting of new accessibility features for PLM to existing transport networks.

Further information, design guidance and standards

- DFID/TRL (2004) Enhancing the mobility of disabled people: Guidelines for practitioners. Overseas Road Note 21, Department for International Development and TRL Limited, Crowthorne, Berkshire. *Chapter 3*

- ECMT (2006) Improving transport accessibility for all. European Conference of Ministers of Transport, OECD Publications Service, Paris. *Chapter 2.*
- UNDP (2010). *A review of international good practice in accessible transport for persons with disabilities.* Available at http://www.undp.my.
- W3C (1999) Web content accessibility guidelines' available at: http://www.w3.org/TR/WCAG10/.
- Mashari, M. Marrian, M., Bogopane-Zulo, H., Maunder, D., Venter, D. (Undated). Improving the provision of public transport information for persons with disabilities in the developed world. Available at http://www.codatu.org.

ii.   Information at transport stops and stations

Information at stops and stations can be of three types – visual, audible and tactile. It is used to inform people of the vehicle routes that will use the stop or station, the timing of the vehicle, where to board the vehicle, the arrival of the vehicle and any changes to "normal" service. It can also be used to tell PLM which vehicles are accessible, and how accessible stops and stations may be.

Static visual information (e.g. signs, schematic diagrams or maps, bus stop flags) should use upper and lower case letters that are large enough for people with impaired vision to read. A sans-serif font and clear color contrast can also be used to enhance visibility. Pictures can be used alongside text if these are locally recognised. Color coding on routes and stops can also help those with visual impairments or people who are illiterate. 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. Widely recognised symbols, such as the international symbol of access can be used to indicate services that are accessible.

Case study example: accessible bus route information in Xigang Township, Taiwan

It was identified that people with age related physical limitations and people who are unfamiliar with a local area found it difficult to understand local bus routes based on the information provided at bus stops and stations.

People found that the bus stop signs were too high and too small, they had difficulty telling which bus was approaching, the bus route numbers were too long and people were unaware that different bus routes even existed.

Therefore a revised means of presenting this information was developed and tested. The results from this are shown to the left, with a schematic route map showing color coded routes, and associated road map showing major roads, settlements and landmarks. A bus board for display on the vehicle windscreen was also developed which displayed the route number, destination and stops so that passengers can identify which bus is approaching.

Overall user feedback on the redesigned maps was very positive. The results from this project suggested that: 4 digit route numbers are too long, and 2 digit ones are more memorable; bus signs should be large enough to see clearly and comfortably; a board displayed on the bus should be the same color as the route on the map; and consideration should be given to linguistic and local taboos when developing route numbers and names. (Chang, S et al, 2010).

Real-time information displays (e.g. next departure boards or information on service changes) can be used at transport stops and stations. They provide up to date information on the status of transport services, and the areas served by these services. 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.

Real-time information, Sofia, Bulgaria

(Source: European Commission, 2010)

Hearing loop installed sign

Real-time and pre-recorded audible information (e.g. station and stop announcements, counter services and telephone information facilities within stations) is particularly useful for sight-impaired people. Audible information may be pre-recorded or live to deal with particular circumstances. The information can come from a speaker system within a station or stop, or from a hand held device. The volume should be loud enough to be clearly heard, and if possible, a t-coil should be available for people with a hearing impairment, or alternatively the volume of audio devices should be able to be amplified.

Tactile information (e.g., braille or tactile signs at bus stops and stations) is provided to help people with visual impairment to access information about transport services, and facilities in the station. If tactile signage is used rather than braille:

- Letters, numbers or symbols should be slightly raised (1-2mm).

- Information at bus stops should show the number of the service (with raised letters up to 20mm high).

- Information should be fixed to surfaces at about 1m above ground level.

Local requirements may vary, and it is recommended that the input of blind or low-vision advisors is sought to guide the application and location of tactile information.

Terminals and kiosks (e.g. for information and the purchasing of tickets) can be provided to give people information on transport services, and to provide a facility through which tickets can be purchased. If these facilities are being implemented it is important that they are accessible to PLM. Accessibility can be enhanced by ensuring the terminal screen is not more than 1200 mm above floor level and the terminal has recesses for the feet and knees. The screen should be flush with the casing, and carefully angled, and displays of text should follow standard guidelines.

Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Static visual information	Low overall cost – typically <$500 per sign	The main marginal costs of achieving accessibility are likely to be associated with the redesign of current information to ensure that international design principles are followed; and changes to the height of information displays.	Useful for people with visual, auditory or physical impairments in terms of assisting with identification of public transport services and reduces need for staff to help PLM
Real-time information displays	Medium to high cost – typically $2000 to $5000 per sign, plus control system		
Real time and pre-recorded audible information	Low to medium overall cost (lower if added to an existing real-time information system) A sound beacon is likely to cost $200- $550 per beacon (ECMT, 2004 and EC, 2010)	Pre-recorded systems may be cheaper than real-time systems due to the reduction in human resources required to operate the system.	Significant benefits for people with a visual impairment in terms of helping them to locate transport services and facilities, and helping them become aware of any changes to transport services.
Tactile information	Low overall cost A braille plate starts at around $15.	More complex information plates are likely to cost slightly more to produce, but still at low cost compared with other measures.	Beneficial to people with a sight impairment in terms of helping them to identify transport services
Terminals and kiosks	Medium cost Range of $6000 to $10000 per unit	Some ongoing maintenance costs, and software and payment-related costs (if machines are required for ticket purchases as well as information).	Allow PLM to buy tickets and find information without communicating verbally with anyone – particularly useful for PLM with a verbal impairment.

Implementation issues

- The information provided through any of the mechanisms outlined above needs to be timely, accurate and concise. Outdated information provided through such systems will cause dissatisfaction and loss of trust.

- Information should be designed taking onto account local service characteristics – for example timetable information should not be provided where services rarely run to timetable, but are frequent. Instead in these instances operating times and approximate frequency could be provided.

- Local context needs to be taken into account in terms of literacy, and cultural issues. In some cultures certain numbers or words are deemed unlucky, and using these in service information could cause offence. For tactile information, Braille is not widely used in many developing countries, so it may be more useful to provide raised lettering instead.

- In some areas vandalism of information systems may be a problem. Therefore the presentation and delivery of information should take this into account to ensure that the information provided remains useable.

Further information, design guidance and standards

This section has drawn on the following documents:

- DFID/TRL (2004) Enhancing the mobility of disabled people: Guidelines for practitioners. Overseas Road Note 21, Department for International Development and TRL Limited, Crowthorne, Berkshire. Chapter 3
- ECMT (2006) Improving transport accessibility for all. European Conference of Ministers of Transport, OECD Publications Service, Paris. Chapter 2.
- UNDP (2010). A review of international good practice in accessible transport for persons with disabilities. Available at http://www.undp.my.
- SCIE (2005). *How to produce information in an accessible way.* Available at http://www.scie.org.uk
- Access Group (undated). *Information and communication.* Available at http://www.accessgroupresources.co.uk

iii.   On-board information

On-board information is often provided on public transport vehicles such as buses, trams, trains, metros and ferries to keep all users informed of the vehicle route, timetable, current location and exit routes. Clear signage on the outside of the vehicle is important to help users identify which vehicle they should board. While people with physical mobility impairments can often make use of the same information provided for all users, special consideration needs to be given to the means of delivery for users who have sight or hearing impairments.

Real time information display on a London bus

(European Commission, 2010)

Static visual information (e.g. signs, stickers, schematic posters) should use upper and lower case letters that are large enough for people with impaired vision to read, a sans serif font (e.g. Helvetica) and clear color contrasts. Color coding of route or vehicle number information may help illiterate users as well as those with impaired vision (DFID, 2004).

Real-time information (RTI) displays are generally relatively expensive to implement because they require high-tech systems, but they may be considered as part of the overall system design in some major transport systems (e.g., BRT). As with static signs, clear color contrasts, fonts and letter sizes are important to aid people with impaired vision. Simple low-cost versions of real time information are also possible – for example, a light that is illuminated by a driver on the approach to a stop.

Tactile information can provide additional assistance for people with vision 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.

Audible information usually relates to announcing the current, next or forthcoming stops and is of benefit to all transport users, but

Braille plate as part of information notice on a Hong Kong bus

Source: Hong Kong Transport Department

particularly those with impaired vision. At the most basic level, announcements can be provided by an appropriately trained driver or conductor. An on bus communication device that the bus driver can use will cost in the region of $1200 per vehicle. There are also automated announcement systems which often work in tandem with real information displays.

Case study example: low-cost accessible public transport information, Katlehong, South Africa

In Katlehong in the Metropolitan Municipality of Ekurhuleni, a DFIF funded demonstration project was implemented to design and test low cost technologies that would improve information and communication on minibus taxis for both disabled people and others. The needs of deaf, blind and people unable to speak were considered in particular through consultation with PLM user groups.

The system in Katlehong included high visibility signage on the outside of the vehicle and visual information inside the minibus indicating the main destinations. A beeper and light system inside the vehicle was also implemented that allowed the driver to indicate when a stop was coming up and allowed passengers to alert the driver that they wanted to stop, without the need for speech. Visual information included a simple hand signal scheme that enabled users and trained drivers to communicate essential details without speech.

Evaluation of the project showed that the system was welcomed by the targeted users as a significant step towards improving public transport information provision for PLM, enabling them to make informed decisions relating to their journeys and helping them communicate their needs. Transport operators and staff were also reported to be supportive (Mashiri, M. et al, 2010).

Likely costs and benefits

Feature	Cost	Comments	Likely benefits
Static visual information	Low overall cost (typically < $100 per vehicle)	Information must be designed using appropriate universal design principles so that the information is accessible to everyone.	Beneficial for people with visual impairments in terms of helping them use public transport more easily as well as universal benefits
Real time information displays	Low-medium overall system cost typically $1000 to $3000 per display, plus control system	Marginal cost of considering the needs of people with impaired vision within the design of such displays is generally low. For example, consideration of letter size requirements may slightly increase the size and cost of displays from the minimum level.	
Tactile information	Low overall cost - Braille plates cost as little as $15	Consider whether Braille or large tactile letters are most appropriate	Significant benefit to travellers with serious visual impairments.
Audible information	Low to medium overall cost $0 to $2000	Automated announcement systems (possibly linked to real time information displays) are only likely to be appropriate for some transport systems due to their cost.	Beneficial for people with visual impairments in terms of helping them use public transport more easily as well as universal benefits

Implementation issues

- Provision of information on board public transport vehicles requires the cooperation of the operators involved. If several operators provide service in an area then multi-party agreements on common approaches may be need to be negotiated so that information provision is consistent across all operators.

- With all information provision, there is a requirement for the information on board the vehicles to be kept up-to-date.

- If symbols or pictograms are used within information, consideration needs to be given to users who are not local to an area and may not be familiar with local features or signals.

- Where information provision involves technological systems, these need to be procured from a supplier that can provide local support (e.g. through a local agent) so that systems can be maintained and running continuously.

- Training of operating staff to use any new systems is essential if the full benefits are to be realised. In some cases, it may also be beneficial to provide training on system use for groups of disabled people.

Further information, design guidance and standards

- DFID/TRL (2004) Enhancing the mobility of disabled people: Guidelines for practitioners. Overseas Road Note 21, Department for International Development and TRL Limited, Crowthorne, Berkshire. Chapter 3
- ECMT (2006) Improving transport accessibility for all. European Conference of Ministers of Transport, OECD Publications Service, Paris. Chapter 2.

iv.   Travel training

Travel training is personalised training provided for people who have difficulties using transport. Travel training can have a number of facets 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.

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.

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 specialized transport. Some similar schemes are also provided for adults, for example to help them travel to employment. Travel training can be delivered by a range of organizations, including local government, the local transport operator or a charity.

Case study example: Travel Mentors, London, England

This scheme 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 ten accompanied journeys via the scheme, where a mentor travels with the person on various modes of public transport. The scheme also includes an element of "train the trainer", whereby potential travel trainers from organizations such as charities can be equipped with the skills that they need to provide travel training. The mentors collect feedback from the participants in the scheme that they pass onto the public transport design teams so that service design can be modified to be more accessible in the future. (European Commission, 2010)

Likely costs and benefits

Feature	Cost	Comments	Likely benefits
Travel training	Low overall cost, mainly staff time and some printed materials. Costs between $21 and $87 per hour for one to one training (European Commission, 2010)	The overall cost of travel training is low overall because the costs are limited to staff time, administration and some printed materials.	Benefits people with physical impairments through teaching them how to board and alight vehicles. Benefits for people with some cognitive and sight impairments, enabling them to travel independently. Travel training can be particularly useful for wheelchair users who are unfamiliar with new Bus Rapid Transit systems, especially to assist them to enhance competencies in crossing the platform-to-bus gap by practicing their skills at off-peak hours or, better still, when buses are not in revenue service. Reduced requirement for (more expensive) specialized transport services

*Implementation **issues***

- Local people need to be trained to act as travel trainers, including developing an understanding of the barriers that PLM face.

- Attention needs to be paid to the design of the program so that it meets local needs and takes into account cultural issues in the local area.

- Publicity and awareness raising also needs to be undertaken so that people are aware of the scheme and able to benefit from it. This could either be through building networks within the community, or advertising directly to PLM.

Further information, design guidance and standards

- Easter Seals Project Action, an American organization has set up an online forum for Global Travel Trainers. More information is available on their website: http://projectaction.easterseals.com

- Department for Transport (2011). Travel Training Good Practice Guidance. Available at http://assets.dft.gov.uk/publications

- GMPTE (2005). Travel Training Good Practice guidance. Available at http://www.tfgm.com

v.   Disability awareness training

Many countries have developed training courses in **disability awareness** that are used to train station, stop and other public transport staff. The training courses are likely to cover: barriers faced by disabled people; information on disabilities; communication and interpersonal skills; enabling staff to "think on their feet" should any unexpected issues occur; vehicle driving tips that help disabled people; suggestions for removing the barriers faced by disabled people; and the principles of access audits.

Model handout for bus drivers

Seniors and passengers with disabilities need your help

• **Always pick up passengers with disabilities and seniors.**

• **Drive safely and allow time for passengers with disabilities and seniors to sit down or hold on.**

• **Avoid sudden starts and stops, slow down before curves, and stop as close to the curb as you can.**

• **Call out major stops and requested stops for blind passengers.**

(World Bank, 2009)

Staff training can be delivered **face to face**, through a training session that usually lasts between half a day and a day. This should include theoretical learning and practical examples to make it as useful as possible. Where possible, disabled people should help design and deliver the training.

An alternative is to use a **video based training approach**. Some organizations make their own videos that highlight the issues that disabled people face, and these can be used to train existing and new staff. The advantage of this is that once the video has been made, the ongoing costs are relatively low. However this approach is less interactive and does not give staff the facility to ask questions.

Where it is not practical to deliver face to face training, **small handouts** can be used to make staff more aware of how they can help disabled people. This may be particularly applicable in a system where there are lots of taxis and mini-bus taxis. **Posters** can also be displayed at stops, stations or on vehicles to get messages across to drivers and staff.

Training should not just take place once, but should happen on a periodic basis so that the knowledge of staff members remains up to date. It is important to ensure that all relevant staff members get training, not just one person from a route or location.

Case study example: Awareness training for railway staff - Luxembourg

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 disabled people 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 organizations that represent the needs of different groups of PLM, including 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 and the total annual operating cost is between $4000 and $5200. 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 disabled people have reduced. (European Commission, 2010)

Likely costs and benefits

Element	Likely cost	Comments	Benefits
Disability awareness training events	A course in the UK can be purchased for between $280 for a half day to $440 for a full day of training per person.	Interactive - gives opportunity for people to ask questions throughout the training, and take part in demonstrations regarding issues of relevance.	Travelling is made easier for disabled people because staff members understand the barriers and are able to assist them.
Disability awareness video	A basic video can be made for around $1000 to $5000	Less interactive and opportunities to ask questions are limited, but is easily reusable.	
Disability awareness posters and leaflets	Very low cost – typically $100 - $500	Awareness is dependent on people reading leaflets or posters.	

Implementation issues

- In some cases there may not be the skills in country to provide disability awareness training. However, it should be possible to up-skill people using the guidance available and contacting experts in other countries to "train the trainers" in country for a short period of time.

- Getting messages across to staff may be challenging in more dispersed industries such as taxis, minibus taxis and rickshaws. Posters and leaflets may be more appropriate in these circumstances.

Further information, design guidance and standards

- DFID/TRL (2004). Enhancing the mobility of disabled people: Guidelines for practitioners. Overseas Road Note 21, Department for International Development and TRL Limited, Crowthorne, Berkshire. Chapter 16

- DPTAC (2000) Advice for taxi drivers. Disabled Persons Transport Advisory Committee, London.

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B. PEDESTRIAN FOOTWAYS AND STREET CROSSINGS

This group of measures focuses on the public realm, considering the various features of the pedestrian environment that can be enhanced to the benefit of PLM.

i. Footways and sidewalks

Footways and sidewalks are a very important part of the public realm because most people start and finish their journeys using these facilities in some way – so they are nearly always part of the trip chain. Therefore the design of these facilities should take into account the needs of all potential users, including PLM. There are a number of aspects of footway and sidewalk design that facilitate creation of an accessible pedestrian environment.

Measures are also needed to ensure that footways and sidewalks are not obstructed by garbage, construction debris, tree roots, or other objects. Obstructions created by street vendors, parked cars, and utility poles may also prevent PLM from using the footway. While obstructions such as tree roots can be dealt with through regular maintenance, re-education of drivers and re-location of street vendors or utility poles will require major long-term enforcement and/or close coordination between different municipal departments.

In order to deliver universal accessibility, there are certain minimum **dimensions** that need to be observed. These are shown in the diagram above. A footway or sidewalk should be at least 2000mm wide in areas with moderate to heavy pedestrian traffic, or 1500mm in less heavily trafficked areas. Around shops and bus stops, the footway will ideally be at least 3000 – 3500mm wide.

Other considerations are:

- The **bottom of the tapping rail** (depicted in the diagram overleaf) should be 200 mm max above the sidewalk surface and the rail itself should be 150-200 mm, deep.

- A **gradient** of 5% is considered the steepest that a footway or sidewalk should be to ensure universal accessibility, with rest areas (e.g. seats) provided every 10 meters for areas where the gradient is over 5%.

