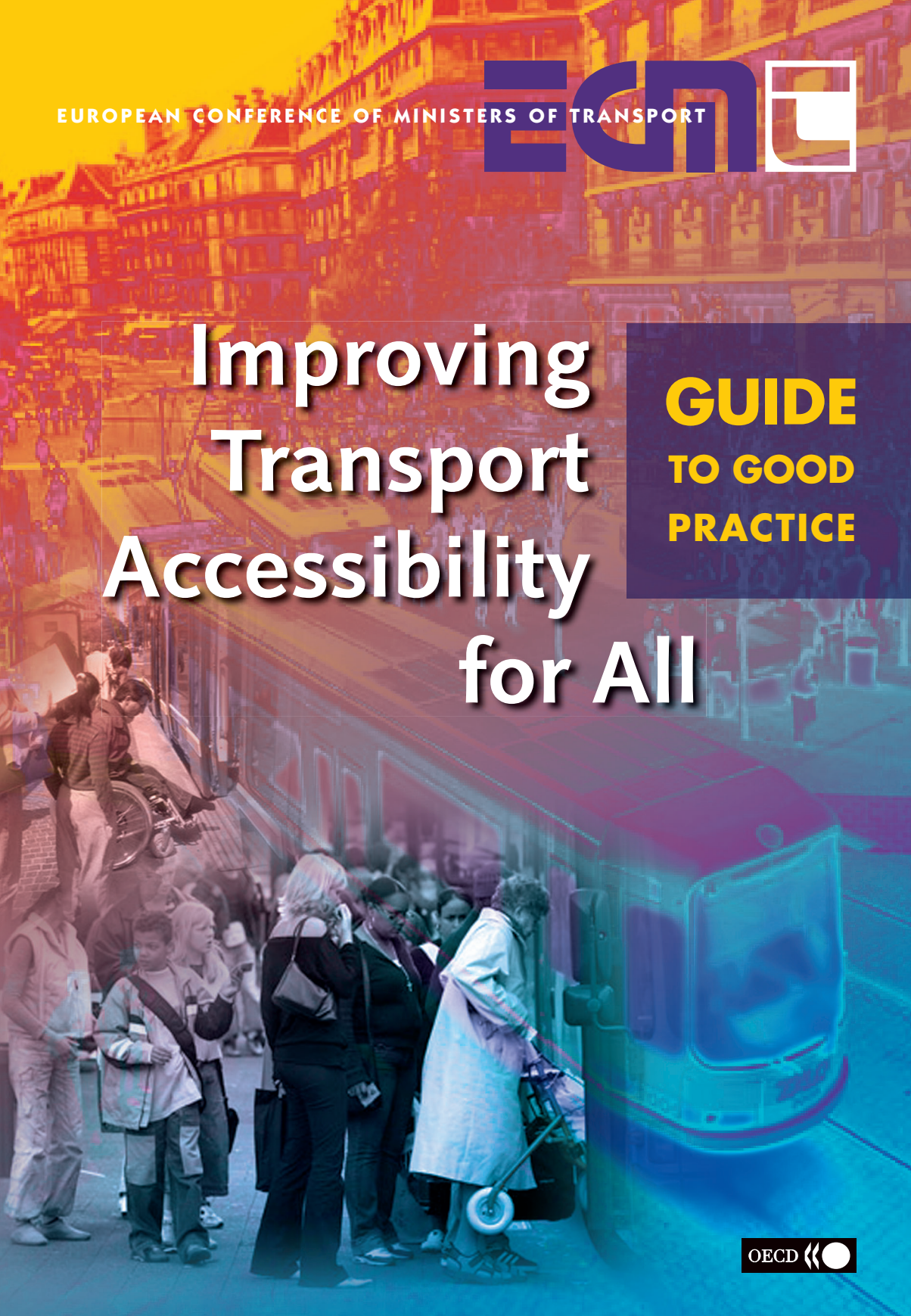
EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

ECMT

Improving Transport Accessibility for All

GUIDE TO GOOD PRACTICE



OECD

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EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT (ECMT)

The European Conference of Ministers of Transport (ECMT) is an inter-governmental organisation established by a Protocol signed in Brussels on 17 October 1953. It comprises the Ministers of Transport of 43 full Member countries: Albania, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, FRY Macedonia, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine and the United Kingdom. There are seven Associate member countries (Australia, Canada, Japan, Korea, Mexico, New Zealand and the United States) and one Observer country (Morocco).

The ECMT is a forum in which Ministers responsible for transport, and more specifically the inland transport sector, can co-operate on policy. Within this forum, Ministers can openly discuss current problems and agree upon joint approaches aimed at improving the utilization and at ensuring the rational development of European transport systems of international importance.

At present, ECMT has a dual role. On one hand it helps to create an integrated transport system throughout the enlarged Europe that is economically efficient and meets environmental and safety standards. In order to achieve this, it is important for ECMT to help build a bridge between the European Union and the rest of the European continent at a political level.

On the other hand, ECMT's mission is also to develop reflections on long-term trends in the transport sector and to study the implications for the sector of increased globalisation. The activities in this regard have recently been reinforced by the setting up of a New Joint OECD/ECMT Transport Research Centre.

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Further information about the ECMT is available on Internet at the following address: ***www.cemt.org***

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The ECMT is additionally grateful to the cities which submitted candidate dossiers for the 2003 ECMT-EDF Access and Inclusion Award for Transport Services and Infrastructure. Selected good practice experience from these dossiers is also reflected in this report.

Particular appreciation is extended to accessibility expert Philip Oxley from the United Kingdom for his expertise in the preparation and drafting of this report.

FOREWORD
From the ECMT Presidency

Accessibility is increasingly recognized as a key element of a high-quality, efficient and sustainable transport system. Indeed all of us as users of the transport system benefit from easier access to buses, trams, trains, planes and ships. The economic benefits of better accessibility for transport operators and service providers are also becoming progressively clearer.

This recognition has been pushed forward over the last 10-15 years by legislation and regulation in many countries. This has helped to establish a framework to encourage cooperative action among all stakeholders of the system – public authorities, transport service providers and operators – working hand-in-hand with disabled and older persons and their representative organizations to design and construct transport networks, infrastructure and vehicles that are accessible to all users of the transport system.

Other essential aspects of accessible transport such as training for transport personnel and user information continue to improve, as does our understanding of the range of particular travel needs of individuals with different types of disability: motor, sensory, intellectual.

But much remains to be done to improve access to transport, and different countries face specific challenges in making their transport systems more accessible.

It is for this reason that the sharing of experience and good practice – what has worked well and what has worked less well – is an essential part of making accessible transport a reality across our countries.

This *Guide to Good Practice* is designed to facilitate that exchange of experience. With new examples from recent experience in a wide range of countries, it updates the ECMT's 1999 Guide, highlighting areas where progress has been made, and those where particular challenges persist.

During its 2005-2006 Presidency of ECMT, Ireland has taken its own steps to improve the accessibility of its transport system. We passed significant disability legislation in 2005, and will publish a sectoral plan for accessibility to transport in mid-2006.

In preparing to take forward these major initiatives, we have benefited from the experience of a number of other ECMT countries and the ground-breaking policy work carried out by the ECMT itself. We stand ready to share our experience with other countries.

It is in this spirit that the ECMT has prepared this *Guide to Good Practice*, and with hopes that it helps not only countries already working towards better transport accessibility, but also those that are just now making the commitment to do so.

Martin Cullen

Minister of Transport Ireland

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INTRODUCTION

Many people find travelling around, whether within their own neighbourhood or over longer distances, difficult or even impossible. It is only in comparatively recent times that the scale of the barriers to mobility in the environment and in transport services has been recognised. Unless and until these barriers are removed, a substantial proportion of the population will continue to be at a disadvantage; unable to travel as they would wish and consequently limited in the extent to which they can participate in society.

The numbers of people whose mobility is constrained in this way are very substantial. A recent study[1] by Eurostat on employment of disabled people in Europe estimated that among people of working age (16 to 64 years) 44.6 million – i.e. one in six (15.7%) had a long-standing health problem or disability.

A recent communication from the European Commission (February 2005)[2] to the European Parliament and the Council cited an earlier (2000) paper (Towards a barrier-free Europe for people with disabilities) which estimated that around 10% of the European population had reduced mobility. National estimates, as well as the Eurostat survey, would suggest that this estimate is probably too low. Difficulty moving around can arise for many reasons; disability is one but so too are temporary impairments, which can encompass anything from a leg broken in a skiing accident to having a small child and/or several baskets of shopping. Two studies, one in Germany the other in France, estimated that at any one time between 20 and 30% of people travelling have a mobility difficulty for one reason or another.

A study[3] conducted in 2003 by the Berliner Verkehrsbetriebe (BVG) on the accessibility of public transport for people with reduced

mobility estimated that, in the (then) 15 member countries of the EU, 99 million or 26% of the population had some degree of mobility impairment. The figure of 99 million comprised 37.3 million people aged 16 to 64 with either moderate or severe disabilities and 61.3 million people aged 65 or more. These figures refer to the position in the year 2000; by 2010 the report estimates that the total will have risen from 99 million to over 113 million. The report also notes that there is no standard definition throughout Europe of "disability", so interpretations vary from country to country, sometimes quite widely.

It is also important to remember that it is not just physical disabilities that may cause problems for people when they are travelling. Sensory impairments – not being able to see or hear – can cause difficulties, so too can intellectual disabilities, mental health problems and difficulties with communication.