Dimensions of a sidewalk or footway to deliver universal access

(taken from: DFID Road Note 21, TRL, UK)
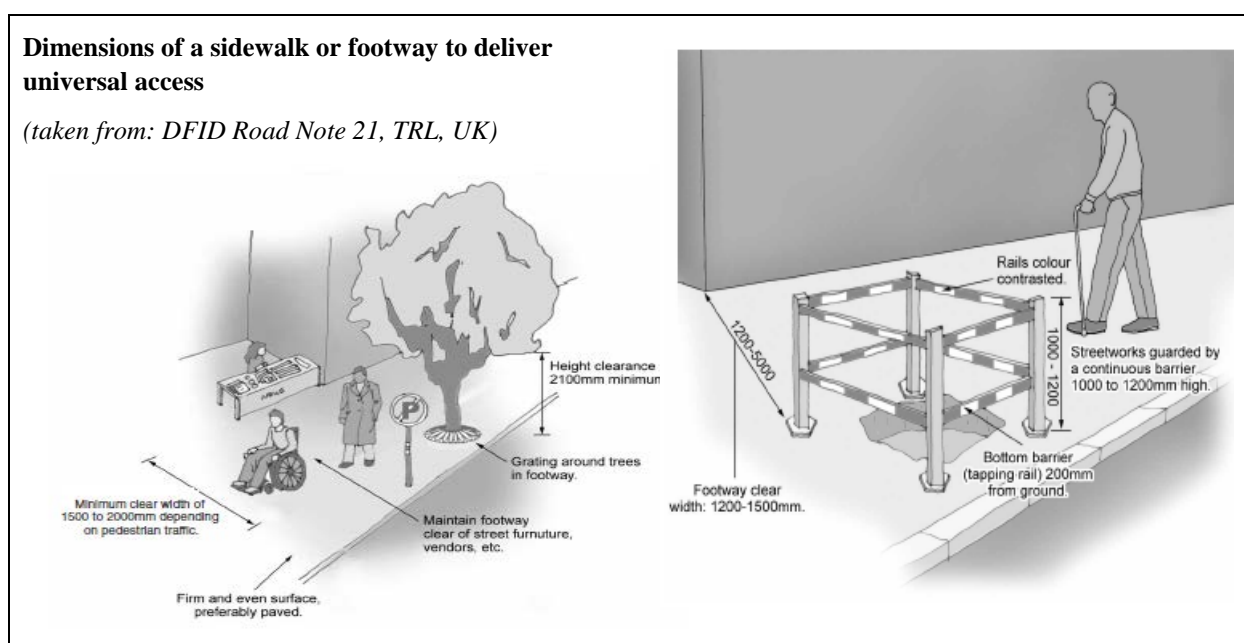
- **Surfaces s**hould be firm and even and constructed of asphalt or concrete rather than brick for easy maintenance.

- Sidewalks and footways should ideally be well **separated from the highway** so that pedestrians are segregated from traffic.

- **Grates** over storm drains should be avoided as far as possible on the footway, or if they cannot be avoided, the grate should be at a right angle to the normal direction of travel so that wheelchair wheels cannot get stuck in it.

- **Crossfalls**, which are required for drainage, should not exceed a gradient of 2.5%, otherwise they are difficult for wheelchair users to cross.

- **Layout** should be simple so that navigation is easy.

- **Unnecessary street clutter** such as redundant signs or broken street furniture should be removed as far as possible.

- Action should be taken to ensure that street traders and parked cars are not allowed to block the sidewalk or footway.

- **Adequate lighting** should be provided to ensure that all users can see any hazards.

- Consideration should be given the placement of necessary **street furniture** such as lighting, fire hydrants or bus stops to ensure that they do not impede the progress of PLM. Where street furniture such as lampposts cannot be avoided, it should have a contrasting band of color on it that is between 140mm and 160mm wide, with the edge 1500mm to 1700mm above street level.

- If there is a large drop between the footway and the road, or at the rear of the footway, **guardrails** should be provided to ensure that pedestrians remain safe. This should be at least 1100mm high and painted in highly visible colors that contrast clearly with the surrounding areas. Alternatively, an upstand of 100mm could be provided where the drop is not as far, to offer a safeguard for wheelchair users and provide a tapping point for long cane users.

- **Seating should be provided** on footways and sidewalks to provide a rest area, typically every 50 - 60 meters. These should be placed so as not to obstruct the footway. Seats should be 480mm high, and should be painted in colors that contrast with the surroundings.

- It is important that **ongoing maintenance** is budgeted for and regularly undertaken to ensure that the footpath or sidewalk remains accessible. Where street works are required, they should be cordoned off with rigid barriers when unattended.

Tactile surface indicators facilitate the safe movement of blind and sight-impaired people through the installation of paving surfaces that contain simple detail about the surrounding area. There are two types of tactile paving - warning blocks or "attention patterns" that indicate the location of hazards or destination facilities; and directional blocks or "tactile guideways" that indicate direction of travel. To get the greatest benefit, paving should be installed in a contrasting color to the surroundings so that visually impaired people can use the color warning as well as the tactile warning.

Various surfaces are used around the world, therefore it is important to use the surfaces sparingly and consistently to avoid confusion. In addition, some training may be required within country to ensure that people are aware of the purpose and meaning of tactile paving. Guidance suggests a height of approximately 5mm for the raised profile of the surface is

enough for most visually impaired people to identify, but does not present a hazard for other road user or sidewalk users.

Testing the footpath in 2007

Case study example: Pedestrian infrastructure improvements for PLM in Bangkok, Thailand

In 2007, improvements were made to a pedestrian environment through the re-development of footpaths along a 1.5km section in the Ratchaprasong district of Bangkok. These improvements included widening the footway to 5 metres, making the surface smoother by replacing caterpillar concrete blocks with concrete tiles; adding gentler slopes so that wheelchair users can get onto the road and relocating street furniture such as telephone booths and fire hydrants so that they are 1.2 metres back from the road. This allowed for a more seamless walking area, which is easier to navigate for people with visual impairments; and created a more wheelchair friendly environment.

The project was led by the Quiet Bangkok Group Committee, who worked with Disabled People's International Asia Pacific Region, the Pathumwan district office and owners of property along the pavement. The improvements were predominantly paid for by local property owners, with each owner paying to improve the area in their jurisdiction.

(Source: Bunnag 2007)

One of the most useful places that **warning tactile paving** can be installed is immediately before road crossings. The tactile paving should be the whole width of the curb ramp and be of a contrasting color to the surroundings. Tactile paving can also be installed in front of other hazards - for example street furniture. Warning strips are required at open areas on heavy rail, LRT or BRT platforms to enable people with sight impairments to navigate safely and independently.

Wayfinding tactile paving can be used to guide PLM around an area, or to services and facilities. The strip of tactile paving that needs to be wide enough for a visually impaired person to follow easily (at least 800mm) either with their feet, or a long cane. The path that is installed should avoid unnecessary bends with warning blocks installed where sharp bends are required.

Metal warning discs

(Source Tokudu, K et al, 2008)

Concrete directional blocks

Rubber warning blocks at directional intersection

Signs indicating the location of crossings can be enhanced for PLM through the addition of **tactile or large font lettering** to increase readability. Strong color contrasts should be used so that any lettering stands out from the background, and characters on tactile signs should be raised by 1-1.5mm and be at least 15mm high. Alongside this, signs should be well lit. As a rule of thumb it should be possible for a person with 20:20 vision to read a newspaper in the

immediate vicinity of the sign. Where local light conditions do not allow this, backlit signs are preferable. A matt finish is preferable because this reduces reflections which make signs harder to read.

	Case study example: signs with large print and Braille at pedestrian crossings, Hong Kong This project centred on the design of signs that can be fitted to pedestrian crossings in order to help visually impaired people identify their current location, and their direction of travel. The signs contain the current street name and the names of streets parallel and to the left and right. The text and Braille on the signs is in Cantonese and English, and the text is in large print. The text is etched onto the signs, which have a matt surface to maximise readability. The signs are fitted to the crossing posts, above the audible traffic signal control box. Surveys were undertaken when the signs were implemented at the first crossing to refine the design of the sign and test its utility. More than 80% of people surveyed considered that it was necessary to introduce the signs to Hong Kong to enhance the independent mobility and social integration of people who have a visual impairment. *(Source: Cho, 2010)*

Likely costs and benefits

Feature	Likely cost	Comments	Benefits
Improved footways and sidewalks	Medium – high overall cost of implementation – typically $35-$50 per m2 to construct. (Atkinson, V. Et al, 2006)	Costs are highly dependent on local labour and material costs. Costs are likely to be slightly higher if the footway needs to be able to withstand light vehicle use, and higher still if heavy vehicle use is required.	Accessibility for PLM on walk parts of trip chain improved. Reduced likelihood of trips and falls on poor surfaces for all users
Signage and wayfinding	Low overall cost of implementation - the cost of Braille plates starts from around $15	Properly located Braille plates fitted to existing crossing poles will be relatively low cost, although the cost of larger fully lit signs will be higher.	Tactile signage benefits people with visual impairment; audible wayfinding signs benefit those with a hearing impairment.
Tactile paving and colored concrete	Medium overall cost of implementation In the region of $250 per m^2 to purchase and lay Cost is nominal with colored concrete	Only relatively small areas of footway need to use tactile paving, keeping costs down. It could be considerably cheaper to incorporate tactile paving into the design of a new scheme, than to retrofit (Auburn Council, 2005).	People with a visual impairment will be able to travel more independently

Implementation issues

- Selection of materials appropriate to the climate is critical, as is maintenance of new surfaces.

- Discord may occur when street traders are affected by footway construction. Adequate consultation and planning should take place so that where necessary they can be re-located and offered assistance so that they can maintain their livelihoods.

- Some localised publicity and training may be required to ensure that people are aware of how to use tactile paving and signage and what it means.

*Further information, design guidance and standards*

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- UNDP (2010). A review of international good practice in accessible transport for persons with disabilities. Available at http://www.undp.my/

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- Tokudu, K., Mizuno, T., Nishidate, A., Arai, K. & Aoyagi., M. (2008). Guidebook for the proper installation of tactile ground surface indicators (Braille Blocks): Common Installation errors. International Association of Traffic and safety sciences, Japan.

- UN (2004). Accessibility for the disabled: A design manual for a barrier free environment. Available at http://www.un.org/esa/socdev/enable/designm/index.html

ii.   Dropped curbs (kerbs) and street crossings

Dropped curbs, also known as curb ramps, should be used in all areas where the footway crosses a road, pavement or other raised surface. They exist to help people who use a wheelchair, or have other mobility difficulties in crossing the road by removing the step between the road and the footway. The diagram below sets out recommended dimensions.

At wider roads, it may be useful to install a **refuge island** to provide a safe stopping point for a person who is crossing the road. Refuges should be at least 1500mm wide, and should be the same level as the crossing.

In busier road environments **signalized crossings** may be more appropriate. This type of crossing indicates to the traffic when it must stop, and indicates to the pedestrian when it is safe to cross. Crossing is usually operated at the request of a pedestrian pushing a button attached to a pole sited at the crossing. Audible signals, such as a beep or tactile signal such as a vibration at a pedestrian crossing can be very useful for people with a visual impairment. These signals enable PLM to recognize when it is safe to cross. Signalized crossings are safer for pedestrians because vehicles are more likely to respect them, however they are more expensive and complex to design and install. If a signalised crossing is not

(Source: Adapted from Oxley 2002, by DFID 2004)

justifiable, then safety at un-signalised crossings can be improved by ensuring that adequate signage and lighting is installed.
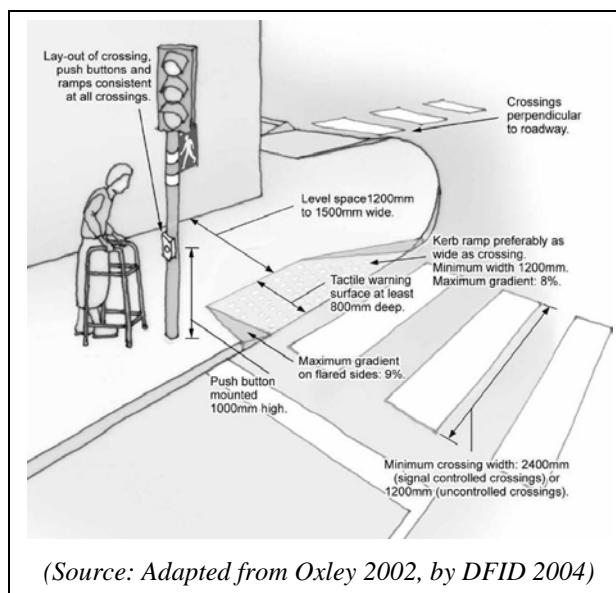
It is important that **crossings** are designed simply and consistently so that they are easy to use and people with a visual impairment can orientate themselves easily. The pole should always be on the same side, and the button should be approximately 1000mm from ground level. In locations where car parking is provided at the side of the road safety can be increased by **extending the footway across the parking lane**. This increases visibility for car drivers and pedestrians.

Cast study example: installation of a new pedestrian crossing near a hospital, Maputo, Mozambique

A pedestrian crossing was constructed outside a hospital in Maputo to enable pedestrians to cross the road safely. The crossing has dropped curbs and cuts through the central reservation in the road to facilitate safe crossing. Since the road was not deemed to be busy enough to support a signalised crossing, and the high cost of lighting made this option unjustifiable, clear pavement makings and signs for drivers were installed to ensure that the crossing was as safe as possible. Since installation the number of older and disabled people using the crossing rather than jay walking has increased from 13% to 73%.

Road Crossing in Maputo   *Dropped curb at a road crossing, Maputo*

(Source: DFID 2004)

Likely costs and benefits

Feature	Likely cost	Comments	Likely benefits
Dropped curb	$750 - $3000 to retro fit Low marginal cost of constructing new footway.	Costs would be more if utilities or street furniture need re-siting	Significant benefits for PLM, particularly wheelchair users, but also those with pushchairs, shopping trolleys or suitcases.
Footway buildouts	$700 - $15000 in the UK to design and install Low to medium marginal cost of constructing new footway	Labour costs would vary in developing countries	Improves visibility where parked cars may obstruct pedestrian and driver vision, in particular for children and wheelchair users who may be lower and have poorer visibility.
Zebra Crossing	$40,000 in the UK non-signalized $55,000 in the UK if signalized Costs will be lower in developing regions	Labour costs in developing countries would reduce these costs, as would a simplified design involving on/off curb ramps and basic painting of a crossing onto the road surface	Makes crossing the road safer for all pedestrians - signalized crossing would offer the greatest safety benefits.
Island Refuge	$6,500 - $50,000 in the UK	Costs vary if the roadway needs to be widened to incorporate crossing	Gives all pedestrians a safe place to stop as they cross the road, but particularly if the road is wide and PLM struggle to walk long distances.
Raised Table	$10,000 approximately	Labour costs should reduce costs in developing countries	Remove the need for PLM to change levels to cross the road. Also slow traffic making the road environment safer for all pedestrians
Footbridge / Subway	Medium to high cost	Costs can vary considerably depending on the span of the footbridge/width of subway.	Remove any interaction with road traffic so safer for all pedestrians, but less suitable for PLM unless lifts are installed due to steep gradients or steps.

Implementation issues

- For controlled crossings, it is important to ensure that the green light for pedestrians is on sufficiently long for slower moving people to cross safely.

- Traffic enforcement and driver education programmes may be necessary for drivers so they become more aware of pedestrians crossing the road.

- Pedestrians may be unaware or unwilling to use new crossing facilities so may need to be educated in the benefits.

Promotional campaign educating people on the use of zebra crossings in East Timor.

(Source:www.ifrc.org)

- Where new road crossings are being constructed, the time taken to use crossing points compared to using desire lines needs to be considered. In some situations barriers in the median may be required to encourage pedestrians to use safe road crossing points.

- In line with trip chain considerations, it is important to ensure that the environment around a street crossing is as accessible as possible so that PLM are able to access the crossing or continue their journey from it.

Further information, design guidance and standards

- DFID/TRL (2004) Enhancing the mobility of disabled people: Guidelines for practitioners. Overseas Road Note 21, Department for International Development and TRL Limited, Crowthorne, Berkshire. *Chapter 3*

- ECMT (2006) Improving transport accessibility for all. European Conference of Ministers of Transport, OECD Publications Service, Paris. *Chapter 2.*

- UNDP (2010). *A review of international good practice in accessible transport for persons with disabilities.* Available at http://www.undp.my.

- Highways Agency (2011). Design Manual for Roads and Bridges Volume 8. Available at http://www.dft.gov.uk/ha/standards/dmrb/

- Transportation Research Board (2006). Improving safety at un-signalised crossings. TRB, Washington.

C. PUBLIC TRANSPORT STOP AND STATION INFRASTRUCTURE

This grouping focuses on the different types of accessibility features that may be implemented at transport stops/stations/terminals/interchanges.

i.   Bus Stops

Bus stop surfacing that is both paved and level around a bus stop greatly benefits PLM when accessing a stop/shelter and when boarding and alighting a bus. Pot holes, gaps between paving slabs and drainage channels should be covered or removed to improve accessibility, while tactile paving can be used to guide PLM towards the bus entrance.

Bus stop layouts should provide ample space for passengers to enter and wait for a bus without obstructing passing pedestrians. The diagram shows preferred minimum dimensions.

Additional space may be required if mechanical lifts or ramps are to be used to board a bus. The length of the bus stop should be appropriate to the size of buses using it and to ensure all entry and exit doors can be accessed at the stop.

Shelters should be large enough to accommodate a wheelchair and other

BUS STOP WITH A SHELTER

BUS STOP WITHOUT A SHELTER

Surface level, firm and flush with surroundings

Clear area for boarding at least 2 x 2m if wheelchair lift is used

Preferred minimum 1500mm, but absolute minimum of 900mm for short distance only

Preferred total width 3000mm, absolute minimum 2400mm

1400mm (min)   1300mm (min)

1500mm (min)

Preferred minimum 1500mm, but absolute minimum of 900mm for short distance only.

Raised kerb height: 140 to 160mm

Source: Adapted from Oxley 2002, by DFID 2004

walking aids with adequate turning and manoeuvring space.

Seating should be provided, but can consist of a rail to rest against or a low cost bench. As a general rule, seating should be clean, comfortable, easy to get in and out of and freely available. Seating should be a minimum of 480mm off the ground and painted in a contrasting color to the surrounding street and stop furniture. If the shelter has transparent side or rear panels, a tonally contrasting band of at least 150mm wide should be provided at a height of 1,400-1,600mm above ground level. Shelter supports should be marked with contrasting color bands about 1,500mm from the ground to maximise visibility.

Security in and around a bus shelter can be enhanced by effective lighting and the removal of unnecessary structures or panels that can serve as hiding places. Effective lighting additionally benefits way finding for people with partial sight impairments.

Bus stop poles which mark the location to board a bus should be painted with colored bands to enhance visibility. Where lamp posts are used, these should be clearly distinguishable.

Raising the height of the **boarding area** reduces the height of the first step onto the bus and improves access, and speed of boarding and alighting, for passengers. A curb 140mm to 160mm above the road surface would help some PLM, while raised boarding structures with heights of 300mm or more can enable a greater proportion of PLM to access buses. As a general rule, the ideal height of a bus stop surface should be 10mm-20mm below the level of the first step of the vehicle.

Case study example: low-cost bus stop infrastructure in Pune, India

A demonstration project to improve access for PLM at a bus shelter was undertaken in 2001. Features of the shelter included:

- Benches of appropriate height for PLM

- Large text route information boards with route numbers, destinations, frequencies and timings of the first & last bus

- New signs designed containing pictogram of a bus, in addition to route numbers which service the stop

- Removal of structures or protrusions along the pavement to enable unhindered movement to and within the shelter

- Color contrast in shelter, with dark-colored pillars painted with white strips to improve visibility at night

- A tactile guide way to guide visually impaired passengers from the bus stand to the bus entrance

Passenger surveys following the implementation of the bus stop demonstrated a higher usage of the bus shelter and that passengers felt there was a higher level of comfort after the changes were made.

Before   *After*

(Source: DFID 2004)

Likely costs and benefits

Feature	Likely cost	Comments	Likely benefits
Bus stop surfacing	$10-15 per buff blistered tile Footway surface costs between $35 and $70 per square metre (in the UK in 2006 prices)	Surfacing costs vary depending on the surface material. Asphalt is usually one of the cheaper materials.	A smooth flat surface at the bus stop benefits all users when boarding and alighting. Tactile paving benefits those with visual impairments to be directed to or from the bus.
Bus shelters	$7000-8000 (in the UK) for a 5m shelter with glass rear panel and 4 metal seats. Excludes installation.	Installation costs vary due to labour costs and location of shelter. Gradient, drainage, electricity supply can impact on installation costs.	Adequate space for PLM to board, alight and wait for a bus, particularly beneficial for wheelchair users. All users benefit from greater levels of comfort through sheltering from sun/rain.
Folding or fixed seats	Low cost Typically $200 - $800 (UK)	Dependent upon seating type and materials used	Allows people to rest in relative comfort while waiting for a bus
Raised boarding structures	Low to medium overall cost $2000 for Kassel Curb at bus stop.	Costs vary depending on the design of the structure and materials used	Benefit wheelchair users who wouldn't be able to access the bus without support. Level boarding also benefits other passengers.