Whatever definition of reduced mobility or disability is used, it is clear that very large numbers of people are affected by barriers to movement. Moreover the numbers of people affected are likely to increase in the future. Europe has an ageing population and there is a clear correlation between age and disability. It is also worth remembering that improved accessibility makes travelling easier for everyone, not just disabled people.

This Guide – which updates the previous publication *Improving Transport for People with Mobility Handicaps: A Guide to Good Practice*, published by the ECMT in 1999 – is intended to show how barriers to mobility and the use of public and private transport can be removed. This current Guide builds on information included in the 1999 version and includes updated examples of good practice from throughout ECMT Member and Associate Member countries. It also draws on good practice examples revealed in the ECMT's 2003 joint Access and Inclusion Award for Transport Services and Infrastructure, organized with the European Disability Forum in the context of the 2003 European Year for Persons with Disabilities[4]. The objective of the Prize was to promote recognition of examples of good practice in improving accessibility to transport, to reward approaches in the field that are inclusive of all people with disabilities and recognise the importance of consulting with representative disability organisations.

The Guide is not intended to be a very detailed and absolutely comprehensive guide to good practice: if it were that it would be several times bigger than it is. Rather, it is intended to provide a vade mecum for anyone who is concerned with transport whether as a designer, planner or operator; to give good advice and some details of the more important aspects of accessible transport infrastructure, vehicles and information, and to provide a list of sources where more detailed and specific information can be found.

It is important to remember that the majority of journeys involve using more than one mode of transport. Therefore, the overall objective of creating accessible transport services should be to develop a "seamless" system in which disabled people can access, travel on and interchange between modes easily and safely. That process of seamless transport starts with access to information about services and covers the infrastructure as well as the vehicles themselves.

NOTES

1. “Employment of disabled people in Europe in 2002”, Eurostat, European Communities (2003).

2. Communication from the Commission to the European Parliament and the Council (“Strengthening passenger rights within the European Union”), Brussels, 16.2.2005 COM (2005)46 final.

3. “The Accessibility of Urban Transport to People with Reduced Mobility”, Final Report, BVG for DG Energy and Transport, European Commission, 2003.

4. Please see the ECMT web site www.cemt.org/topics/handicaps/index.htm for a full description of the prize and its winners.

1. INFORMATION

In whatever form information is made available it should meet the four criteria:

- Clear
- Concise
- Accurate
- Timely

It makes no difference whether the information is presented on a leaflet, a sign, in response to a telephone call or in any other way, those criteria must be satisfied if it is to meet the needs of travellers.

These criteria, of course, apply to information for everyone who has to travel, but for disabled people there are aspects of these criteria that are **particularly** important.

1.1 Clarity

Clear means two things: easily legible in the case of textual information, whether printed or on a screen or a sign and in all cases, including spoken information, easily understood.

There are quite a lot of good guidelines developed for the presentation of text.

Generally people find it easier to comprehend text when it is written in lower case, with appropriate capitals RATHER THAN ALL IN CAPITALS. This applies to timetables and leaflets as well as signs and television displays.

Size is important. Failing eyesight is a common accompaniment to increasing age and very small print is difficult to read. Conventional

timetables and brochures should be printed in a clear type face for the benefit of everyone but should also be produced in large print, minimum 14pt, preferably 19pt: which is this size.

Even large print can be rendered difficult to read if the contrast between the colours used for the text and for the background paper is not good. Brown print on a beige background may be aesthetically pleasing but it is not easy to read, especially if the light is not too good. Black or dark blue on a white background is fine.

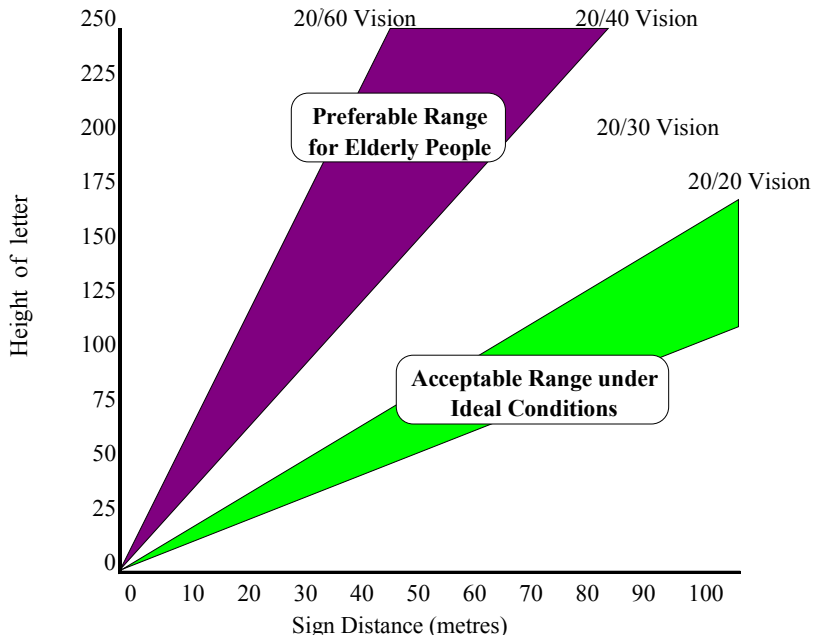
These guidelines generally also apply to signs. Lower case lettering, again, should be used and the type face should be a clear one like:

- Helvetica
- Airport
- Futura
- Folio

Part of the process of ensuring that signs are legible is the placing of them. The ideal position for seeing a sign is on a level with the eyeline of the individual but this is often not possible. Put at that level in, for example, a railway terminus would mean that unless you were right by them you would not be able to see them because of other people getting in the way. So they often have to be raised. The extent to which they are raised will depend on the specific location, but to avoid other people getting in the way they should be placed not less than 2.3 m[1,2] above ground level. Of course, in large areas like a station concourse they will be a lot higher than that because people need to see them from a long way away.

There are several guidelines on the size of lettering in relation to distance varying according to the degree of visual impairment of the observer. The figure below shows the size of lettering required at a range of distances. Thus to meet the needs of older people and others with rather poor sight a letter height of 25 mm is required for a viewing distance of 7.5 m. At 20 m distance, letters should be about 75 mm. Some transport authorities have more exacting standards. For

example London Transport's standard is based on 10 mm letter height for every metre of viewing distance, with no lettering less than 22 mm.



Source: Improving Transportation Information. Prepared for Transportation Development Centre, Transport Canada by TransVision consultants Ltd (1996).

Lighting of static signs

Signs should be well lit. As a rule of thumb, it should be possible for a person with good (20/20) vision to read a newspaper in the vicinity of the sign. Where ambient light levels are not as good as this, illuminated (back lit) signs may be preferable. In conditions where the light is not good, glossy finishes to signs should be avoided as they can cause glare and disadvantage people with low or impaired vision; a matt finish is better.

1.2 Overall information

In recent years there have been considerable developments in the provision of comprehensive travel information systems. Some of these

systems cover a specific area, for example a major city; others cover a whole country. In some cases they provide information about the transport infrastructure as well as services and, provided they contain the appropriate information on accessibility, these information services can be very helpful for disabled people who are planning a journey.

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 Sweden, an Internet-based timetable information system is being extended with detailed information on design, accessibility, service and quality of stations and bus terminals. The system covers all train services and all regional public transport services: bus, coach, train and ferry. The extended system includes information about taxis (including train-taxi), car parking (including disabled persons' parking spaces) and accessible toilets. Other national rail systems, for example in Germany, Switzerland and Italy, have websites which provide information specially prepared to meet the requirements of disabled travellers.

In the UK a new Internet based system "Transport Direct" is being developed to provide national journey planning facilities, including by car as well as on public transport. As part of the research programme for the system, the needs of disabled people are being investigated both in terms of the type of information required and the usability of the system.

Where information is provided via the Internet, care should be taken to ensure that the website is designed to be easily used by disabled people. Information on the design of accessible websites is given by the World Wide Web Consortium's (W3C) Web Content Accessibility Guidelines.[3] These guidelines are comprehensive and seek to encourage "design for all" principles when considering web design to make web content accessible for disabled people.

In Finland, the Helsinki Metropolitan Area Council has a door-to-door Internet journey planner, which provides itinerary planning, timetable and route information for the whole public transport system in the area.

Telephone based systems can also play an important part in providing travel information for disabled people. The national service in the UK ("traveline") provides timetable and routing information for bus, rail, scheduled coach and ferry services. Some recently completed research has proposed that this service should include information for disabled users, including the accessibility of vehicles and of individual stations and stops, the availability of accessible toilets and of assistance for disabled people while travelling.

It may not always be feasible for national or regional telephone-based information services to provide all of the information needed by a disabled traveller. In these circumstances, more specialised telephone services can give the necessary information. Examples of national organisations that cover all modes of transport and which have detailed information on accessibility of vehicles and related infrastructure include TRIPSCOPE (UK) and Infopunt Toegankelijk Reizen in Belgium.

There are increasing numbers of public access information terminals and kiosks at transport terminals and on-street. The type of information they give varies. It may be related to one specific service or to a whole range of transport information including planning journeys by car. There are examples of this type of service in several European cities including Madrid, Munich and Helsinki.