Implementation issues

- A bus stop should be made available during construction to enable passengers to continue using the bus

- Adequate space for bus shelters can be a problem where there is little space and street traders encroach sidewalks

- Lack of driver awareness of accessible infrastructure can be a barrier to the effective use of the infrastructure. Drivers and conductors should be trained in disability awareness training and in how to use the accessible infrastructure.

- Enforcement may be required to keep bus stops clear of encroaching cars and trucks

- Passengers should be prevented from standing in the roadway which can prevent buses from using the stop

Further information, design guidance and standards

- DFID (2004), ORN21 Enhancing the Mobility for Disabled people; Guidelines for Practitioners; TRL, England

ii.   BRT and light rail stops

Accessible BRT and light rail stops or stations have many similarities, most notably when providing level access from the stop onto the vehicle. This section therefore considers BRT and light rail stops together.

Stops should have sloped ramps that lead up to a raised platform to allow for level boarding. Dimensions for **station ramps** are illustrated right.

(Source: Adapted from Oxley 2002 by DFID 2004)
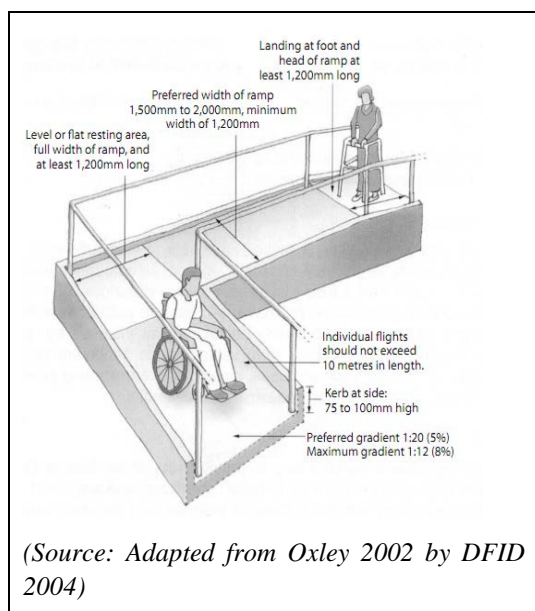
Depending on the frequency of the BRT or LRT service, it may be necessary to install **seating**. This could include folding seats (minimum of 480mm from the ground) or hori-zontal perches (700mm from the ground). Folding seats would be beneficial for periods of peak demand where seats could be folded up to accommodate additional passengers. Seats should be painted a high contrast color to distinguish them from their surroundings.

Fare gates and doorways into the station/stop should have a minimum width of 900mm to accommodate PLM, as shown in the diagram on the left.

(Source: Adapted from Oxley 2002 by DFID 2004)

At the **platform edge**, tactile paving denotes the extent of where passengers can wait safely. A contrasting colored line can be used for way finding by PLM with partial sight impairments as well as denoting t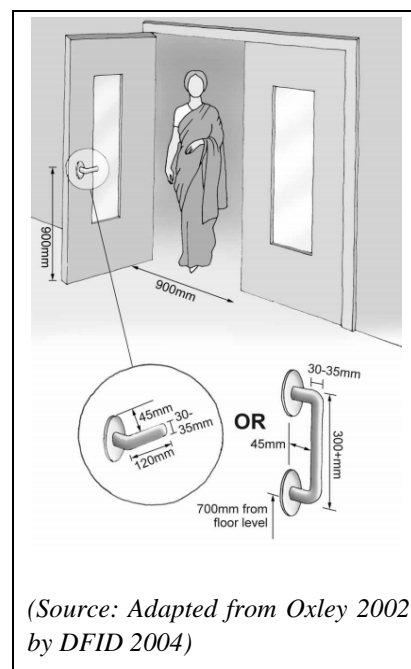he edge of the platform. Transparent, full length sliding glass doors can be used to provide safety and security for all passengers. Audible signals should be used to alert PLM with hearing impairments to the opening and closing of doors.

For LRT systems there is likely to be a minimal gap between the platform and the vehicle, while BRT vehicles are less able to dock at the platform as precisely and consistently. For BRT systems, gaps between the platform and the vehicle should be no more than 100mm and preferably less than 75mm. Where gaps do exist a bridging device can be used. For example in Quito, Ecuador, and Cape Town, South Africa, bus-mounted boarding bridges have been used to eliminate gaps between platforms and buses. Portable bridges can also be used to bridge the gap, as used for example in Johannesburg, South Africa.

However, there are some steps that can be taken to reduce the incidence of gaps and reduce the impact on PLM, these include:

- Locate designated wheelchair areas near the buses' front entrance, where the platform gap is at its narrowest

- Train bus drivers to minimise platform gaps when manoeuvring the bus on approach to stops

- Station staff should be alert to assist wheelchair users and other PLM to bridge any gap

- Wheelchair users should be advised to consider reversing on and off the bus, so that the large wheels can cross the gap first.

- Bevelled curbs (e.g. shaped to accommodate the bus, as in the photo of the Rea Vaya BRT stop in the case study overleaf) could be considered to help guide buses closer to the platform edge.

(Source: Sorlie)

Where elevators or stair lifts are required the following elements should be considered: doorway width of 900mm, a hand rail at appropriate height, a control panel with alarm and emergency stop buttons, large tactile push buttons, non slip flooring and color contrast elevator edges. However, elevators are only recommended in

Elevator:
1,6 x 1,5 m floor area
Transparency for emergencies or crimes. /
Elevador:
Área de piso 1,6 x 1,5 mt.
Transparencia para emergencias crimenes.
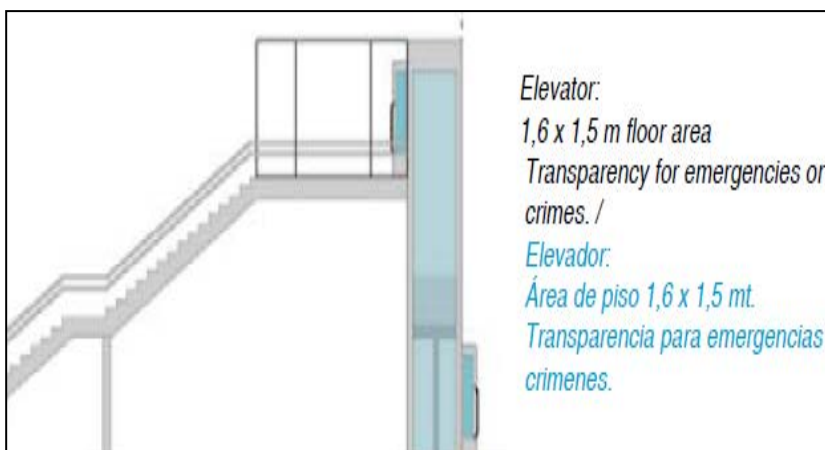
extreme circumstances where there is no alternative due to their cost, maintenance requirements and an increased likelihood of vandalism. We note that stair lifts are difficult to maintain and used by far fewer passengers than elevators. Stair lifts are best utilised inside and in controlled environments, whereas elevators are more robust and provide access for multiple PLM at any one time.

Case study example: Rea Vaya BRT System, Johannesburg

Each station has ramps leading up to a raised platform for level boarding. The ramps are graded, with a level area part way along the incline to allow for a brief rest. There are handrails on either side of the ramps as well as rest rails at the stations. The window height of the ticket booth is lower to accommodate people in wheelchairs and the booths have also been designed so that there is enough space to allow people in wheelchairs to work there. For visually impaired people, ramps have lights on both sides and specific colors are used inside the station; for example, there are yellow blocks at the areas where the bus doors will open for boarding. Each station also has an electronic variable message system in different languages for the hearing impaired and toilets.

Finally, once in operation, it was found that the gap between the platform and bus was too large for some wheelchair users, therefore in conjunction with various PLM groups, a mini portable ramp was designed and can be used to enable wheelchair users to board and alight the bus with ease. *(Source: www.reavaya.org.za)*

Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Accessible BRT Station	$900,000 in Jo'burg. $450,000 in Jakarta.	Johannesburg figure is for a high quality station serving 4 buses. Jakarta figure includes $170,000 for the station and $280,000 for the pedestrian bridges to access stations, which is required for all pedestrians.	Incorporating all accessibility features benefits PLM through barrier free and level access to stops/stations and vehicles.
Bus mounted boarding bridges	$1000 per door (in Ecuador).	Costs based on equipping a 3 door articulated bus.	Enables all users to move from the platform to the bus with relative ease, but notably benefits wheelchair users.
Elevator or stair lift	Elevators cost between $20,000 and $600,000. Stair lifts cost approx. $20,000.	Elevator costs vary depending on the type of elevator the specification and the height it must reach. Costs do not include maintenance or installation. Stair lifts often have a high maintenance requirement.	Benefit wheelchair users and those unable to climb steps or slopes. Can also benefit those with children and heavy luggage.
Folding seats within stop/station	Low cost - typically $500 - $1000 (UK)		Benefits those unable to stand for long periods of time.

Implementation issues

- The whole trip chain is a key implementation consideration for BRT and LRT stops/stations. An accessible BRT or LRT stop loses a portion of its potential usability if it is not accessible from surrounding areas, for example, if pedestrian crossings to access a median stop/station are inadequate, or if there are inaccessible footpaths in the area surrounding the stop/station. As such BRT/LRT systems often present an opportunity to improve surrounding infrastructure.

- When making changes to a bus, BRT or LRT stop, attention must be paid to providing the stopping facilities during periods of construction.

- Comprehensive driver training is also required to ensure drivers can dock their vehicles appropriately to minimise any impact on PLM accessing the vehicle.

Further information, design guidance and standards

- Rickert T, (2007) BRT Accessibility Guidelines, World Bank, Washington

- Rickert, T. (2010) Technical and operational challenges to inclusive Bus Rapid Transit: a guide for practitioners.

- DFID (2004), ORN21 Enhancing the Mobility for Disabled people; Guidelines for Practitioners; TRL, England

- Sorlie, S, (2009) A design manual for accessibility in Transmetro BRT system, Guatemala City, Design Without Borders, Norway

iii.   Major bus/train/metro/air/ferry interchanges and terminals

Major transport interchanges and terminals can have similar accessibility features within the interchange and terminal environment, therefore are considered together in this section. Firstly, the definition of interchange is such that many passengers will be changing from one mode of transport to another within that environment. The first priority therefore is to ensure that there is an obstacle free route across a concourse that provides access to and from:

- Platforms for connecting modes
- Customer assistance
- Accessible entrances and exit
- Information desk
- Ticketing facilities
- Waiting area
- Toilet facilities

(Source: Adapted from Oxley 2002 by DFID 2004)
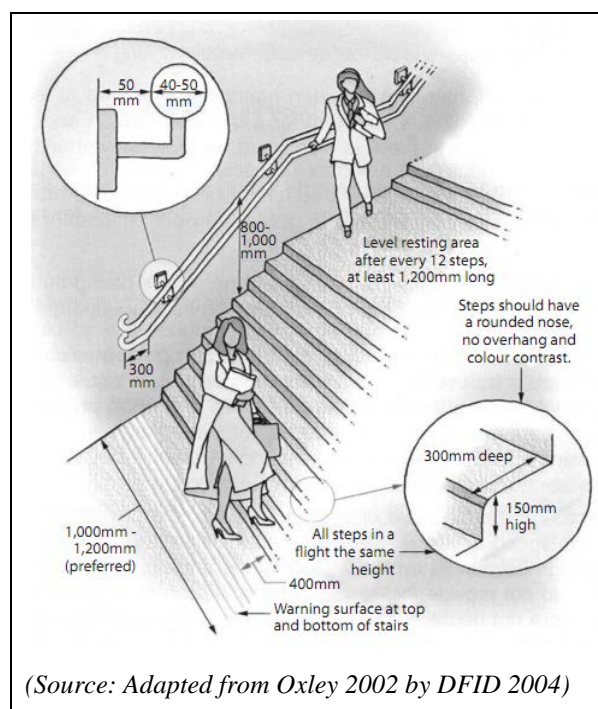
All obstacle-free routes, stairs, ramps, footbridges and subways shall have an obstruction free width of a minimum of 1600 mm, with minimum headroom of 2300 mm. Where stairs do exist, consideration should be given to the features and dimensions, as illustrated right.

At least one **accessible entrance** to the station and one accessible entrance to each platform should be provided. Within the doorways, thresholds sho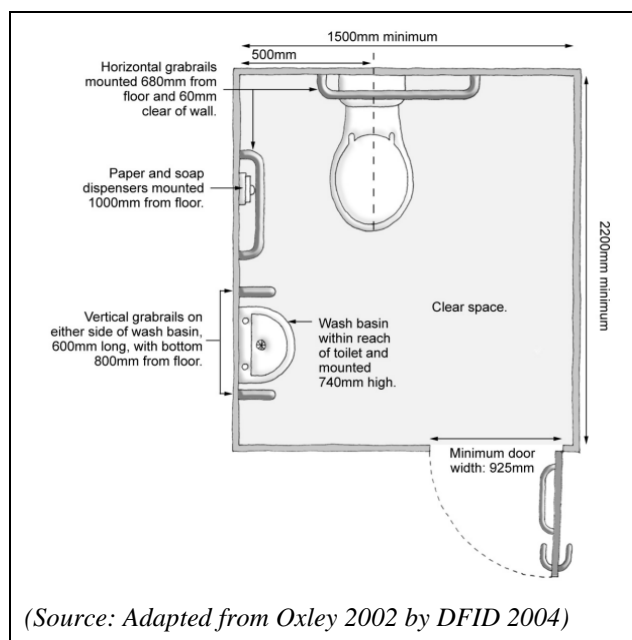uld ideally be avoided, or be no higher than 25mm and contrast in color with the background. Door widths should be a minimum of 800mm with a clear headway of 2100mm. The force required to open or close a manual door should not exceed 25 Newton while horizontal push bars, extending across the full width of the door, should be present on both sides of the door. Door operating devices should be available at a height between 800mm and 1200mm.

Flooring should be firm, even, easily cleaned and slip-resistant. Floors should have a matt or semi-matt finish to avoid reflection and glare, and changes in color and texture should be used to mark the edge of the thoroughfares and any hazards.

Information and ticket desks should have a counter with an up stand at the front edge so tickets/change does not fall on the floor. At least one desk, with 1200mm of clear space in front of it to allow for manoeuvring wheelchairs, would ideally be a minimum of 750mm to the underside of the desk, have a knee-well of a minimum of 500mm deep and have a minimum width of 900 mm. The height of the upper surface, or a part of it with a minimum width of 300 mm and a minimum depth of 200mm, should be between 700 mm and 800 mm.

If there is a glass barrier between the passenger and person at the counter either making it removable, non-reflective, or with an intercom system improves accessibility for people with speech and/or hearing impairments. In addition, an induction loop should be mounted at a height of 1100 mm, so that there is no visual barrier between the person at the counter and the passenger. It is important that lighting in the booking office enables effective lip-reading.

Operating instructions on **ticket vending machines** should be clearly visible, operating buttons should be at least 20 mm in diameter and protruding with all interactive elements (push buttons, coin slots and ticket collection) to be between 750 and 1200mm in height from ground level. Ticket vending machines need a good level of lighting (200 lux) and the places on the machine where tickets and change are issued should be large enough for people with manual dexterity impairments to be able to retrieve tickets etc. without difficulty (Vending machine manufacturers still sometimes forget this). If **ticket barriers** or turnstiles are fitted, a minimum of one of the machines shall have a free passageway with a minimum width of 800 mm and shall be able to accommodate a wheelchair up to 1200 mm in length. At times when stations are open but unstaffed, ticket barriers and gates should be fixed in an open position to prevent the system from becoming 'closed' to PLM.

(Source: Adapted from Oxley 2002 by DFID 2004)

Waiting areas should have sufficient space for wheelchair users to wait and manoeuvre. If there is sufficient space two levels of seats should be provided, one at 480mm and the other at 580mm, with a seat width of 500mm. Seating layouts that allow a wheelchair user and a companion to sit next to each other are desirable and not all seats should have armrests. Arm rests should be at a height of 200 mm above the seat and coated in a slip-resistant material with color contrast against the seat.

Interchanges and terminals that require passengers to wait for long periods of time should provide accessible **public toilet facilities** and should provide at least one unisex wheelchair accessible cubicle, but ideally accessible toilets should be no less available than those for able-bodied people. Basic design features are illustrated in the diagram above.

Common requirements for accessible toilets at major interchanges and terminals are: a wide, easily opened door (minimum clear width of 925 mm); sufficient space for a wheelchair user to manoeuvre inside the cubicle; space around the lavatory to enable the wheelchair user to transfer from front or side from wheelchair to lavatory; hand-washing and drying facilities within reach from the lavatory; sufficient space for a helper to assist in the transfer. The overall size of the toilet cubicle depends on whether it has a corner or central WC. The latter allows the user to transfer from right or left on to the lavatory or from the front and needs overall dimensions of 2,800 mm width by 2,200 mm length. A corner layout, which allows transfer from either left or right, requires less space: 1,500 mm width by 2,200 mm length. The lavatory seat height should be 480 mm, with firm hinged (drop down) support rails on the transfer side(s). Wash basins should have a height of 720-740 mm (maximum 800 mm) and hand dryers, soap dispensers should be at a height of approximately 850 mm. Each toilet should have an emergency alarm or call for assistance cord that is easy to reach and operate and any fittings should be color contrasted..

Case study example: Sao Paulo, Brazil, Metro Line 4

The aim of the Line 4 project was to build a state of the art driverless Metro system in Sao Paulo that links all lines together and therefore is a key line for facilitating interchange. Accessible features were designed into the planning phase, with consideration of accessibility extending beyond the vehicles and stations to the surrounding areas.

Accessibility features include tactile paving to alert people of hazards and provide directional assistance; clear signage (tactile in some locations); modern clear lighting; well trained staff who are able to provide assistance; escalators and lifts, doors between the trains and the platforms; a minimal gap between the train and the platform, priority seating for PLM; fare gates (not turnstiles), including wider ones for a wheelchair users; and trains that are fully connected so that passengers can move around freely within them.

The addition of extra accessibility features is thought to have only minimally raise the costs of the project, but it is felt that the benefits to PLM and the wider population are high. It is reported that more PLM use Line 4 than some of the other lines, although no formal evaluation has taken place of the success of the features. *(Picture source: www.metro.sp.gov.br)*

Likely costs and benefits

Retrofitting accessibility features in a station environment can be expensive depending on the circumstances and constraints in a given location, and the number of major changes in level requiring lifts or escalators. At the high end, in 2011, London Underground planned to spend £400m ($600m) on retrofitting accessibility features in 17 stations, equating to an average of £23.5m ($36m) spent on each station. Improvements will include providing step-free access from the station to the train, in addition to features such as induction loops, tactile paving, more visible help and information points, wide aisle gates and more accessible train design.