It seems likely that this source of information will increase in the future and it obviously has great value if **properly designed**. An ergonomic evaluation of the ROMANSE terminals[4] produced the following guidelines:

- The operational face of the machine, which is a touch-sensitive screen, should be no more than 1.2 m from ground level.
- The screen should be flush with the front surface of the terminal casing, not recessed into it.
- Parallax can make it difficult for people to place their finger on the desired icon or symbol on the screen; this effect can be reduced by careful positioning of the screen in relation to the viewing angle.
- The cabinet in which the screen is placed should have a foot and knee recess, so that wheelchair users can get close to it.
- Displays of text should follow the guidelines mentioned earlier concerning clarity, contrast and legibility.

Further information on the design requirements for new information technologies, including Internet services, can be found in reports produced by the EC project QUARTET PLUS. A contact point for obtaining this information is included in the References section of this publication.

Help Points, which people can use to get travel information or to call for emergency assistance, are becoming more common, particularly on stations which are not staffed all the time. These help points should be placed so that the maximum height of any button which the caller has to use is 1.2 m, they should be clearly distinguishable by visually impaired people and should be fitted with an induction loop.

1.3 Information at stations and stops

There is an increasing use of variable message signs (VMS) particularly in air and rail services but also growing on bus services as well.

These take a variety of forms from television screen displays, LED and fibre optics to the more old-fashioned but still much used flip disks. Following the advice given for printed texts and static signs will improve the legibility of these displays - clarity, appropriate size of letters and contrast are just as important. But, by their nature, variable message signs change by scrolling or flipping. It is most important that speed of change should not be too fast otherwise people who can read, but not well, will find it difficult to understand the message. It is recommended that a line of text should be displayed for at least ten seconds, preferably a little longer. Dynamic signs should have non-reflective glass and should be shielded from direct sunlight.

The Swiss Federal Office of Transport has produced a comprehensive report (in German) on the readability of dynamic visual information for people with impaired vision[5].

Photo 1. **Dynamic information at bus stops helps all passengers**

Source: Courtesy of Bernmobil, Bern, Switzerland.

1.4 Concise

Quite a lot of information is seen while *en route* when the observer him- or herself is moving - perhaps walking or maybe on a bus or a train. The time available to see, read and understand the information may therefore be quite short. This then emphasises the importance of keeping information as concise as possible and emphasises the value of using symbols.

The French organisation COLITRAH[6] (now COLIAC) has produced a comprehensive set of recommendations on signage - "*chaîne signalétique*" - which makes the point that for passengers in transit signs should be designed to give an instantaneous "snap-shot" of information. Symbols can be very helpful in this process, not least because they can be understood by people with low levels of literacy, but they must be used consistently, be unambiguous and if or when new ones are introduced, they should be accompanied by a verbal explanation until the public is fully familiar with the symbol and its meaning.

1.5 Hearing information

The emphasis on the preceding paragraphs has been on visual display of information, but audible information is also important, especially for conveying any unexpected changes to services and in emergencies. However, audible information is not restricted to announcements at stations and on-board public transport vehicles. Other sources include telephone information, information and ticket offices.

Many personal hearing aids incorporate a "T-coil" which provides direct inductive coupling with a second coil, for example in a telephone receiver or at a ticket office window. However, as not all hearing aid users have a T switch, it is recommended that telephones should also have user-controlled amplification of received sound. Amplification of sound is accessed via a button on the telephone that automatically reverts to the ordinary sound level once the telephone handset has been replaced.

Photo 2. **Dynamic information can be given audibly by this Passenger Information System in Munster**

Source: Courtesy of Stadt Münster – Tiefbauamt und Verkehrsbetrieb der Stadtwerke Münster, Germany.

Some telephone information services now include a Telecommunications Device for the Deaf (TDD)[7] Text phones are

available and are essential for those people who are profoundly or severely deaf. In Switzerland, the Federal Office of Transport published in 2005 a report[8] on the transfer of speech-based information (for example from information or emergency call systems) to personal devices with displays, like mobile phones, so providing the spoken information in text form.

1.6 Accurate and timely

Of course it is obvious that any information in whatever form should be accurate. This means more than just making sure that it is correct at the time it is **first** presented: it also means a process of up-dating and checking to make sure that it continues to be accurate. A mistake in a timetable may be the cause of irritation to anyone, but to a disabled person the consequences can be much more serious.

Timing of information is also important. Thought should be given not just to the content but to the point in the journey when it is needed. To take one simple example, an audible announcement of the next stop on a metro is very helpful particularly to visually impaired people but it needs to be made in sufficient time for the passenger to get ready to leave the train; an announcement as the train draws to a halt (or the bus) is too late for people who are less than fully agile.

1.7 General information

The preceding sections have dealt with specific aspects of the ways in which information should be presented, but there is also a need for more general information. Transport services change over time and so do the facilities that they offer. Knowledge about public transport services - where and when they operate, what the fares are and so on - is important for everyone but disabled people really need more information especially if they use a wheelchair.