Feature	Costs	Comments	Likely benefits
Ramps to provide level, step free environments	$250-$300 per metre	Enable those unable to negotiate steps to easily move around the station	Enables those unable to use steps to move around the station; other passengers will also benefit
Passenger elevator to platform	Approximately $600,000	Elevator costs from footbridge to platform.	Benefits passengers unable to climb stairs. Also benefits those traveling with children or luggage.
Accessible toilets	$15,000-$30,000	Costs can vary significantly, but are typically greater if retro fitting.	Beneficial for all PLM, particularly wheelchair users. Also benefits parents with children as toilets provide more space.
Accessible automatic ticket barriers	Medium-high cost		Benefits those unable to operate ticket barriers. Also helps prevent fare evasion
Accessible information and ticket desks	Medium cost		Benefits wheelchair users and those with hearing impairments.
Accessible terminals and kiosks	$6,000 - $10000 per terminal	Requires ongoing maintenance and related costs if used for ticketing	Benefits all users.. Also reduces need for station staff.

Implementation issues

- Retrofitting a terminal or interchange to ensure it is accessible may be complex to ensure there is step free access throughout the station. The complexity of installing accessible features will depend on the level of access provision, such as if the interchange or terminal is to be wholly flat, or whether ramps are used where stairs are located.

- Any retro fitting should be undertaken to try and minimise impact on all passengers during construction.

Further information, design guidance and standards

- DfT (2010), "Accessible Train Station Design for Disabled People: A Code of Practice", TSO, London

- DFID (2004), ORN21 Enhancing the Mobility for Disabled people; Guidelines for Practitioners; TRL, England

- COST 335 (1999), Passengers Accessibility of Heavy Rail Systems: Final Report of the Action; Office for Official Publications of the European Communities, Luxembourg

D. PUBLIC TRANSPORTATION VEHICLES

This grouping focuses on the in-vehicle accessibility features specific to each mode of public transport.

i. Airplanes

Airplanes can incorporate various accessibility features to make it easier for PLM to travel by plane. PLM should be able to take on board mobility aids such as walking frames, crutches or foldable wheelchairs, free of charge, and should be stored within the confines of the cabin. Battery powered wheelchairs are typically carried in the hold of the aircraft, while airlines are required to store the batteries, particularly wet-cell batteries which may be "spillable".

Moveable armrests enable easier access into and out of a seat. Airlines may also provide back support aids, such as the Burnett Body Support, and are required to permit passengers' own seat supports such as the Child Aviation Restraint System.

Lavatories should be big enough for the passenger, an on-board wheelchair and a personal attendant entirely enclosed with the door closed. It should be possible for the passenger using an on-board wheelchair to pass through the lavatory door and into the lavatory to be able to transfer from the wheelchair to the toilet. Hand grip rails allow the passenger to transfer and should be mounted on the wall behind the toilet and one mounted on the wall or cabinet opposite the door. Aircraft lavatories should have a call light to alert cabin crew of emergencies and have toilet flush controls that are able to be used by PLM. Any signage should be tactile, and contrast from its background.

Passengers with hearing impairments can be catered to by specially trained cabin crew with sign language skills. In addition, some aircraft carry neck loops which work in conjunction with the 'T' switch on a hearing aid to enable a hearing impaired passenger to listen to information messages, or enjoy in-flight entertainment.

On board safety information should be provided for **visually impaired passengers** in large print and Braille. Assistance and service animals should also be permitted on board.

> **Case study example: Air Asia, Malaysia**
>
> Air Asia, a low cost airline based in Malaysia, received complaints that it lacked disabled friendly facilities and that boarding in particular was undignified for PLM as those unable to climb up steps to the aircraft had to be carried by Air Asia staff.
>
> In 2008, the airline acquired two Ambulifts, a mechanical lift that is attached to the back of a van to transport PLM, and wheelchair users in particular, from the ground onto the aircraft. The airline also introduced aisle wheelchairs, 4 specific seats for PLM, installed handles within on board lavatories and offer priority boarding for PLM. The airline also negotiated an agreement to use aerobridges for PLM. The two Ambulifts cost $430,000.
>
> *Source: www.thestar.com.my*

Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Burnett Seat Supports	$600-$1,000+		Benefits passengers who require the seat support, making journey more comfortable
Aisle Wheelchairs	$150-$1,000		Benefits wheelchair users and those less able to walk to access on-board facilities
Moveable arm rests	From $0	Many airline seats have moveable or adjustable arm rests.	Benefits passengers who have to slide onto the seat, particularly wheelchair users
Ambulifts	$200,000-$250,000		Wheelchair users and those unable to climb stairs can board with dignity
Accessible lavatories	Medium cost	Cost is usually incorporated within cost of the aircraft	Benefits all passengers, but particularly wheelchair users

Implementation issues

- Retro fitting accessibility features is complex and more expensive due to costs associated with safety certification, therefore it is often cost effective to install accessibility features when purchasing the aircraft. There are additional costs to the airline for taking the aircraft out of service whilst making modifications

Further information, design guidance and standards

- Ad Hoc Working Group on Design Guidelines (1992), "Suggested Guidelines for Accessible Lavatories in Twin Aisle Aircraft", Department of Transportation, Washington DC

ii. Ferries and marine vessels

If ferries or other marine vessels form part of a transportation project, the following design considerations should apply:

- When **accessing a vessel**, it should be constructed and equipped in such a way that wheelchair users and other PLM can embark and disembark easily and safely, either unassisted or by means of ramps, elevators or lifts. The maximum slope of ramps for wheelchairs should be 1:20. There should be at least one entrance/exit that is accessible for PLM without stairs and steps and be marked with the international symbol for disabled installations.

- **On board** the vessel, where stairways are necessary, they should not be steep and should be of a design with closed steps.

- **Lavatories** should be provided on board marine vessels, and the requirements of these are discussed elsewhere in this Guidance Note.

- At least 4% of the ship's **passenger seats** should be suitable for PLM and should be situated near evacuation routes and toilets. There should be supports, such as hand rails, close to the designated seats. Space for wheelchair users should also be provided.

- **Decks and floors** should be level and have slip resistant surface. If steps are necessary, they should not be higher than 30mm, or a ramp of a fine-masked grid or equivalent and handholds should be alongside the step.

- If an information counter is available, the height of the counter should be no higher than 90 cm. An induction loop should be installed and crew should be given training and issued with instructions about the assistance needed by PLM in an emergency.

Case study example: Hong Kong domestic passenger ferry services *(Source: www.td.gov.hk)*

Ferries in Hong Kong have staff members who are available to assist on piers to aid people getting through turnstiles and onto the ferry and at the entrance to piers there are clearly signed call bells to request assistance. Once boarded there are anti-skid gang planks and grooves on the landing planks to facilitate the movement of wheelchairs and dedicated wheelchair spaces are available on most ferries. PLM are advised to remain on the lower deck as there are only stairs separating the two decks. Staff assistance is available at most pier entrances for those who struggle to progress through the turnstiles

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Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Transfer ramps	Low - medium cost	Costs vary based on materials used and the specification of the ramp	Benefits all passengers, but particularly those unable to negotiate steps & wheelchair users
Dedicated wheelchair spaces	Low to medium cost		Benefits wheelchair users and their companions, making the journey more comfortable.
Emergency call alarms	Low to medium cost		All passengers are able to use the alarm in case of emergency

Implementation issues

- Access to and from the pier is important, without access an accessible ferry is redundant. Providing designated PLM parking bays close to the pier/terminal and providing an accessible route from the parking bay to the pier are vital.

- Tides should be considered when designing any feature to transfer passengers to and from a ferry. Access will be via a ramp, therefore the ramp needs to be moveable to cope with the differences in height between the vessel and pier.

Further information, design guidance and standards

- Passenger Vessels Accessibility Guidelines, 2008, Department of Transport, Washington DC

- Marine Guidance Note 306 (M) (2006), "Designing and operating smaller passenger vessels: Guidance on meeting the needs of persons with reduced mobility", HMSO, London

- DPTAC (2000), "The design of large passenger ships and passenger infrastructure: Guidance on meeting the needs of disabled people", HMSO, London

iii.   Buses and Mass Transit Vehicles

Large buses, BRT vehicles, LRT vehicles, and Metro vehicles (rapid transit vehicles) have broadly similar characteristics in terms of transporting PLM - therefore are all discussed together in this section.

Low floor "kneeling" buses are being introduced across the world to enable step free boarding for wheelchair users and all other passengers.

However, in many developing countries, buses with high floors remain popular because they are less expensive and more suited to rugged operating terrain. These types of buses have floors approximately 1m above ground level, have narrow entrances with steep, high steps and narrow spacing between seating.

The vehicle entrance can be a barrier for PLM for **boarding and alighting**, and appropriate specifications are as follows:

- A maximum first step height of 250mm (325mm is acceptable during transitional periods)

- A maximum of three steps

- Minimum depth of steps of 300mm (280mm on vehicles less than 2.5m wide)

- Step risers should be vertical, smooth, flat with color contrast on the nose

- Minimum ceiling height at door of 1.8m above step

- A maximum width of 850mm between handrails at the entrance to the vehicle

Reducing the distance to the first step can be achieved using a foldable step which can be attached to the stairwell and deployed automatically or manually by the driver. Some high floor buses can include road side lifts, and this has been used in BRT systems in places such as Johannesburg (pictured). Curbside lifts are used on feeder routes where the bus stop infrastructure does not allow for level or low floor access.

Source: www.reavaya.org.za

The following internal features can all be incorporated on all types of transit vehicle including buses, BRT, LRT and Metro vehicles in addition to large conventional buses.

- Non-slip finish to flooring and surfaces, plus handrails and stanchions throughout.

- Sloping handrails both sides of the door, parallel to the slope of the steps which are round, between 30mm and 35mm in diameter, and with clearance of 45mm.

- Vertical handrails and stanchions should be color contrasted and available at every row of seats. Where this is not feasible there should be a maximum distance of 1,050mm between each hand rail.

- Suspended hand holds should be considered for passengers unable to reach ceiling mounted horizontal rails

- Seating should be a minimum of 450mm wide per passenger and between 430mm and 460mm from the floor, with 230mm of leg room. Priority seats should be available which face either the front or back of a vehicle – not towards the side

- Priority seats should be located near the driver, be clearly marked, have adequate signage and have a minimum of 450mm of clearance for room to store mobility aids such as a folded wheelchair, walker, crutches or a guide dog

Source: BRT Accessibility Guidelines, 2007

- Aisles should be a minimum of 450mm wide on vehicles not equipped for wheelchairs; 750-800mm for vehicles that are equipped

- Tie downs should be used in wheelchair spaces, or the user could sit with their back against a solid back rest facing the rear of the vehicle, provided drivers are trained to avoid sudden starts and routes do not involve steep grades/sharp turns (see diagram on previous page).

- Stop cords or bell pushes should be located near seats to enable passengers to signal their stop

- In wheelchair areas, a lower cord or bell push to be included, and activate a highly visible "STOPPING" sign at front of vehicle

- The vehicle floor should be flat and level from the front to at least the middle of the vehicle with a non-slip surface
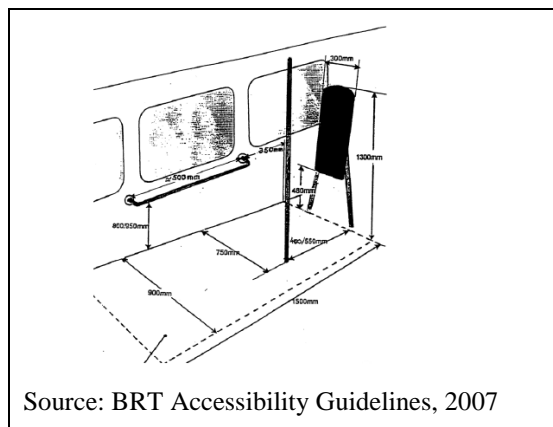
Case study example: accessible BRT vehicle in Guatemala City

The Transmetro system in Guatemala City was designed from the outset to incorporate as many accessibility features as possible. These features included an area for wheel chair users close to the front door where the platform gap is usually smaller. This also enables the driver to be more aware of PLM who are on board the bus. Priority seating for PLM is located close to the door and have different colored seating to denote who should use those seats. The priority seats are marked with Braille and/or tactile text and there is a minimum of 450mm clearance in front of the seat for any mobility aid. All doors are 900mm wide while there are stanchions by each seat and PLM are able to move from one stanchion to another to keep balance. Stanchions are color contrasted while horizontal bars are lower than standards from the US and Europe. Finally, the floor is made of a non-skid material to provide firm footing for PLM.

(Source: Sorlie, 2009)

Likely costs and benefits

The additional marginal cost of incorporating accessibility factors on board transit vehicles when bought new is relatively low given the high cost of purchasing vehicles. Buses, for example, can cost from $80,000-$100,000 for a high floored Ashok Leyland Falcon 54 seat bus (similar to those used for the Lagos BRT-Lite system) to upwards of $320,000 for an articulated, highly specified low floored bus. By comparison, a metro style vehicle, such as those used in the London underground system cost up to $12m each, while trams can cost between $4million and $6million.

Feature	Costs	Comments	Likely benefits
High Floor Coach	$80,000 -$100,000	Costs vary significantly between manufacturers	Benefits all PLM and wheelchair users to board the vehicle
Single Deck Articulated Low Floor Kneeling Bus	$300,000 - $500,000	Costs vary significantly between manufacturers	Benefits all users, but particularly PLM and wheelchair users to board the vehicle
Priority Seating	Low cost		Benefits PLM by enabling them to access a seat more easily and make their journey more comfortable
Hand rails and Stanchions	Low overall cost	Less expensive to include within specification when a new vehicle is ordered	Benefits those who find steps difficult, but also benefits all users to board/alight with greater ease
Curbside Lifts	$10,000 - $30,000	More economic to include within specification when vehicle is ordered	Benefits wheelchair users and those unable to step up onto the vehicle
Color contrasted step nose	Low cost	Can be retro fitted to a vehicle with relative ease	Benefits those with sight impairments to distinguish the edge of each step

Case study example: low-floor bus in Grenoble, France

Grenoble is renown as a pioneer city for its accessibility policy. The SMTC transport authority and Semitag transport operator regularly record the usage of their system by disabled people. The following figures illustrate the progress registered from the introduction of low-floor and level-access of the light rail in 1987 and of low-floor buses from 1994. In early 2008, 3 light rail lines with 63 stations were fully accessible including visual and audible announcements onboard and on the platforms. 68% of the bus routes and 75% of the bus stops were accessible. Passenger counting is recorded only for wheelchair users, not other disabled,. During 2007, on 3 tramway lines and 19 bus lines:

- 363 mean value of WC users per week day,
- 81% travelled on the tramway lines

The accessibility of the bus and tramway network had a significant influence on the usage of the special transport service (on-demand, door-to-door). The PT authority and the operator modified the admission rules to the on-demand service so that vision impaired persons and ambulant impaired persons can now register for this service, whereas only wheelchair users could use it before. The travels of wheelchair users decreased by 17% while the travels of vision impaired remained stable and those of ambulant impaired people more than doubled.

Source: Certu.

Implementation issues

- Retro fitting access features onto existing vehicles is more costly and more complex than specifying the measure at the point of vehicle procurement. If retro-fitting accessibility features, consideration should be given to the period that the vehicle will be out of service, as this will limit revenue earning capabilities for the owner/driver for a period of time

- For benefiting from the step-free access of low-floor buses in urban areas, the bus stops should be adapted so that the access ramp can be easily deployed and used by wheelchair users and parents with child prams. It will benefit all users and increase the dwelling time at stops

- Roadside lifts may reduce the space available on board the vehicle. However, wheelchair securement areas are often welcome by urban transit system operators as they increase peak hour capacity by providing more space for standees. In case of intercity operation, the wheelchair securement area could be equipped with two folding seats for passengers when there is no wheelchair user on board.

Curbside lift for wheel-chair access in a long-distance coach

(Source: Certu.)

- Driver training should be considered where accessible vehicles are available to avoid sudden braking and acceleration, and for drivers to assist PLM to board and alight safely, particularly if curbside lifts are available.

Further information, design guidance and standards

- Rickert T, (2007) BRT Accessibility Guidelines, World Bank, Washington

- DFID (2004), ORN21 Enhancing the Mobility for Disabled people; Guidelines for Practitioners; TRL, England

- UNDP (2010) A Review of International Best Practice in Accessible Public Transportation for Persons with Disabilities, available at: http://www.undp.my

- Storlie, S, (2009) A design manual for accessibility in Transmetro BRT system, Guatemala City, Design Without Borders, Norway

- COST 349 (2005) Accessibility of interurban buses and coaches for people with reduced mobility. Final scientific report. European Cooperation in the field of Scientific and Technical research

iv.   Trains

To enable ease of **boarding and alighting** for PLM:

- Trains should ideally have level access from the station platform to the coach

- Where level access is not possible, there should be raised areas of platform that align with doors to carriages that can accommodate wheelchair users, or portable ramps. Ramps that are longer than 1,000mm should not have a slope greater than 8%; for ramps between 600mm and 1000mm, the slope should be no greater than 13% and any manual ramp must be able to be securely fixed to the train, be a minimum of 760mm wide, with raised edges on both sides if it is narrower than 900mm

- Where steps are prevalent, there should be adequate grab rails and color contrasting of steps (see rapid transit section)

- Portable hand operated lifts can also be used for wheelchair users to enable them to board a train whilst seated

- Consideration should be given to the locations where PLM board. These locations should be away from curved sections of track where the gap between the train and platform could be large.

- Doorway widths should be a minimum of 800mm and unobstructed

- Train doors should open automatically, or when a passenger pushes a button which should be located no more than 1300mm above the floor of the train, raised by 3mm and be large enough to be pressed by a palm.

Design considerations for **interior features are similar to those set out for rapid transit vehicles** in the previous section of this guide.

In addition, an accessible lavatory should be provided adjacent to the wheelchair accessible area.

Doors should have a minimum width of 800mm, be marked with the international symbol for access and preferably be electrically powered. There should be sufficient space to manoeuvre a wheelchair within the lavatory and

position a wheelchair adjacent to the toilet seat, and a horizontal hand rail be provided at the side of the toilet seat. This should have a hinge so that it can be moved to allow wheelchair users direct access to the toilet seat. The toilet seat should be 475mm - 485mm above floor level and any amenities should be accessible for wheelchair users. The cubicle should be fitted with emergency alarms that can be activated by the palm of a hand and heard by a member of train staff.

Source: www.ricability.org.uk

Likely costs and benefits

The marginal cost of accessibility features on board trains is low relative to the overall cost of purchasing rolling stock. Typically, when purchasing new rolling stock many of the accessibility features discussed are likely to be incorporated within the price.

Feature	Costs	Comments	Likely benefits
Incorporating fully accessible rolling stock	5% additional cost of new accessible rail vehicles to make accessible	Enable wheelchair users to board, alight and move around the train with ease	Benefits all PLM, but particularly wheelchair users, to board, alight and move about the train with ease.
Portable manual train lifts	$10-14,000 per lift		Enables wheelchair users only to board and alight with ease.
Wheelchair ramps	$275 per metre		Enable wheelchair users to board, alight and move around the train with ease. Also benefits those with children or luggage
Automatic doors on trains	$20-25,000 per double width opening door		Makes boarding and alighting easier for all passengers, but particularly those unable to use door handles
Hand rails on stairs	$140 per metre		Enable PLM (and all other passengers) to use stairs with greater support

Implementation issues

- Platform heights and train heights can vary significantly between countries which can result in differing levels between countries and the gaps that would need to be negotiated or bridged will vary.

- The ease and cost of retro-fitting equipment to existing rolling stock will depend on the structure already available within the vehicle. Depending on the accessibility features, it may only be viable to fit them during a period of major refurbishment, which could add time to the process of making rolling stock accessible for PLM.

- Where equipment is required, such as ramps and platforms, railway staff should be fully trained to use it safely and efficiently and have full awareness of the issues faced by PLM. This will help ensure PLM to travel with greater dignity.

Further information, design guidance and standards

- Department for Transport (2004) Significant Steps:- Technical Analysis; available at http://assets.dft.gov.uk/publications/topics/access-11

- DFID (2004), ORN21 Enhancing the Mobility for Disabled people; Guidelines for Practitioners; TRL, England

- COST 335 (1999), Passengers Accessibility of Heavy Rail Systems: Final Report of the Action; Office for Official Publications of the European Communities, Luxembourg.

E. PRIVATE MODES OF TRANSPORTATION

This grouping focuses on private modes of transportation used by PLM, often where public transportation is not sufficiently accessible to meet their needs. Such modes may play a role in some transport projects funded by World Bank.
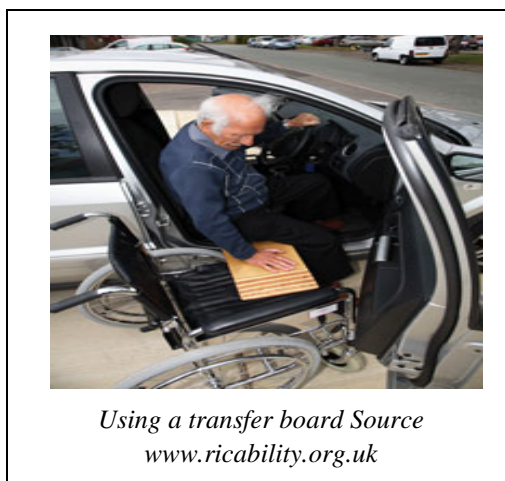
i. Adapted vehicles

There is a broad range of **adaptations** that can be made to private vehicles to enable people with different physical disabilities to use them. These include:

- Steering aids for people with upper limb difficulties such as easy grip devices on steering wheels including steering knobs or spinners, joysticks, a turntable system or stirrups that allow the vehicle to be steered by the feet, horizontal steering wheels or tillers.

- Adaptation of controls such as direction indicators or the horn to be within finger reach of the steering wheel or as foot controls.

- On a motorbike, hand controls can be transferred to be used by the more functional arm, while clutches and brakes can be controlled by the feet.

- Shifting pedal controls away from disabled or weakened lower limbs to use as hand controls

- Moving the accelerator to the left side of the foot well if the user has a right leg disability

- Transferring rear brake controls and gear changing pedals on a motorbike to a handlebar mounted lever.

Cars with wide opening doors or sliding doors provide the most flexibility for PLM, while vehicles with high doors and low sills enable passengers to enter the vehicle with minimal bending or stepping. Within the vehicle a flat floor at the front of the vehicle can enable easy movement within the vehicle. Transfer boards are a cheap and simple solution for someone to transfer between a vehicle and a wheelchair of a similar height.

Wheelchair accessible vehicles (WAV) enable users to stay in a wheelchair while the vehicle is driven, either as driver or as a passenger. As a driver WAVs can be modified to enable control of the

Using a transfer board Source www.ricability.org.uk

vehicle through hand controls, tailored to meet their needs. As a passenger in a WAV, PLM are usually located behind the first row of seats, however some designs allow accessibility next to the driver. WAVs can be fitted with a ramp or a lift, which can be either hand operated or automatic.

Likely costs and benefits

Feature	Costs	Likely benefits
Swivel Cushion to aid getting in and out of the vehicle	$30-$10	Being able to access, and/or drive vehicles improves access for disabled people who cannot access public transport and reduces the need for specialized transport services.
Transfer board	$10- $100	
Wheelchair Ramps	$400-$800	
Button-operated clutch on the gearshift	$2,000+	
Handbrake adaptations	$200+	
Simple car control adaptations (steering spinners/knobs and brake/accelerator hand controls)	$500- $1,500	
Horizontal steering wheel	$8,000-$25,000	
Wheelchair accessible motorcycle	$1,000-$12,000	
Wheelchair Accessible Vehicle	$10,000 (used 4 year old Renault Kangoo in the UK) to $50,000+	

Implementation issues

- All vehicle adaptations should be made to suit the needs of the individual.

- There should be complementary infrastructure, such as accessible parking spaces to enable PLM to use adapted vehicles

Further information, design guidance and standards

- Ricability (UK) http://www.ricability.org.uk/index.aspx

- National Association of Bikers with a Disability (UK) http://www.nabd.org.uk/

ii.   Parking facilities and associated concessions

Creating **accessible parking spaces** helps disabled people to make use of private vehicles and access key opportunities. The diagram to the right shows recommended dimensions for bay parking spaces. On-road parking spaces specifically for disabled people should be 6.6m in length to allow access through the rear of the vehicle. Where the parking bays are at an angle to the curb, the bay should be a minimum of 4.8 m long by 2.4 m wide plus clear space of 1.2 m at the side.

Parking spaces for disabled people should be clearly marked with a wheelchair symbol. For on street parking a post mounted sign is recommended with accompanying drop curb for access onto the sidewalk. They should be located in close proximity to sites of interest to limit the distance needed to walk and should be located on a generally flat area and be connected to an accessible sidewalk.

Consideration should be given to ensuring that disabled parking spaces are not abused by motorists who are not eligible to use them. Consideration should also be given to disabled parking permits (see case study below).

Source: Adapted from Oxley 2002 by DFID 2004
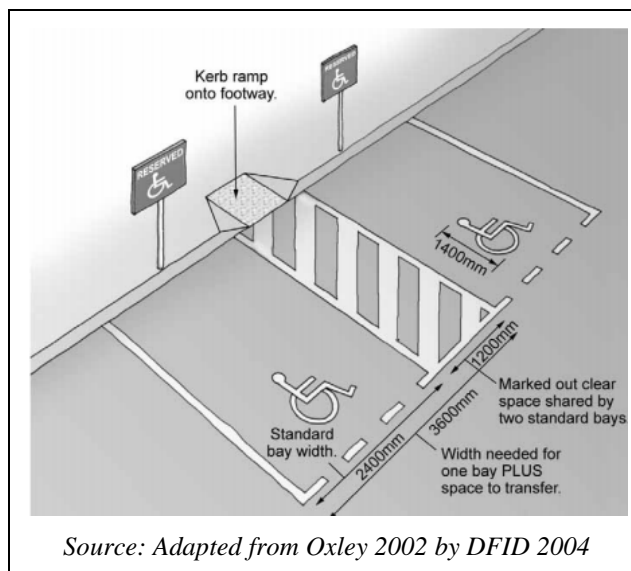
Case study example: Hong Kong disabled parking permits

In Hong Kong, eligible disabled people can apply for a disabled parking permit. These permits are available for individuals who have been assessed by the Hospital Authority to have a 'permanent disease or physical disability that causes him considerable difficulty in walking'. To apply, individuals must have passed the driving ability assessment. Disabled drivers who obtain the permit are able to park in the designated disabled parking spaces, are able to park for free at on-street metered parking spaces, and are eligible for half-fare concession on monthly parking charges at multi-storey car parks managed by the Transport Department. Each permit is valid for three years before renewal.

Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Disabled parking concessions	$40-$45 administrative cost per applicant (in the UK in 2010) plus any loss of parking revenue	Require wider infrastructure improvements to ensure there are genuine benefits for disabled people	Being able to access sites of interest reduces need for alternative transport to be provided
Widening parking spaces for disabled users	Medium cost	Increases the accessibility of locations for use by disabled people	Potential increase to economic activity with increased accessibility to shopping, leisure and work facilities for disabled people
Accommodating parking spaces closer to buildings	Low-medium cost	Increases the accessibility of locations for use by disabled people	

Implementation issues

- Consideration should be given to footways, ramps, and doorways to make the whole journey accessible

- In multi-storey car parks, accessible parking spaces should be located on the ground floor or, close to lifts

- Parking permit schemes can encourage fraudulent misuse or abuse of permits, which requires greater levels of policing

- For those administering a parking permit scheme, staff members should have received disability awareness training

Further information, design guidance and standards

- DFID (2004), ORN21 Enhancing the Mobility for Disabled People; Guidelines for Practitioners; TRL, England

- Canadian Human Rights Commission (2006) International Best Practices in Universal Design: A Global Review, Ottawa

- ECMT (2006) Improving Transport Accessibility for All: A Guide to Good Practice European Conference of Ministers of Transport, Paris

iii.   Powered wheelchairs and mobility scooters

Powered wheelchairs and mobility scooters can form a key part of the trip chain for people who are unable to walk and cannot propel a manual wheelchair. They are often privately owned but can also be made available through hire or loan schemes at key destinations such as town centres or other attractions.

There are several types of powered wheelchair, including some aimed at indoor use and others also allowing outdoor use. Mobility scooters can also be used indoors, but are typically used outdoors. A useful classification is adopted in the UK to distinguish between two types of mobility scooter:

- Class 2 Scooter: 3 or 4 wheels, maximum speed of 6.4kph, for use on sidewalks

- Class 3 scooter: Larger, sturdier frame, max speed of 12.8kph, for use on roads. If roadworthy, should be fitted with lights and indicators

Case study example: Shopmobility scheme, UK

Shopmobility is a scheme run by the National Federation of Shopmobility UK (NFSUK) which lends manual wheelchairs, powered wheelchairs and powered scooters to PLM to shop and to visit leisure and commercial facilities within town, city or shopping centres. To use the system registration is required with a membership card and when PLM require a mobility aid to go shopping, they simply show this card. There is often a cost to becoming a member, and this can range from $15 for one year, or life membership for around $30.

The scheme can vary depending on the region of the UK, but many schemes prefer you to book in advance. When using new vehicles PLM are provided with a short demonstration and there may be an opportunity to book a volunteer escort to accompany the user whilst shopping. Some schemes also have escorts who are trained to guide people with visual impairments. The cost of hiring the mobility scooter varies on the type of scooter, however some offer the service free of charge. Some shopmobility schemes also offer long term rental of mobility scooters for members.

(Source: www.shopmobilityuk.org)

Likely costs and benefits

Feature	Costs	Likely benefits
Powered wheelchair	$1,500 - $6,000	Benefits those unable to walk, or who can only walk short distances. Provides greater independence and reduces reliance on relatives and specialised transport services
Mobility scooter (class 2)	$1,000 - $4,000	
Mobility scooter (class 3)	$1,500 - $5,000	

Implementation issues

- The use of powered wheelchairs and mobility scooters require relatively level surfaces upon which to function efficiently. This may require wider improvements to sidewalks and/or road surfaces

- Wider infrastructure within users' houses may be required, such as ramps and access features

Further information, design guidance and standards

- www.ricability.urg.uk

- www.us-mobility.com/

- www.direct.gov.uk

iv. Rickshaws and auto-rickshaws

Rickshaws provide a reliable and consumer friendly form of personal transport for many millions of people in low income countries. There are typically three types of rickshaw, hand pulled rickshaws, cycle rickshaws and auto rickshaws.

The design of a conventional **cycle rickshaw** does not permit easy access for PLM; due to the high step access and the limited amount of space and support within the vehicle. However, cycle rickshaws can be adapted to make it easier for PLM, as illustrated below.

Case study example: disabled cycle rickshaw design, Delhi, India

The easy rickshaw concept was a variation on the standard rickshaw design in order to improve the ease of access for PLM. Key design features include reducing the footboard height to 23cm from the floor (half of the standard height of 46cm), redesigning the footboard, top stay, and chain stay allow the passenger to enter from the front, rather than the side of the vehicle. By providing comfortable seating, a backrest and footboard for the passenger ensures a more comfortable journey.

Allow entry to rickshaw from the front

Height of footboard reduced to 23 cms
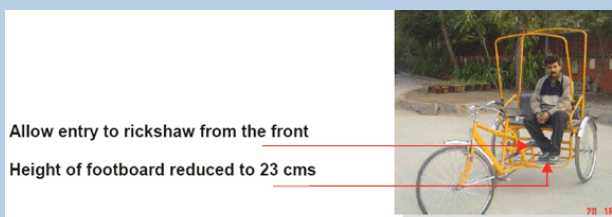
Source: Singh et al, 2007

Auto rickshaws have a lower step up onto the vehicle compared to buses – typically the initial step is around 35cm, often divided into two steps half this distance in newer models – while the personal door to door service reduces the need for interchange. Options to improve the accessibility of auto rickshaws include:

- A talking meter to assist people with vision impairments

- Braille plates providing registration details

- Additional hand holds for boarding and alighting

- Adequate space for a folded wheelchair to be stored

- Passenger seat belts

Photo by Tom Rickert (AEI), courtesy of Svayam and GNB Motors

Likely costs and benefits

Feature	Costs	Comments	Likely benefits
Lowering the floor of a cycle rickshaw	Low cost		Enable PLM to board more easily, without a big step up onto the vehicle
Adapt an auto rickshaw with minor improvements	Low cost	Costs vary depending on the improvement, but are typically low cost	Enable PLM to board more easily. Added handholds make it easier for all passengers to access the vehicles.

Implementation issues

- Any time it takes to adapt any type of rickshaw will result in a potential loss of earnings for the owner/driver

- Consideration could be given to the scheduling and dispatching of autorickshaws for use with PLM, and on business models which would enhance their use with PLM

Further information, design guidance and standards

- Whitelegg and Williams, (2000), Non-motorized Transport and Sustainable Development: Evidence from Calcutta, available online at: http://www.eco-logica.co.uk/pdf/Calcutta2.pdf

- DFID (no date), "Enhanced Accessibility for Persons with Disabilities Living In Urban Areas", Unpublished.

- Ratnala, V (2006-7), Mobility and Health: A case study on –"Accessible Transport and Health of Persons with Disability in Rural areas of India", available online at: http://www.ifrtd.org/mobilityandhealth/

- Forthcoming publication by Rickert (2011), Access Exchange International with Svayam in New Delhi in relation to Autorickshaws.

v.   Taxis and minivans

Within developing countries, there are two types of vehicles that are referred to as taxis, a) internationally recognised conventional taxi vehicles that offer door to door services, and b) minibus and midibus type vehicles.

Some **conventional taxi** manufacturers now produce fully accessible vehicles. Taxis and minivans can also be adapted and modified to improve accessibility for PLM. The minimum requirements of an accessible taxi include:

- Door width of 850mm and height of 1,595mm

- Minimum roof height of 1,625m (although 1,825mm is preferred)

- Grab handles located throughout the cabin

- Handles with a diameter of 40mm and surface clearance of 45mm

- Vertical handles provided close to doorways

- Seat heights between 430mm and 460mm from the floor

- 1,176mm should be given from the seat back to any obstruction in front of the seat

- All major accessibility features of a taxi should be color contrasted

- Internal lighting a minimum of 150lux, but brighter around steps

Source: www.excelschoolofmotoring.co.uk

Access for wheelchair users can either be at the side of the vehicle or the back. Side access prevents wheelchair users from having to negotiate a curb, while the ramp angle would be shallower, making access easier for the user or attendant. Rear access may enable more simple manoeuvres within the vehicle to secure the wheelchair for travel, but accessing the vehicle from the curbside or in a taxi rank may be difficult with rear access.

International guidance on ensuring access to **minibus taxis** includes:

- Entrance on curb side of vehicle by steps/removable ramps. Minimum clear opening of the door to be 850mm wide

- Steps should be 800mm wide, 200mm deep, and the first step a maximum of 250 mm above ground level

- Each step, or its front edge, shall be of a bright contrasting color

Case study example: Wheelchair accessible taxis in Delhi, India

In Delhi there have been low cost developments in modifications to taxis to enable easier access for disabled people. The changes to the vehicles involve retro-fitting existing vehicles fleets with low cost modifications. The 'Maruti' van can be modified to accommodate wheelchair passengers through increasing the vehicle height, relocating the Compressed Natural Gas (CNG) cylinder and adding adjustable sliding passenger seats. The challenge of getting a wheelchair user into the van was resolved through the simple modification of a power jack, which is typically used to lift the vehicle to change tires, but was found to be effective at lifting wheelchairs to the level of the platform of the van for boarding and alighting the vehicle. These changes were estimated to the cost Maruti Company only $224 (Indian Rs. 10,000) per vehicle.
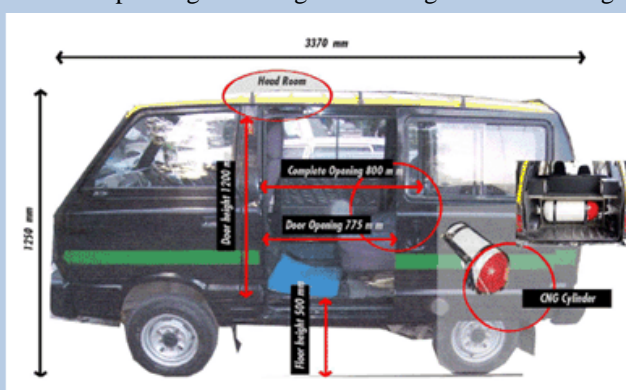
Source: Singh et al, 2003

- Portable ramps should have a maximum gradient of 1:4 with a minimum width of 150mm. Ramps should be positioned with a gap of 330mm between the ramps. Ramps shall have a safe working load of not less than 300 kg.

- The wheelchair position should face forward or backward in the vehicle

- Minimum of one seat fitted with a waist restraint or seatbelt. Wheelchair positions fitted with one waist level restraint

- Sufficient grab bars provided to accommodate wheelchair users and ambulant persons

- The fare collection and other interfaces should be designed to ensure universal access for all passengers

Likely costs and benefits

The likely cost of adapting a taxi or minivan can vary depending on the type of vehicle. It has been estimated that the cost of converting a door aperture to meet standard width and heights may increase the cost of a vehicle by 30-50%.

Feature	Costs	Comments	Likely benefits
An accessible taxi	$40,000 - $50,000 for a new taxi (in the UK)	A typical cost of a new accessible London Taxi	Enables all PLM, but especially wheelchair users, to travel and access key goods and services.
Adapting a taxi or minivan	From $200 to $20,000	Costs depend on scale of adaptation and cost of parts and labour	Can also benefit other users through improved access (depending on adaptation).

Implementation issues

- Some vehicles will not be able to be modified and it would not make economic sense to modify them, so cost is an immediate barrier to making taxis and minivans accessible

- Drivers should be trained to be aware of the issues PLM face. This might include assisting PLM to board and alight the vehicle or at least being patient while PLM board, driving more carefully and avoiding sudden movements whilst travelling

- Taxis ranks and taxi parks should be designed so that PLM can access the taxis without barriers

Guidance and standards

- ECMT (2000), Improving Access to Taxis, Available at: http://www.internationaltransportforum.org/pub/

- DfT (undated), Ergonomic Requirements for Accessible Taxis. Available at: http://www2.dft.gov.uk/transportforyou/access/taxis/.

- Rickert, Transit Access Training Toolkit (World Bank, 2009), http://go.worldbank.org/MQUMJCL1W1, available in English, Spanish, and Portuguese.

Fuel and rest areas on major highways

In order to make the full trip chain accessible to PLM, highway service and rest areas need to have accessibility features. In developed countries, this requirement is often built into

legislation. The DPTAC (UK) Code of Practice on Facilities for Disabled Motorists at Filling Stations sets out the following guidelines:

- Where a wheelchair sign is displayed at service stations, at least one member of staff must be trained in the needs of disabled motorists

- Access to the pay desk and shop must be level or provided by means of a ramp which should have a gradient not exceeding 1 in 20, with an unobstructed width of 1.0m.