A good example of this is the guide produced by the French rail company SNCF[9] which gives information on facilities and equipment (toilets for disabled people, ramps, lifts, accessible telephones, etc.) at stations and on trains, ticket booking and seat reservation and, most

importantly, also gives information on accessible public transport (buses, trains, etc.) to and from the rail stations.

Trenitalia (Italy) has produced a comprehensive but compact booklet “Services for disabled passengers” which gives information on national and some direct international rail services (from and to Italy) that are accessible to passengers using wheelchairs. It includes information on facilities available at stations, concessionary fares and the dedicated telephone numbers of disabled customer assistance offices. This information is also available on the web site www.Trenitalia.it. The Association of Train Operating Companies in the UK has recently produced a map covering all rail stations (approximately 2500) with a notation to indicate whether they are wheelchair accessible or not.

Another example of making comprehensive information available is shown by the Regional Information Centre established by STIF (the public transport authority for the région of Paris – Ile de France) in 2002. The centre provides a service, called Infomobi, which gives information about the accessibility of transport systems operated by RATP (bus, train, metro and light rail in Paris and nearby suburbs) SNCF (suburban rail services) and OPTILE, which is a federation of 80 private companies operating buses in the outer suburbs.

At a more general level, covering a range of modes of public transport, guides such as the French “Guide des transports à l’usage des personnes à mobilité réduite” or the “Door-to-Door” website of the UK Disabled Persons Transport Advisory Committee (www.dptac.gov.uk/door-to-door/index.htm) can be of value to disabled people. These publications provide a summary of the range of services available to disabled people. They are not intended to offer detailed, local information but to provide a broad overview of what is available and to give contact telephone numbers for more specific enquiries.

In Switzerland, there is a similar information centre called "Call Center Handicap" run by the Swiss Federal Railways (SBB) which

provides information about the accessibility of transport systems all over Switzerland and to and from other countries.

Another aspect, which is sometimes overlooked, is the provision of information in ways in which it can be understood by people with learning or cognitive difficulties. Inclusion Europe, which is an association of societies of people with intellectual disabilities, has produced guidance on this matter. For example, it advocates using symbols and illustrations to make timetables more understandable and clear simple signage to help people orient themselves and find places such as ticket offices in large bus and rail stations. Where services or equipment (like ticket machines) have been designed to meet the needs of people with intellectual disabilities and other disabled people, then the pictogramme S3A, designed by UNAPEI, can be displayed.[10]

With a different purpose in mind, guides on good design for accessibility can be used to raise awareness of transport operators and local authorities to the needs of disabled people. In the Netherlands, for example, brochures are being prepared with specifications on accessibility in urban public transport, for information systems, and for parking and facilities on motorways. The idea is that such brochures will provide guidance to operators and authorities in a way that is easier for them to assimilate than if the same information is conveyed in a scientific report.

1.8 Multi-modal journeys

Many journeys involve the use of more than one mode of transport. A rail journey, for example, will almost always involve the use of other modes to get to and from the station as well as, quite often, interchange from one train to another.

In developing comprehensive transport information services, like some of those mentioned earlier in this chapter, it is most important to include information on intermodal as well as within mode accessibility. Having fully accessible trains is clearly important but so too is the ability to have access from one platform to another where a change of

trains is necessary. Similarly, the route between different modes, say from a bus station to a neighbouring rail station should be accessible. Information on this aspect of travelling is as important as on the accessibility (or otherwise) of transport vehicles.

NOTES

1. See Page 22, “Access prohibited” by John Gill, published by the Royal National Institute for the Blind, London, for more information on this and related subjects.
2. Fruin JJ, “Synthesis of Transport Practice: Passenger Information Systems for Transit Transfer Facilities”, US Transportation Board, Washington DC (1985).
3. www.w3.org/WAI
4. Barham, P. and Alexander, J. “Evaluation of Interactive Information Terminals (with respect to their use by the elderly and people with disabilities) – ROMANSE Project. “CCLT”, Cranfield University (1998).
5. Büser F, "Bericht für die Entwicklung von Normen zur Gestaltung von optischen, dynamischen Fahrgastinformationssystemen im öffentlichen Verkehr unter dem Aspekt der Bedürfnisse sehbehinderter Personen", Swiss Federal Office of Transport, Berne (2005).
6. Stevoux P, Smolar M, Thery C and Briaux-Trouverie C., “Une conception de la signalétique adaptée aux besoins de l’ensemble des usagers”, COLITRAH. Conseil National des Transports (1989).
7. See ECMT Transport for People with Mobility Handicaps – Information & Communication, p. 65 and p. 104-105 ECMT (Paris, 1991).
8. Raemy P, “Drahtlose Übermittlung von Kundeninformationen im öffentlichen Verkehr unter besonderer Berücksichtigung der Bedürfnisse von sinnesbehinderten Reisenden”, Swiss Federal Office of Transport, Berne (2005).
9. “Guide du voyageur à mobilité réduite”, published by SNCF, Paris.
10. “Revue de Presse du Pictogramme S3A (Symbole d’Accueil, d’Accompagnement, d’Accessibilité)”, UNAPEI, Paris (2004).