- Care should be taken not to block access to the ramp or level entrance with outside displays of plants or other goods.

- Doors should be easy to open, with a minimum clear opening of 800mm.

- A unisex wheelchair accessible toilet should be provided and should be clearly signed and kept open at all times throughout shop opening hours.

Case study example: accessible service station, Malaysia

At the Ayer Keroh rest and service area in Malaysia, efforts have been made to introduce more accessible features. There are designated parking spaces within the car park which are clearly marked and located close to the entrance of the rest area. In addition, ramps with hand rails have been installed in areas where there are steps. Within the rest area there are accessible toilets available for both males and females.

Source: www.petertan.com

Likely costs and benefits

Feature	Costs	Likely benefits
Widening parking spaces for disabled users	Low-medium cost	Benefits PLM and makes longer distance journeys more comfortable
Accommodating parking spaces closer to buildings	Medium cost	Benefits PLM and makes longer distance journeys more comfortable

Implementation issues

- Accessibility measures need to be provided inside any buildings as well as in parking and refuelling areas.

Guidance and standards

- DPTAC (undated), Code of Practice on Facilities for Disabled Motorists at Filling Stations, Available at: http://dptac.independent.gov.uk/pubs/fill/.

3. PRIORITIZED ACCESSIBILITY MEASURES

This chapter sets out summary tables in which the accessibility features from Chapter 2 have been generalized into ranked lists so that Task Team Leaders may refer to them to see which measures represent low cost options, and which have the best benefit/cost relationships. These lists are intended to provide a quick reference guide that helps inform TTLs' project design or infrastructure investment decisions.

In practice, the extent to which accessibility features represent 'low cost' or 'highly cost-effective' measures will vary greatly from one location to another because the cost of implementing comparable accessibility features is not uniform everywhere. Also, the patterns of incidence and severity of disabilities within wider populations vary considerably across different countries and regions. As such the benefits that accrue to a local group of PLM in one location are unlikely to be identical to those elsewhere.

Therefore TTLs are strongly urged to consider each transport project in its broader context, and consider the extent to which the costs and benefits described in this guide relate to the local situation. Further guidance on the design and implementation process that includes these considerations is set out in Chapter 6.

A. COST PRIORITIZATION

The cost prioritization presented in Table 3-1 was developed by compiling and generalising the available cost information associated with the features presented in Chapter 2, and analysing the scale of implementation costs for each accessibility measure. The table is ranked according to the estimated <u>marginal</u> cost of making basic transport system features more accessible for PLM, when compared with the cost of implementing 'standard' or less accessible infrastructure or services. It also contains an assessment of the overall cost of implementing the feature. The estimated marginal costs of improving the accessibility of basic transport system features were based upon the following thresholds:

- Low marginal cost = Less than 5% of the total implementation cost of the basic transport system feature.

- Medium marginal cost = 5 to 10% of the total implementation cost for this feature.

- High marginal cost = More than 10% of the total implementation cost.

Within Table 3-1, costs are classified as low, medium or high and cells are than color coded so that low cost features are pale green while higher cost features are shown in progressively darker shades of green.

B. COST-EFFECTIVENESS PRIORITIZATION

The cost-effectiveness prioritization presented in Table 3-1 was developed by compiling generalized cost and benefit information presented in Chapter 2 of this Guidance Note and estimating:

- The scale of implementation costs for each accessibility measure. Where appropriate this includes due consideration of the marginal cost and maintenance or associated costs as appropriate.

- The scale of likely benefits arising from implementing each accessibility feature, with due consideration of the extent to which likely benefits accrue to both PLM and the wider population.

Table 3-1: Cost prioritization of accessible transport features for PLM

Element	Overall cost of implementation[1]	Marginal cost of accessibility[2]	Cost effectiveness
Pre-journey information			
Printed information- booklets, leaflets, timetables	Low	Low	High
Developing an online journey planner and travel information system	High	Medium	Medium
Telephone information services	Medium-high	Low	Medium
Information at stops and stations			
Static visual information	Low	Low	High
Real-time information displays	Medium- high	Low	Medium
Real time and pre-recorded audible information	Low-medium	Low	Medium
Tactile information	Low	Low	Medium
Terminals and kiosks	Low-medium	Low	Low- medium
Information on-board vehicles			
Static visual information	Low	Low	High
Real time information displays	Low-medium	Low	Medium
Audible information	Low-medium	Low	Medium
Tactile information	Low	Low	Medium
Travel training			
Disability awareness training events	Low	Low	Medium-high
Travel training	Low	Low-medium	Medium
Disability awareness training videos	Low	Low	Medium
Disability awareness training posters and leaflets	Low	Low	Medium
Footways and sidewalks			
Improved footways and sidewalks	Medium-high	Medium	Medium-high
Tactile paving	Medium	Medium	Low- medium
Signage and wayfinding	Low	Low	Low- medium
Dropped curbs and street crossings			
Drop curb	Low	Low	High
Footway build-out	Medium	Low-medium	Medium-high
Signalised crossing	Medium-high	Medium	Medium-high
Island refuge	Medium-high	Low	Medium
Raised table	Medium	Low-medium	Low- medium
Zebra crossing	Medium	Low-medium	Medium
Public transport stop/station infrastructure			
Raised boarding structures	Low-medium	Low-medium	Medium-high
Bus stop surfacing	Low	Low-medium	Medium-high
Folding or fixed seats at stops or stations	Low	Low	Medium-High
Bus shelters	Low	Low-medium	Medium
BRT/light rail stops			
Bus mounted boarding bridge	Low-medium	Low-medium	Medium-high
Folding seats within stop/station	Low	Low	Medium-high
Elevator or stair lift	High	Medium-high	Low- medium
Major terminals and interchanges			
Accessible toilets	Medium	Medium	Medium
Ramps to provide level, step free environments	Low-medium	Low-medium	Medium
Passenger lift to platform	High	High	Low-medium

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[1] The total cost of procuring or executing an element, including accessibility improvements

[2] The incremental cost of making an element accessible

Element	Overall cost of implementation[1]	Marginal cost of accessibility[2]	Cost effectiveness
Airplanes			
Burnett seat supports	Low	Low	Low-medium
Aisle wheelchairs	Low	Low	Low-medium
Ambulifts	High	High	Low
Ferries and marine vessels			
Transfer ramps from pier to vessel	Medium	Low-medium	Medium-high
Providing dedicated wheelchair spaces	Low-medium	Low-medium	Medium
Emergency call alarms	Low-medium	Low-medium	Medium
Rapid transit vehicles			
Hand rails and stanchions	Low	Low	High
Color contrast step noses	Low	Low	High
Priority seating	Low	Low	Medium-high
Single deck articulated low floor kneeling bus	High	Medium-high	Medium
Curbside lifts	Medium-high	Medium-high	Low
Trains			
Hand rails on stairs	Low	Low	High
Wheelchair ramps	Low	Low	Medium-high
Portable manual train lifts	Medium	Medium	Medium-high
Automatic doors on trains	Medium	Low-medium	Medium
Incorporating fully accessible rolling stock	High	Low	Low- medium
Private vehicle adaptations			
Wheelchair ramps	Low-medium	Low-medium	Medium-high
Swivel cushion to aid getting in and out of the vehicle	Low	Low	Medium
Transfer board	Low	Low	Medium
Wheelchair accessible vehicle	Medium-high	Medium-high	Low- medium
Button-operated clutch on the gearshift	Low-medium	Low-medium	Low- medium
Horizontal steering wheel	Medium	Medium	Low
Wheelchair accessible motorcycle	Medium	Medium	Low
Handbrake adaptations	Low	Low	Low
Parking facilities and associated concessions			
Widening parking spaces for disabled users	Medium	Medium	Medium
Accommodating parking spaces closer to retail outlets and leisure facilities	Low-medium	Low-medium	Medium
Disabled parking concessions	Medium	Medium	Low-medium
Powered wheelchairs and mobility scooters			
Powered wheelchair	Medium	Medium	Low- medium
Mobility scooter (class 2)	Medium	Medium	Low-medium
Mobility scooter (class 3)	Medium	Medium	Low-medium
Rickshaws			
Seat belts and other modest adaptations	Low	Low	Medium-high
Lowering the floor of a cycle rickshaw	Low	Low	Medium-high
Taxis and minibuses			
Adapting a taxi or minivan to accommodate plm	Low-medium	Low-medium	Medium-high
Purchasing an accessible taxi	Medium-high	Medium-high	Medium
Rest areas			
Widening parking spaces for disabled users	Medium	Medium	Medium
Accommodating parking spaces closer to buildings	Low-medium	Low-medium	Medium

4. REGULATORY AND INSTITUTIONAL FRAMEWORKS

This chapter summarizes the different types of regulations and institutions involved in ensuring accessibility measures are delivered in different regions. The extent to which accessibility regulations have been adopted and implemented reflects the overall legal and institutional framework within each country. Understanding specific national, regional and local frameworks is therefore a key starting point for World Bank task managers looking to enshrine accessibility for PLM into development-focused transport and public realm projects.

A. REGULATIONS AND STANDARDS THAT SUPPORT IMPLEMENTATION OF ACCESSIBILITY MEASURES

International accessibility standards and regulations

In places where no regulatory framework exists to define accessibility requirements, and no guidelines have been promulgated by ngos, international standards and guidelines can be adapted to meet local circumstances. The best current sources of information on these are UNDP's 2010 "Review of International Best Practice in Accessible Public Transportation for Persons with Disabilities" which summarises both standards and best practices for accessible transport modes (UNDP, 2010). DFID's "Enhancing the Mobility of Disabled People: Guidelines for Practitioners" from 2004 interprets accessibility standards applied in developed countries and explains how they can be adapted for transport and public urban realm projects in developing regions and the International Transport Forum's guide to "Improving Transport Accessibility for All", which was last updated in 2006.

The UN's Convention on the Rights of Persons with Disabilities (UNCRPD) is arguably the most important accessibility policy framework to emerge in recent years (United Nations, 2009). It was adopted in 2006 and is now ratified by more than 100 countries, representing most of the world's population. Article 4 of the UNCRPD commits signatory countries to "undertake or promote research and development of uniformly designed goods, services, equipment and facilities . . . (and) promote universal design in the development of standards and guidelines."   Article 9 requires that ratifying nations "take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment and to transportation". The Convention has an international constituency and will continue to be a key focus of advocacy by international NGOs as countries around the world work to align their national statutes with the objectives of the Convention.

National-level regulations

A common way that improvements to accessibility are achieved is through the publication of national laws or decrees. These typically articulate a nation state's requirements in terms of what stakeholders can (and cannot) do to achieve desirable policy objectives in the context of improving accessibility.   In many countries, the publication of accessibility/disability discrimination legislation coincided with acceptance of the 'Social Model' of disability which underpins the United Nations' Standard Rules on the Equalisation of Opportunities for Person with Disabilities (United Nations, 1993).   The Social Model views the collective disadvantage of disabled people as being due to their societies' inability to accommodate their varied needs, rather than as a problem of the individual (DFID, 2004).

National laws or decrees often reference accompanying accessibility standards or codes of practice; with the law being used to proactively enforce the uptake or implementation of such standards. In developed countries, such laws have largely been successful at influencing the accessible design of new public realm infrastructure, buildings and transport vehicles,

because architects and designers are subsequently required to comply with national level legislation, or risk prosecution.

Case study: UK Disability Discrimination Act

The UK's Disability Discrimination Act 1995 (DDA) was introduced to ensure rights of access to goods, facilities, services and premises. In 2010, the DDA was superseded by the Equality Act (directgov, 2011), to consolidate different aspects of anti-discrimination law. In transport terms the Act covers taxis, public service vehicles and rail vehicles. For taxis, regulations specify the technical standards applying to licensed taxis and impose requirements on taxi drivers to enable disabled people to access taxis safely, even when seated in a wheelchair, and to be carried in safety and reasonable comfort. It makes it an offence, punishable by a fine, for a driver of a regulated taxi to fail to comply with the requirements of the regulations (HM Government, 2010). In terms of public service and rail vehicles the Act requires that it is possible for disabled persons to get on to and off regulated public service/rail vehicles in safety and without unreasonable difficulty; to do so while in wheelchairs; to travel in such vehicles in safety and reasonable comfort. Operators of buses and coaches are additionally compelled to ensure that vehicles both old and new comply with the legislation from the year 2015 (through to 2017) for buses, and from 2020 for coaches. Different dates apply according to the size and type of vehicle. From then on all public transport by bus or coach, with the few exceptions mentioned above, will be accessible to disabled people, including wheelchair users (dft, 2000). Examples that demonstrate compliance with this UK legislation include the increase in accessible and low floor buses from a total of 53% of the national fleet in 2004/5 to 89% in 2009/10 (dft, 2011), accessible design and operation of the Nottingham Express Transit tram system (Nottingham Express Transit, 2010), adoption of inclusive design principles, and regulatory impact assessments, for Crossrail (Crossrail, 2011). To support the legislation, the UK government published "Inclusive Mobility", in 2002 to give detailed guidance on the design of all ground-based transport-related infrastructure; including associated public realm features and travel information for PLM.

In many Latin American countries, informal guidelines promulgated by NGOs and government agencies initiated advocacy for more formal legislation and regulations which govern construction and vehicle specifications. In time these have given way to updated national legislation that considers the needs of disabled people. Most Latin American countries now provide some form of legislation and guidance concerning access to transport. The level of the guidance and extent to which it is delivered can vary between countries, but published guidelines exist in Brazil, Peru and Colombia, amongst others. Initially these guidelines focused on access to buildings and public spaces, but increasingly involve transportation recommendations.

Case study: India

The Persons with Disabilities Act 1995 introduced measures to encourage transport providers to take special measures, within the limits of their economic capacity and development, to "adapt rail compartments, buses, vessels and aircrafts in such a way as to permit easy access" to disabled people, in addition to making toilet facilities accessible in such vehicles. It states that, in addition, governments and local authorities should install auditory signals at red lights on public roads, have dropped curbs along footpaths for wheelchair users, mark the surface of zebra crossings, devise appropriate symbols of disability, place warning signals at appropriate places, provide ramps in public buildings, adapt toilets for wheelchair users, provide Braille symbols and auditory signals in elevators, and; provide ramps in hospitals, primary health centres and other medical institutions. The Rehabilitation Council of India produced a training aid to guide the development of barrier free environments in India and aid compliance with the legislation. This guide covered public transport, rail, sea and river transport and air travel; and set out guidelines it believes will provide a barrier free environment (Indian Government, 1995 and Rehabilitation Council India, 2004).

The extent to which laws and standards are enforced differs considerably from one country to another. **Accessibility Audits** offer a means of objectively comparing the accessibility of

different places or transport infrastructure, and can be used as a way of evaluating the extent and consistency with which laws and standards on inclusive design are being implemented and adhered to. Accessibility Audits are typically conducted by disabled people or expert surveyors and use a standardised framework that records step heights, doorway widths, and the quality of the kinds of accessibility features described in chapter 2 of this Practical Guidance Note. While an individual audit may be relatively inexpensive (Between $100 and $500 on the basis of a day of an auditor's time), the costs scale depending on the complexity of the facility being audited. For example, a complex rail terminal will take longer to audit than a basic bus stop. Furthermore the costs of auditing a large area, such as a whole city or national rail network, can be very large. Thoroughly implemented Accessibility Audits usually yield good quality information that allows comparisons of how accessible similar transport systems or features are. However, it is important to remember that (like most audits) they are static snapshots of accessibility, and do not reflect the dynamically changing nature of transport systems and the built environment. For example, such an audit overlooks the impact on accessibility of a railway station's elevator breaking down, or on the accessibility of a bus route if a stop is temporarily relocated to accommodate road repairs.

Accessibility Audits conducted in Penang State, Malaysia, revealed existing accessible footways were deteriorating because of lack of maintenance, and some did not comply with prevailing Malaysian standards and legislation for accessible infrastructure. Some curb ramps and tactile guidance paving appeared to have been built in ways that demonstrated the builders did not understand how they are used and why they need to be constructed to a given standard (Mitchell et al, 2010). These findings underline the important message that enacting legislation aimed at improving the accessibility of transport and associated public realm infrastructure in isolation may not achieve the desired improvements in accessibility for PLM - even when supported by guidance and design standards. *The example above highlights the need for monitoring and enforcement, as well as ongoing consultation with disabled people's representative groups, to ensure the desired outcomes of national laws are being achieved.*

Case study: Nigeria

The Nigerians with Disabilities Decree was set out in 1993 by the Federal Military Government of Nigeria. It aimed to provide a clear and comprehensive legal framework, and security, for Nigerians with disabilities. The decree sought to establish standards for enforcing the rights and privileges it guaranteed, and other laws applicable to disabled people, in the Federal Republic of Nigeria. Sections 8 and 9 covered accessibility and transport, and required all public buildings in Nigeria to provide access and adequate mobility within its facilities, and that disabled people were entitled to free transportation by any mode except air travel. The impact of the decree was limited because rights to travel and access basic facilities were not strongly perceived by policymakers as key factors that enhance livelihoods, and sections 8 and 9 were not implemented. Research conducted in 2007 with disabled people living in urban areas of Nigeria found the majority of disabled people depend on public transport for most trips, and spend higher proportions of their income on it than non-disabled peers. Two-thirds of respondents could not travel independently, while their most valuable, or essential, trips were often curtailed due to the poor state of public transportation services and delays encountered when trying to get around (Odufuwa, 2007).

In this context it is important to note that the presence of a legal framework does not necessarily imply that a detailed regulatory framework has been developed to support it. Similarly, the presence of a regulatory framework may not necessarily mean that working plans to implement these regulations are indeed being carried out (Venter et al, 2002). This is something that World Bank TTLs are strongly advised to explore when researching projects with the potential to improve accessibility to transport for PLM.

City-level regulations

Decrees and ministerial decisions are less frequently used to enact legislation at the national level, but are more commonly used to set out city or regional policies aimed at improving accessibility for PLM. At the city/regional level, policies and Council decisions often reflect local interpretations of national-level guidance and statutes. They are sometimes the result of legislative gap-filling by local administrations wishing to use a national legislative framework as the basis for more detailed local ordinances. In others it reflects proactive cities/regions seeking to be more responsive than national-level governments by quickly adopting local policies aimed at improving accessibility for PLM in anticipation of future national-level legislation.

Case study: Mexico City

Mexico implemented disability rights laws in 1995 but does not have comprehensive national statutes to enforce them. Instead Mexico City's Federal District and some other states in the country, took responsibility for promulgating federal and state legislation on this topic. Mexico City's Federal District, with a population of some ten million persons, established its Law for Disabled Persons in 2005. This included provisions on health and rehabilitation, employment and training, promotion and defence of the rights of people with disabilities, requirements for urban and architectural facilities that are accessible to people with disabilities, transportation, social development and penalties for violations. The impact of these policies and legislation has included the roll out of dedicated buses equipped to accommodate wheelchair users and other disabled travellers in Mexico City, the introduction of a monthly travel stipend for disabled people, and free access to the Mexico City Metro (IDRM, 2003). Furthermore, the Federal authorities in Mexico City have successfully encouraged the replacement of inherently inaccessible 'Micro' buses. The city paid owners 100,000 pesos (approximately USD $11,000) for their old, inefficient and polluting micro buses; which they used as a down payment for a midi sized bus with accessibility features including: wider entrances, better hand holds, more spacious interior layouts, priority seating and color contrasts for passengers with sight impairments.

B. INSTITUTIONAL ARRANGEMENTS FOR DELIVERING ACCESSIBILITY MEASURES

While national, local and international regulations and standards can provide a meaningful framework within which accessibility to transport for PLM can be significantly improved; their implementation depends on the action taken by the institutions responsible for delivery. The range and types of institutions involved in delivering accessibility for PLM; and the roles they fulfil; are influenced by the variable regulatory frameworks, political processes and social patterns across different countries.

Figure 4-1 highlights the roles commonly played by different types of institutions in relation to delivering tangible improvements to the accessibility of transport systems and public urban realm for PLM. It reveals that local government institutions often operate in a dual role as the agents that are required to implement national policies and legislation; as well as being responsible for setting local policies and ordinances that influence the accessibility of transport, and public realm infrastructure/services, for PLM. State owned and private sector transport operators can have similar accessible service delivery responsibilities to meet the needs of PLM. In developing regions where there are no/limited public transport services, and limited or poorly enforced regulations on private transport services, the degree of ownership of these responsibilities will vary considerably.

The main focus of professional bodies is usually upon developing and adopting inclusive design standards, or best practices, within their memberships. Their members typically make up delivery agents working for national/local governments, state owned or private sector transport companies and delivery consultants.

Figure 4-1 highlights the important role that NGOs and delivery consultants (sometimes working collaboratively) can play in terms of improving accessibility for PLM. In particular,

the advocacy role delivered by NGOs enables groups of PLM to drive the process of increasing awareness of their needs in society and demand a response from national and local governments, transport operators and service providers. Such stakeholder groups are often crucial to successfully delivering better accessibility for PLM, because they spur local delivery consultants, transport operators, architects and engineers to be creative and focused on user needs in their respective roles.

Figure 4-1: Common roles of different institutions in delivering accessibility for PLM

National government ministries
(Transport/Social Care/Equality/Public Works/Environment)
- Subscribe to international conventions on accessibility
- Set and enforce national accessibility policy and legislation
- Fund major transport/infrastructure projects

National government agencies
(Transport/Disability & Equality/Environment/Social Care)
- Support nationally important accessibility infrastructure/services
- Advise Government ministries on accessibility issues
- Document and monitor the impact of accessibility initiatives

State owned/public companies
(Rail/bus operators/infrastructure managers)
- Delivery of accessible transport services and infrastructure
- Provision of concessionary fares/services for PLM
- Train employees and raise awareness of PLM's transport needs

Local government
(City/regional authorities)
- Deliver accessibility initiatives on behalf of national government
- Set local policy and ordinances in relation to accessibility for PLM
- Fund/support local concessionary fares/services for PLM

Private sector
(Private transport operators/Developers/Shops/Service providers)
- Delivery of accessible transport services and infrastructure
- Provision of concessionary fares/services for PLM
- Train employees and raise awareness of PLM's access needs

Professional bodies
(Architects, Engineers, Transport Planners, Manufacturers)
- Develop, share and subscribe to inclusive design standards
- Identify/accredit 'best accessibility practices' in respective fields
- Work with PLM to develop need-focused products/services

Non-Governmental Organisations (NGOs)
(Disability and special interest groups, lobbyists, advocates)
- Develop, share and promote inclusive design standards
- Advocate accessibility for PLM to national & local governments, transport operators, professional bodies and delivery agents
- Document and monitor the impact of accessibility initiatives
- Advise service designers/providers on accessibility issues
- Provide disability awareness training and publicity/campaigns
- Undertake accessibility audits of existing infrastructure/services

Delivery consultants
(e.g. Transport/Construction/Development consultancies)
- Incorporate inclusive design standards in project design/delivery
- Engage local PLM stakeholders and NGOs in project design
- Work with public/private sector delivery agents to define accessible operational and maintenance regimes for transport services/public realm infrastructure/buildings
- Undertake accessibility audits of existing infrastructure/services

A key message for World Bank TTLs is that understanding the relationships between the regulatory context in a given country/city/region, and the various institutions involved in delivering improved transport accessibility for PLM is an essential precursor to achieving greater, and sustainable, levels of accessibility in Bank-funded transport and public urban realm projects. Finally, it is pertinent to note the valuable role that NGO's can play in researching and evidencing whether anticipated impacts associated with accessibility improvements for PLM have actually accrued.

Case study: Pune City, India, DFID demonstration project

UNDP funding was used to support a group comprising researchers, disability NGO's, city transport planners and the management of the local bus company (Pune Municipal Transport) was established in Pune to select and oversee the demonstration project. This group focused on modifying bus stands at bus stops, but additionally monitored the effectiveness of new bus vehicles operating along the route, and led to the introduction of a disability awareness training programme for bus drivers and conductors. The direct involvement of local disabled people's groups in the project resulted in the inclusion of locally designed and developed tactile guideways being installed at some bus stands to help passengers with sight impairments find their way from the bus stand to the bus entrance. Follow-up surveys with passengers using the improved route, and observed journeys made by PLM (both conducted by a local NGO) documented that the benefits of the demonstration project were perceived by <u>both</u> non-disabled and disabled passengers. This before and after research also identified further need for increased disability awareness among drivers and conductors to make them aware of the problems faced by PLM – the simplest of which involved ensuring the driver pulls the bus directly alongside the shelter to avoid the need for passengers to board and alight in the road. In this project the role of a local NGO, acting in a consultancy role, and the funding from DFID proved central to the delivery of the accessibility demonstration (Venkatesh et al 2004)

C. DECISION-MAKING PROCESSES AND RECOGNITION OF LOCAL NEEDS

The Operational Road Map set out in Chapter 6 provides a framework for decision-making through the life-cycle of World Bank projects. Some of the most successful projects that have delivered improved accessibility for PLM are those which have involved significant engagement and consultation with local disability NGOs and other PLM groups in the design and testing of accessibility features such as those described in this guide. This emphasizes the importance of World Bank task managers and counterpart staff ar all levels of government working collaboratively with local groups of disabled people to ensure that the specific needs of these potential transport system users are factored into the key project decisions.

The example set out below, from Liaoning province in China, resulted in user-centred design and achieved high levels of accessibility for the most prevalent local groups of PLM. It also delivered strong levels of capacity building and knowledge transfer to local stakeholders, which it is envisaged will create a culture of accessibility other future projects will adopt.

Case study: using public participation techniques to improve the accessibility of road infrastructure

Liaoning Province is a highly urbanized region in north-east China. This World Bank funded project aimed to improve public transport in the region, and within this to facilitate public participation in the design stage to ensure that the needs of PLM were considered. It had three main objectives: to determine members of the public's key concerns; prioritize problems; and incorporate public input into project design. While the project was designed to encourage public participation by everyone, it was particularly beneficial for PLM who could share their specific experiences.

Focus group consultation

There were two main elements of public participation:

- **During preliminary design –** Within the project design and feasibility stage people were consulted to identify issues that they experienced with transport. This used focus groups to stimulate discussion on the main issues. Subsequently, during the post-project design and appraisal stage, the solutions identified were subject to public comments. This was undertaken through an open meeting between the design team and local people.
- **During project implementation –** User were asked for their satisfaction levels with the new infrastructure and some field tests were undertaken with disabled users to test usability. This was deemed to be the best way of identifying areas where the construction quality levels were lower than acceptable.

While seemingly small, some of the issues identified were causing PLM significant problems as they travelled. For example the curb cuts were reported not to be smooth enough, and existing 2cm edges obstructed wheelchairs and tripped up pedestrians. This was rectified by levelling curbs to the road surface and removing the ridges of curbs in ongoing projects.

Field testing

As a result of the project, one of the cities within the province (Jinzhou) now has an annual programme of consultation involving the Municipal Urban Transportation Project Management Office, The Municipal Federation of Disabled Persons, The Design and Construction Departments and disabled people. This is used to identify ongoing issues and solutions in the city. Alongside this, community participation is promoted for all projects within China, although it is noted that its success is dependent on the commitment of the people in charge of the consultation.

The public participation elements of this project enhance its successes because they heightened the sensitivity of project design to meet the specific needs of local PLM. Furthermore, during implementation the public participation served to sensitize city leadership, government officials, and contractors to needs of the disabled community; and helped to focus on the details of construction quality (Mehndiratta, 2010).

Task managers are strongly encouraged to involve similar local groups in transport projects that have potential to deliver benefits for PLM wherever practical and possible. There are numerous examples of how this approach has been successfully deployed, including:

- **The City of Stockholm in Sweden** has funded and implemented a long-term project aimed at promoting accessibility public realm, buildings and transport systems. Each area of the city has its own Accessibility Masterplan for improving accessibility and removing obstacles to PLM moving freely around the city. Individual disabled people are involved in the decision-making process and can follow the progress of improvements in their local area through dedicated committees (Frye, 2011).

- **The City of Vienna in Austria** has funded and implemented a similar approach, but has centralised city-wide responsibility for improving accessibility with the city government. The city government has deliberately worked with disabled people's representative organizations in order to gain a sound understanding of mobility and accessibility issues in the city. This user-centred design approach has resulted in highly accessible stops and stations that adhere to the city government's belief that design for disabled people is also good design for everyone.

Case study: George Town in Penang state, Malaysia

George Town in Penang State demonstrates how different institutions can work together effectively to improve accessibility in developing regions. The city is covered by national regulations, and design guidelines for accessible buildings and guidelines on pedestrian facilities. MPPP, the Penang local authority had been steadily improving accessibility of pedestrian infrastructure in central George Town over a period of a decade, and in 2008 a United Nations Development Programme (UNDP) and Malaysian Government project was established to audit the city's public transport accessibility. Accessibility audits and focus groups with local people highlighted shortcomings in infrastructure, terminals and stops, and information provision (Mitchell, 2010). In response the UNDP project team worked with local stakeholders to develop a strategy for improving public transport accessibility in Penang State:

Organization	Roles and responsibilities in developing and implementing the accessibility strategy
MPPP (local government)	Project coordinator and strategy owner responsible for implementing pedestrian infrastructure and crossings to create accessible routes linking the city's World Heritage Site with bus and ferry terminals
Local disability groups and older people	Engaged in focus group discussions with accessibility consultant to help inform the accessibility strategy; and trained by the consultants to audit pedestrian infrastructure, street crossings; bus, ferry and train terminals; bus stops; buses; the airport; taxi services, and signage
Consultants	UK and Singapore based accessibility consultants worked with local disability groups and elderly people to identify local accessibility issues and trained local people in how to conduct accessibility audits.
Rapid Penang (bus operator)	Local operator who had introduced improved public bus services in 2007. Used findings from the study to modify new low-floor buses to improve access via a shallower ramp angle, create more space for wheelchair users to manoeuvre while on-board and improve the securing position for wheelchairs. An accessible demonstration bus route, from George Town to Penang Island, focused on providing system maps and timetable information at bus stops and correctly installing tactile guidance paving.
Malaysian Railways KTM	Included state-of-the-art accessibility features into the railway station being developed for a new railway line to Kuala Lumpur.
Airport operator	Implemented minor access improvements to the airport, which has been built to modern standards.
Ferry terminal operator	Adopted short term operational measures to improve accessibility for PLM, with a longer term addition of escalators and lifts at the terminal to assist passengers climbing to the upper decks of ferries.

5. FUNDING AND FINANCE

This chapter covers two themes related to finance. The first theme concerns funding sources and mechanisms for providing accessibility improvements for people with limited mobility – these sources can in some circumstances provide additional finance to complement the main donor agency and national or regional government funding of a transport project to help maximise its value to PLM. The second theme concerns provision of financial assistance to people of limited mobility. Such assistance can help overcome financial difficulties faced by PLM due to the combination of the extra cost of meeting their special travel needs and the low incomes that many disabled people have. These two areas are explored in the following sections.

A. FUNDING SOURCES AND MECHANISMS

Funding of low cost improvements

Some organizations are set up to focus on disabled people. These are generally foundations with an international reach. However, the grants that they offer tend to be on a relatively small scale, so may be most suitable for funding retro-fit system improvements or lower cost accessibility features. These organizations are usually well placed to offer advice on system improvements and the needs of PLM, and on other funding sources - for example, time-limited grants. Similarly, local charities, local foundations and local businesses may be willing to contribute to low cost accessibility improvements in their local area. These funding sources may be harder to access, but should be identifiable by working with local people and networks.

Funding of higher cost improvements

Where larger scale projects are taking place, assistance can be sought from a number of sources. This can include grants or loans from ODAs, development banks and other financial institutions. Since most of the world population now lives in countries that have signed up to the UN Convention on the Rights of People with Disabilities, many of the funding agencies will be building this more strongly into the conditions that ensure that projects qualify for funding. Therefore highlighting such elements of a project within the specified measurable outcomes is likely to be looked upon favourably.

Funding of ongoing operating and maintenance costs

Most transport projects will have ongoing operating and maintenance costs to meet beyond the initial capital cost. This will require funding, which will normally need to come from local or regional government budgets. However, there are alternative options that are worth considering for specific accessibility measures that have a significant ongoing cost. One way of securing funding for higher cost improvements is to include it in the contractual obligations of any supplier who is providing a service (depending on local regulations). For example, if an operator runs a bus service on behalf of a government, the government could require them to pay a levy from fare revenues through their operating contract in order to fund improvements or provide financial assistance for PLM. This passes some of the cost of improvements to the private sector.

Case study example: Sao Paulo – funding of specialized transport services

Fixed route bus operators working under concession agreements with the city authority pay a monthly levy from their fare revenues, which is used to fund a free door-to-door service for people with severe mobility problems. The size of each operator's levy is based on the size of their fleet and their in-service mileage. A fleet of over 250 vans is equipped with lifts, and van drivers receive special training.

Photo source: www.embarq.org.

<u>Sources of funding</u>

Non-governmental organizations (NGOs)

For smaller projects, or specific elements of larger projects, funding or advice may be provided by a range of non-governmental organizations and foundations. These include international foundations; international non-governmental organizations; international faith/religious organizations; local independent foundations and trusts; community foundations; and service clubs and membership organizations. The international NGOs listed in Appendix D Table 1 focus specifically upon disability issues.

Official development assistance agencies (International)

Official development assistance (ODA) agencies are government agencies set up to channel assistance to other countries - typically directly to the recipient government. To fit into this sector, the organization needs to have three main characteristics:

- The activities that are funded have to be undertaken by the official sector; and

- They must have the main objectives of economic development and welfare; and

- The finance must have concessional financial terms (for example, if it is a loan it should include an element of grant funding).

Table 2 in Appendix D includes a number of ODA agencies that may provide funding for transport projects with benefits for PLM.

Multi-lateral development banks and financial institutions

Multi-lateral development banks (MDBs) are organizations that provide financial support and professional advice for social and economic development activities in developing countries. These banks (including the World Bank) are characterised by a broad membership consisting of developed donor countries and borrowing developing countries. These banks have a considerable number of joint owners. Other banks and funds that lend to developing countries are often categorised as multi-lateral financial institutions. They differ from MDBs by usually having a broader membership or a focus on a specific sector or activities.

These types of organizations are more likely to fund larger projects, for example those involving the construction of a new public transport system. They may fund projects on their own, or in conjunction with other organizations with similar end goals. Table 3 in Appendix D shows a number of the main multi-lateral development banks and financial institutions.

B. AFFORDABILITY AND SUBSIDIES

One method of helping people of limited mobility (PLM) to access key facilities and services via the transport system is providing them with targeted financial assistance. The rationale is

that people with disabilities and their families often have higher out-of-pocket expenses to meet their special needs, combined with lower-than-average income because of restrictions on employment that a disability may impose. The various financial assistance options are discussed in the following paragraphs.

<u>Providing reduced (concessionary) fares on transport services</u>

Setting a reduced or zero fare for PLM is a long-established way of providing financial assistance. This involves the person concerned presenting a pass or travel tokens to confirm their eligibility for the "concessionary" fare when boarding the vehicle (usually a bus or taxi). Initiatives can be established nationally, as well as at the city or local area level. The cost of providing such services clearly depends on local circumstances (fares, wages, fuel costs etc) – in the UK, for example, the annual cost of the national concessionary travel scheme for disabled and older people works out at around $150 per eligible person.

An administrative process is required, in which eligibility for a pass or travel tokens is assessed against defined criteria and the pass or tokens are produced and issued. Such criteria may relate to a degree of mobility impairment (e.g. "has very considerable difficulty in walking because of a permanent and substantial disability") or a specific condition (e.g. "has no arms").

The administrative and assessment process needs to be robust, secure and fair. The pass or token format needs to have inbuilt security features in order to prevent fraudulent applications or counterfeiting. This should include, as a minimum, a photograph and additional features such as holograms, watermarks or tamperproof lamination. It should be recognised that such passes or tokens (real or counterfeit) can have a significant monetary value on the "black market", and physical security measures should be taken to keep and transport them as if they were financial instruments.

The costs of concessionary travel arrangements include the administrative cost of dealing with applications, eligibility assessment and pass or token issue, together with enforcement. They also include the cost to the transport operator of carrying the concessionary traveller, including fare revenue foregone for trips that would otherwise have been made at full commercial fare and the marginal operating cost of carrying any trips generated by the availability of the concession. These costs to the operator can be significant, particularly in urban areas with good transport service availability, and need to be properly assessed before any new concessionary travel scheme is introduced.

Where transport services are publicly owned and operated, the operator costs may simply be "absorbed". However, with privately owned transport services reimbursement mechanisms need to be put in place to pay the operator from public funds for carrying PLM at a concessionary fare. Failure to address this issue properly will jeopardise any scheme as it will lead to reluctance by operators to accept concessionary pass holders.

<u>Providing subsidised specialized transport services</u>

Provision of specialized transport services (STS) that meet the needs of people with limited mobility is an approach that is widely used in developed nations. This is sometimes done in combination with offering concessionary travel on regular public transport services for PLM who can manage to use that. Where the two approaches are combined, a hierarchical system results, in which most PLM use regular public transport services at a discounted fare while those with more severe impairments who need additional assistance use the specialized transport services.

Specialized transport services normally operate door-to-door for those who cannot get to a pickup point (e.g. bus stop) and use vehicles with appropriate accessibility features such as low floors, wheelchair lifts and ramps. Training of drivers or assistants to help people use the vehicles is also a key feature. Most specialized transport services (sometimes referred to as paratransit) are demand responsive, with the need for a booking system for travel – this can range from a basic system based on phone calls and booking forms or (as in some developed countries) a sophisticated computerised system.

The cost of setting up a specialized transport service relates primarily to the cost of vehicle adaptations and establishing a booking system. However, the main cost associated with STS is the ongoing operating cost of vehicles and staff, which can result in a much higher cost per trip than regular public transport - in 2000, the European SAMPLUS Project reported costs per trip for European STS of between 5 and 30 Euro per trip. This is because relatively few people use the service, but also the inherent inefficiency of the service structure. So, while STS may initially appear easier to implement than removing accessibility barriers to mass transportation, a more cost-effective approach in the longer term is to follow both approaches in parallel. This also helps to minimise the segregation of disabled people in society, and can reinforce initiatives to reduce negative attitudes and discrimination that are sometimes directed towards disabled people.

Case study example: Cape Town, South Africa

The City of Cape Town has been operating an expanded Dial-a-Ride special transport service since 2002. This caters for disabled people who are physically unable to board or alight from mainstream public transport such as trains, buses and minibus taxis for their daily commute between home and work. The aim is to help them be economically active, self-supporting and independent. The service is seen by the city as a bridging measure until mainstream public transport becomes universally accessible.

Source: www.capetown.gov.za

The service is heavily subsidised by the city, with the passenger fare being equivalent to the mainstream public transport fare. The service operates seven days a week, from 06.00 to 19.00, and is provided from the nearest safe point at the curbside closest to the booked point of pick-up or drop-off.