2. THE ROAD AND PEDESTRIAN ENVIRONMENT

Almost all journeys start and finish by walking or wheeling. No matter how accessible transport itself may be, if the walking environment contains barriers to movement then the usability of transport services is largely negated. This environment may also contain barriers to communication and orientation, for example, illegible signage or controlled pedestrian crossings that do not have an audible or tactile signal.

2.1 Footpaths and footways[1]

The underlying purpose of a pavement is to provide safe, easy access for everyone walking or using a wheelchair. To achieve this, the following guidelines should be followed wherever possible:

- A minimum obstacle free footway at least 1 500 mm wide - preferably 2 000 mm.
- Widths should be greater at bus stops (minimum 3 000 mm) and in front of shops (3 500 mm or more).
- If possible gradients should be not more than 5% (1 in 20) to cater for self-propelled wheelchairs: this should be used as a design limit in new development. The Swedish Association of Local Authorities[2] noted that a gradient of 2.5% (1 in 40) can be managed by the majority of people, but gradients steeper than this begin to cause difficulties for some manual wheelchair users. See also the section on ramps (3.1).
- Where gradients are unavoidably steeper than this, level areas (preferably 1 500 – 1 800 mm long) should be incorporated at intervals of 10 m.

- Crossfalls, which are needed to make sure rain water drains away quickly, should be between 1.5 and 2.5% (1 in 40). Anything steeper than 2.5% makes it difficult for a wheelchair user to steer in a straight line.

- Where there is a drop or steep slope at the rear side of a footway (or both sides of a footpath) a 100 mm edging upstand should be provided as a safeguard for wheelchair users and as a tapping rail for long cane users.

- Surfaces should be non-slip, well maintained and any joints between paving slabs should be closed and flush to avoid catching the small wheels of a wheelchair.

- Covers and gratings should be non-slip and flush with the pavement surface.

- Nothing should overhang the footway (signs, tree branches, etc.) to a height of less than 2 100 mm (preferably 2 500 mm).

- Where it is not possible to avoid having obstacles in the pavement, such as lamp-posts, traffic signs, etc. they should have a contrasting band of colour 140 mm to 160 mm wide with the lower edge 1 500 to 1 700 mm above ground level. Trees in the footway should have a distinctive surface around them (for example grating or pebbled) to warn blind people.

- Seating should be provided at regular intervals of around 100 m.

- In parts of Europe, particularly in the north and Scandinavia, keeping footways clear of snow and ice is very important. In Finland, the city of Jyväskylä has been equipping some pedestrian areas with a heating system, which melts the snow and ice, making the areas safe to walk on even in winter. Where this is not possible, a winter maintenance programme that includes snow clearance as soon as possible after a snowfall will assist all pedestrians, but especially those who are disabled.

2.2 Junctions and road crossings

These are potentially hazardous for visually impaired people and wheelchair users. Dropped kerbs are of great help to wheelchair users and should be provided at all pedestrian crossing points. At side roads where there is space to do it, dropped kerbs should be set up on the side road out of the direct line of the footway of the main road. This is to prevent blind people walking into the side road without realising it.

The dropped kerb or “kerb cut” should be flush with the carriageway, 2 m wide (more if it is a heavily used crossing point) and the gradients associated with it should be gentle.

To help visually-impaired people, when a dropped kerb is in the direct line of travel, a tactile surface should be laid to a depth of 1 200 mm (see below) in a contrasting colour to the surrounding pavement. This will provide a warning to the pedestrian that they are approaching a road.

Busy junctions require some form of control to assist pedestrians across the road. This may be just a pedestrian crossing (“zebra”) or a controlled crossing (traffic signals with a pedestrian phase and various other forms of control such as “pelicans” and “puffins”). Again all these crossings should have dropped kerbs and tactile warning surfaces.

Further help can be given to visually-impaired pedestrians at controlled crossings by means of audible and tactile (or haptic) signals. Examples of these include the signal popularly known (in the UK) as “bleep and sweep” which is designed to be used at staggered crossings across roads which have a centre reservation, and audible signals coupled with apparatus that rotates or vibrates when it is safe to cross. Munster has examples of the latter, which are of particular help to blind-deaf persons.