Providing financial support for use of private transport vehicles

Financial support can be provided for use of private transport vehicles. In poorer areas, this may be less relevant than support for using public transport for many disabled people. However, it is worth considering in some projects in developing nations where motorised vehicle use is increasing.

One option that has been used is in connection with toll roads, where disabled people may be given reduced or zero charges for using the toll road network. For example, in Malaysia approximately 8,500 tolling cards with a pre-paid value of RM100 (around $30) were offered to disabled people in 2009 by a toll road operator through the Department of Social Welfare, in a bid to improve the mobility of disabled people and encourage future use of the toll road network. Similarly, disabled people may be exempted from road taxes. Another option that has been used in developed nations (e.g. the Motability scheme in the UK) is for advantageous financing packages to be put together using bulk buying power to keep the costs of owning an appropriate vehicle low for disabled people. While the toll concession

option may be relevant to some local or regional projects, road tax reductions and vehicle financing packages for disabled people are more suited to a national approach. In all cases there need to be effective ways of assessing individual's needs to ensure that the system is not abused.

Channelling transport subsidies to PLM as part of a broader financial support package

Providing people of limited mobility with transport subsidy funds as part of a broader financial support package is an approach that has been adopted in some developed countries. In the UK, for example, there is a "mobility component" of the Disability Living Allowance which is paid as a national social benefit to people with a disability. The mobility component is intended to assist eligible people with limited mobility by providing them with finance to help defray the extra costs they may incur to get around because of their disability. The amount payable is dependent on the severity and nature of their disability, which is subject to a formal assessment.

By comparison with subsidised fares, the advantage of this type of approach is that it gives disabled people greater flexibility and control over their own lives. Although the financial support is intended to recognise the extra transport costs they may incur, they have the freedom to spend the money as they wish – meaning that they can set their own priorities in the same way that others do. For example, those without access to public transport services may use the money on taxis. A downside is that specific socio-economic aims concerning transport mobility may not be met because of the spending freedom cited above. Since most general support for disabled people is dealt with at a national level, it may also be complex institutionally to implement payment of transport subsidy funds allocated at a local level to meet local goals.

6. OPERATIONAL ROAD MAP FOR DELIVERING ACCESSIBILITY

This final chapter of this Guidance Note sets out a checklist of key questions for TTLs to consider when devising projects which could deliver improved transport accessibility for PLM through World Bank-funded projects. This checklist has been presented as an Operational Road Map that frames key activities within the context of the World Bank project life cycle.

A. THE OPERATIONAL ROAD MAP

The Operational Road Map is set out in Table 6-1, overleaf, and has been developed based on the key stages of a project life cycle. It is intended to help TTLs negotiate the process of designing accessible transport services/systems and public realm infrastructure.

About the Operational Road Map

The Operational Road Map presents a set of guiding principles that draw upon the body of good practice evidence which has been reviewed and summarised in earlier chapters of this practical guidance note. It is not intended to be a blueprint that is exhaustively and rigorously applied to each and every World Bank transport project. Instead the Road Map is presented as a resource for TTL's to use pragmatically throughout the life cycle of any transport and public realm projects which have the potential to improve accessibility to transport for PLM, particularly in developing and transitional regions.

When applied intelligently in conjunction with the information in the remainder of this Guidance Note, it is envisaged that the Operational Road Map will:

- Support World Bank TTLs that are responsible for delivering existing major infrastructure projects, drawing on the latest thinking regarding the inclusive design of transport systems in developing regions so that they can be readily used by PLM alongside other travellers.

- Enable TTLs to source funding for projects that specifically aim to meet the needs of PLM, or for specific project components from which benefits predominantly accrue to PLM user groups.

- Raise awareness about the range of international and national regulations and design guidelines and standards pertaining to improving the accessibility of transport for PLM.

- Help TTLs identify opportunities for retro-fitting, or enhancing existing transport services and associated infrastructure to specifically improve accessibility for PLM, for example by fixing broken links in accessible trip chains.

- Assist World Bank TTLs when devising and funding transport and public realm projects so that opportunities to optimise the accessibility of new services or infrastructure for PLM are identified and captured at minimal additional cost to donors and funding recipients.

- Encourage TTLs to work in partnership with relevant local NGOs and PLM representative groups to ensure that the user-needs of local PLM are appropriately considered alongside other transport users when designing and developing new transport systems, infrastructure and associated public realm facilities.

- Improve the quality of out-turn cost and (ex-post) benefit monitoring and evaluation by World Bank TTLs in order to improve the evidence base of 'real-world' project examples that improve transport accessibility for PLM.

- Result in a greater number of World Bank projects that satisfy the requirements of the UN Convention on the Rights of Persons with Disabilities (UNCRPD).

As such it is envisaged that World Bank TTL's future project design and investment decisions will be made based on an informed, and holistic, appreciation of the factors set out in the Operational Road Map.

Table 6-1: Operational Road Map to aid World Bank Task Team Leaders with the design and implementation of transport systems that are accessible for PLM

Project stage	Key activities	Important issues for ttls to consider and explore	Impact

Project preparation & planning	Delivery within regulatory frameworks	• National/sub-national/municipal accessibility or equality regulations may apply to, or mandate, accessible infrastructure/services.
		  o Legal and/or safety implications of proposed transport infrastructure/services need to be considered.
		  o Local political-will needs to be secured in order to ensure the project delivers on accessibility aims.
			Influences design parameters, and may impose accessibility specifications or standards.
			
			Guides budget-setting and project specification.

	Project funding	• Budget will be required to ensure accessibility for PLM is designed-in to the project.
		  o Consideration needs to be given to whether any conditions attached to funding sources, or financial assistance mechanisms supporting the project impact on the aim of improving accessibility for PLM.
		  o Explore whether additional sources of finance are available to fund the delivery of accessible transport features.	

	Institutional considerations	• Carefully consider the role that local/regional/national governments will play to ensure accessibility for PLM is designed-in to the project
		  o Consult and engage relevant NGOs in the design of the project.
		  o Define responsibilities for long term operation and management of planned accessibility features.
		  o Define the role of consultants and/or expert advisers required to deliver accessibility for PLM.
			Secures buy-in from relevant local organizations and ensures accessibility for PLM is formalised in project roles.

	Understanding attitudes and needs	• Understand how many PLM live within the catchment area of the proposed intervention, and their specific needs.
		  o Conduct research to understand the locally prominent mobility impairment types.
		  o Forecast how the size, and make-up, of PLM population is likely to change in the intervention's lifetime.
		  o Consider the extent to which local people's attitudes towards PLM are inclusive.
		  o Understand what social research is being conducted with local people, including PLM, and representative groups.
			Influences the selection of appropriate accessibility features by focusing design upon user-needs of PLM to maximise value and utilisation.

Options appraisal	Evaluating options & likely impacts	• Developed and present a long-list of potential accessibility features for consideration in project appraisal. o Consider how potential accessibility features complement local infrastructure and common trip-chains for PLM.	

	Appraising benefits and beneficiaries	• Consider how each accessible transport feature/design will make journeys possible that were not formerly so for PLM.
		  o Document improvements to the safety/comfort/ease of making journeys that are already possible for PLM.
		  o Define other likely benefits arising from implementing accessible transport infrastructure/services.
		  o Quantify how many PLM will benefit from accessibility improvements relative to co-benefits for wider society.
		  o Estimate how long the accessible interventions will continue delivering benefits for PLM and other travellers.
			Recognises time-horizons over which costs and benefits accrue informs investment decisions.
			
			Informs consideration on the viability and affordability of specific accessibility features.

	Appraising costs and cost-effectiveness	• Quantify the extra initial cost of implementing accessible features/designs compared to less accessible alternatives.
		  o Document the extent to which the wider population may be inconvenienced by accessibility features for PLM.
		  o Define any extra recurring (maintenance/running) costs that are incurred as a result of implementing accessible transport features/system designs, and explore how they can be funded.
		  o Record the operational life expectancy of accessible transport infrastructure/services.
		  o Consider whether the level of investment in accessibility features for PLM can be justified based on the benefits and the available budget for this transport project.	

Project stage	Key activities	Important issues for ttls to consider and explore	Impact
Detailed Design	Delivery mechanisms	• Consider whether the accessibility feature can be built as part of a larger transport /construction project. o Explore whether the accessibility feature can be fitted during regular or routine maintenance/ refurbishment. o Consider whether the accessibility feature can only be implemented through a dedicated (retro-fit) intervention. o Compare and appraise the cost/delivery risk implications of the answers to the two questions above.	Enables pragmatic view on 'essential' and 'desirable' accessibility features. Enables identification of potentially wasteful investments based on consideration of likely uptake, maintenance and exposure to theft or vandalism. Ensures local PLM are involved in the design of services intended for them. Empowers local counterpart staff to support new accessible infrastructure and services.
	Fundamental design considerations	• Agree the combinations of accessible transport features that best meet the needs of local PLM, and wider society. o Consider whether dedicated accessible transport infrastructure/services can be maintained - both now and in the future - taking into account issues such as budgets, parts and local staff capacity. o Identify unusual exposures to theft or vandalism that might render specific accessibility features unviable. o Consider the organization of local society and the extent any new accessible transport services or infrastructures are likely to be preserved, or protected, for PLM. o Identify potential unintended negative outcomes of installing accessibility infrastructure for PLM. o Involve local disabled people and other PLM in the design and testing of accessible infrastructure/services. o Implement capacity-building initiatives to help local counterpart staff ensure the benefits of accessible infrastructure/services are maximised. o Adopt staff training initiatives to ensure counterparts understand key principles of disability awareness.	
Construction	Build process	• Ensure that construction workers are made aware of the rationale behind the design of accessibility features so they are delivered as per the plans/designs o Establish management procedures to quality control the delivery of accessibility features.	Ensure accessible design features are delivered Access to transport systems is maintained during construction
	Mitigation	• Implement mitigating steps to maintain access, or transport services, for local people whilst construction takes place.	
	Communication	• Communicate the aims and objectives of the project with local people during the construction phase.	
	Testing	• Involve local disabled people and other PLM in the testing of new accessible transport infrastructure/services.	
Maintenance, Operation & Evaluation	Maintenance & operation	• Implement and monitor maintenance regimes. o Ensure local counterparts have capacity and resources to maintain accessibility features. o Establish operational regimes to ensure accessible transport system features/infrastructure are available to PLM when needed. o Consider establishing appropriate enforcement measures to protect accessibility features for PLM.	New accessibility assets are maintained, to maximise their operational lifecycle
	Evaluation	• Monitor the use and uptake of the implemented accessible transport infrastructure/services being monitored. o Use monitoring activity to capture and evaluate the benefits and co-benefits that have been delivered through the project. o Record lessons-learned, and unintended outcomes, for the benefit of other similar projects.	Benefits are captured and recorded for future projects

B. AN EXAMPLE OF PROJECT DELIVERY USING THE OPERATIONAL ROAD MAP

In order to demonstrate how the Operational Road Map can be deployed by World Bank TTL's, this section contains a worked example of a hypothetical BRT line project. Its' purpose is not to act as a case study for sound project delivery per-se, but specifically focuses upon the practices and processes that can be adopted to ensure that high quality accessible transport features are built into a significant new infrastructure project. The example is hypothetically placed in India in order to provide a specific national regulatory framework setting. Any similarities with planned or existing BRT lines in the region are wholly coincidental.

Step 1 – Project Preparation & planning

Key Activities	Specific issues considered and explored	Impact of decisions
Delivery within regulatory frameworks	• Persons with Disabilities Act 1995 provides a framework for BRT line design features. • Local politicians and councillors briefed on aims and objectives regarding accessibility.	• Early awareness of legal requirement to design-in level/ramped access, colour contrasts, dropped kerbs, auditory crossing signals and Braille symbols as a minimum. • 5% of total budget is ring-fenced to fund accessibility measures and features. • A monitoring requirement is included to satisfy SIDA funding.
Project funding	• Some flexibility in budget due to loan-based funding mechanism ensures core funding for basic legal accessibility requirements. • Accessibility-specific grant secured from SIDA ensures additional accessibility features can be included in holistic design process, in return for data on system usage and uptake.	
Institutional Considerations	• National disability NGOs Samarthyam and Svayam consulted to secure their buy-in and support for later on. • Consultants appointed for feasibility study are partnered with Samarthyam & Svayam. • Capacity needs assessment reveals local PT agency staff require up-skilling to ensure a highly accessible BRT service is provided.	• Both agencies offer to audit, evaluate and monitor system uptake by PLM. • Agreed that the local PT agency will be responsible for maintenance and operation of accessibility features following training and capacity building.
Understanding attitudes and needs	• User surveys, focus groups and ethnographic research explore attitudes and perceptions of PLM alongside those of other users. • Secondary population data is analysed to understand demographic trends. • Pre-formed local disability groups identified and included into project comms so their knowledge can be leveraged later on.	• Needs and expectations of local PLM are understood sufficiently to inform ramped, median accessed concept-designs for the BRT line stops and low-floor vehicles. • Engaging with local people reveals need to also improve pedestrian accessibility around BRT line stops.

Step 2 – Options Appraisal

Key Activities	Specific issues considered and explored	Impact of decisions
Evaluating options and likely impacts	• Consultants and disability NGOs draw on user-needs findings to draw up a long list of all potential accessibility features for BRT buses, stops, staff training and surrounding pedestrian environments. • Analysis of user needs research reveals most common trip chains for PLM	• Further inclusion of audible announcements at stops and on buses, disability awareness training for BRT staff and targeted accessibility features and public realm improvements at key interchanges and commercial (e.g. The local market) BRT stops.
Appraising benefits and beneficiaries	• Benefits appraisal undertaken by NGOs on behalf of consultant team, drawing on ethnographic and stated preference research, helps to identify highest and lowest benefit accessibility features. • Wheelchair users and people with walking impairments identified as key beneficiaries, through the removal of bus stop access and bus-boarding barriers. • Consultant team models estimated numbers of PLM for whom BRT becomes an option through the inclusion of accessibility features, and identifies benefits for wider society. • Benefits are appraised over the estimated 25 year operating life of the BRT line.	• An initial long list of accessibility features, featuring those in the 'Public transport stop and station infrastructure' and 'Public transport vehicles' of Chapter 2 in this guide, is gradually refined using cost:benefit appraisal techniques. • High marginal cost and low benefit measures in the local context; which include stair lifts, bus wheelchair lifts, pedestrian bridges and elevators; are sequentially removed from the specification for the BRT line based on a long-term view of the accessibility needs of local PLM, consideration of available budgets and engineering challenges associated with route alignment and station access. • Pedestrian infrastructure improvements in the vicinity of BRT line stops (such as raised signalised crossings with audible warnings and tactile surfaces), which benefit PLM and wider society, are prioritised over high marginal cost measures with limited benefit.
Appraising costs and cost effectiveness	• Consultant team and NGOs estimate the marginal costs of implementing accessibility features for PLM in terms of the BRT line's design, construction and operation. • Costs of different combinations of accessibility features are considered against the benefits for PLM and wider society.	

Step 3 – Detailed design

Key Activities	Specific issues considered and explored	Impact of decisions
Delivery mechanisms	• Consultants explore technical feasibility and cost:benefit of different options for implementing accessibility features for PLM. BRT line viewed as a good opportunity to additionally improve pedestrian environments around the route alignment.	• Some retro-fitting required of stop infrastructure at major rail interchange and where BRT will integrate with existing bus feeder lines. • BRT vehicles to be specifically ordered and customised for the purpose of this project. Feeder bus services to be retro-fitted with tactile and colour contrasted surfaces. • Costly, and potentially wasteful investment, in off-bus ticket machines for BRT stations is avoided. • Savings achieved are invested in 50% concessionary fares for disabled people and free travel for carers.
Fundamental design considerations	• Difficult to maintain infrastructure, such as stair lifts and bus wheelchair lifts, are discounted on the grounds of the challenging operational environment and anticipated high level of patronage. • Off-bus ticketing to be through staffed ticket booths due to unreliable power supply, risk of cash thefts from ticket machines and local literacy levels. Added benefit for PLM is that staff will be on-hand to provide assistance. • Design-workshops are conducted with PLM to sense-check assumptions about user-friendliness and relevance of accessibility features included in the specification for the BRT line. • Focus group discussions with PT agency staff reveal attitudes and perceptions towards PLM, and highlights need for disability awareness training as part of the BRT line's implementation.	• Local PLM are involved in finalising designs for the BRT line and have the opportunity to request specific features or propose amendments to concept designs. • PT agency staff understand and buy-in to the reasoning behind specific accessibility features included in the detailed designs for the BRT line. • A list of 'desirable' measures which fall outside the scope of the budget for the BRT line, and suggested priorities for their implementation, is prepared so that it may be implemented as and when funding becomes available or genuine need arises.

Step 4 – Construction

Key Activities	Specific issues considered and explored	Impact of decisions
Build process	• Construction workers are briefed on the rationale behind accessibility features and provided with clear guidance on how infrastructure such as tactile surfaces, kerb cuts and ramps are to be implemented. • National NGOs and local disability groups are co-opted to participate in quality control activities alongside BRT line construction project management prior to formal sign-off of accessibility features.	• Local PLM remain involved in the BRT line development through the construction process. • Involvement of PLM in snagging and quality control maintains high standard of accessibility features and prevents common incorrect applications of items such as tactile surfaces. • Access to existing transport services and pedestrian networks is maintained to the extent possible through the construction period. • Pedestrian route diversions are clearly signed and physical segregation from construction sites is maintained. • Local people (including PLM) are kept appraised of progress and planned disruption. • Early user-testing enables potential PLM users of the BRT line to understand how they will be able to use the system once it is operational.
Mitigation	• Alternative pedestrian routes are developed and signed as part of the construction works management planning and implementation. • Existing bus services are maintained, but diverted during construction works.	
Communication	• Changes to existing services, and reasons for disruption, are communicated to PLM as part of wider BRT line communication activities. • National NGOs are involved in the process to ensure key messages reach PLM.	
Testing	• Local groups of PLM are given early access to completed BRT lines and bus vehicles so they can be involved in user-testing/commissioning, as well as to facilitate travel training and familiarisation in advance of line opening.	

Step 5 – Maintenance, operation and evaluation

Key Activities	Specific issues considered and explored	Impact of decisions
Maintenance and operation	• Equipment suppliers, consultants and national NGOs collaborate to train PT agency staff on maintenance requirements, and develop maintenance regimes for accessibility equipment. • Operational roles are defined and reviewed for PT staff to ensure that at each BRT stop, and on-board the vehicles, there are individuals with clear responsibility for helping PLM upon demand. • Complaint reporting and fault investigation procedures are established to enable staff members to report problems, or PLM to complain about poor service / broken equipment.	• Awareness of PT agency staff regarding the existence, purpose and function of accessibility features is maximised. • Maintenance regimes help ensure accessibility equipment such as public address systems and information screens are kept functioning, and replaced when broken. • Dedicated staff roles ensure that individuals working on the new BRT line are aware of their responsibilities towards PLM.
Evaluation	• Post-implementation ridership and patronage surveys with PLM are used to monitor the impact of the new BRT line and identify real-world benefits for accessibility. • Periodic audits of accessibility features are scheduled with local PLM groups to discourage decline in service standards.	• Complaint monitoring provides an independent check on the rigour with which maintenance regimes are implemented. • Monitoring surveys reveal any unintended consequences of the BRT line, and highlight remaining barriers to accessibility to be addressed through future projects.

APPENDIX A

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