Straightforward crossings can use a standard bleep, some with two tones - one to indicate that it is safe to cross, the other to indicate that the safe period is about to come to an end. Electronic systems have been developed which will extend the safe crossing period; this

can be helpful to disabled people who cannot move as quickly as an able-bodied person. The sound output of bleepers can be modified by reference to the ambient (traffic) noise level to ensure that it can be heard over traffic noise but does not cause a noise nuisance at quieter times.

2.3 Pedestrianised areas

Areas, particularly in town centres, that are traffic free for some or all of the time can provide a pleasant and safe environment for all pedestrians, but they can also contain hazards.

The gradients mentioned earlier (in 2.1) also apply to pedestrianized areas and, where there are unavoidable changes in level, ramps should be provided as well as steps. Two level (or more) shopping precincts must have lift access to all floors.

The walking surface, like that of footways, should be non-slip and well lit; good maintenance is also essential.

There is very likely to be some encroachment onto the pedestrian areas of shop displays and goods as well as street furniture - lamp posts, bollards, waste-bins and the like. Such encroachment should be carefully controlled otherwise it can be dangerous for visually-impaired people. The aim should always be to maintain all the principal directions of movement as “pedestrian clearways”.

Large open pedestrian areas are difficult for blind and partially-sighted people to navigate, so tactile guidance surfaces should be incorporated in such areas (see 2.5) as well as appropriate warning for any flights of steps. In the future, navigation systems may help blind people to find their way through these types of area.

2.4 Roadworks: holes and how to avoid them

It is inevitable that from time to time repairs will have to be made to footways and pedestrian areas. When this happens the area should be barricaded off with a continuous rail about 1 m above ground and a tapping rail below this. Audible warnings and lamps should be

provided and where a diversion is necessary, the needs of wheelchair users should not be forgotten. Temporary footways should never be less than 1 200 mm wide and, wherever possible, at least 1 800 mm wide.

Where scaffolding or other temporary structures are erected on or adjacent to a pedestrian way, it is essential that their presence is made apparent to visually impaired people. There should be a minimum passage width of 1 100 mm (more if possible) where scaffolding is erected over a footway.

Corner poles must be padded and all vertical supports should have a band of contrasting colour about 150 mm in depth and with the lower edge 1.5 to 1.7 m above ground level. Lighting and audible warning should be provided.

2.5 Tactile surfaces

For people who are blind or who have little residual vision, tactile surfaces are essential for the safe progress through the street environment.

Many European countries have developed tactile surfaces of various kinds. There is a strong case for Europe-wide agreement on which surface should be used in what circumstance and a CEN standard for the production of such materials is being developed. Meantime, there is some inconsistency even within one country, let alone between countries.

However, there are some general guidelines of good practice that can be adduced:

- Tactile surfaces have to be sufficiently “rough” or “rigorous” for blind people to feel them through their shoes, bearing in mind that some medical conditions which lead to vision impairment also cause loss of feeling in the lower limbs (e.g. diabetic retinopathy).

- The surface should not be so rigorous that it causes problems to other pedestrians, particularly ambulant disabled people and wheelchair users.

- Because most visually-impaired people still have some vision, tactile surfaces should be readily distinguishable by colour and tone from the general pedestrian area.

- There are two categories of tactile surfaces; those that warn of a potential hazard and those that impart information warning surfaces should be used in the following circumstances **and should be readily distinguishable one from another**:

  - At pedestrian crossings (where colour may be used to differentiate between controlled and uncontrolled crossings).
  - At the edges of rail, tram and raised bus platforms.
  - To warn of other hazards: steps, level crossings, the approach to on-street light rapid transit platforms.

- Information surfaces can be used to:

  - Provide a guidance route through large open spaces or through complex pedestrian environments.

  - Indicate the presence of facilities such as bus stops, telephone kiosks, tactile or talking information services, toilets and so on.

Research[3] has shown that a height of approximately 5 mm for the raised profile part of a surface is sufficient for almost all blind people to detect the surface and at this height it does not cause too much of a problem to other pedestrians. An alternative to a surface with a raised profile is one that feels different underfoot. A surface made of neoprene rubber or similar elastomeric compound feels noticeably softer than normal paving and sounds different when walked on. This type of surface is recommended in the UK as an information surface.

Photo 3. **Tactile surfaces are essential to warn blind and visually impaired people of hazards**

Source: Courtesy of the Department for Transport, United Kingdom.

Sound itself can be a guide. Hamburger Hochbahn AG has equipped some of its underground stations with ceramic tiles with raised bumps 30 mm in diameter but only 1.5 mm high[4]. The detection of these tiles depends on sound rather than feel, and thus the environment is of major importance.

Photo 4. **Tactile guidance and platform edge warning surfaces**

Source: Courtesy of Bundesamt für Verkehr, Bern, Switzerland.

The Dutch town of Gouda has introduced an extensive system of tactile surfaces including route guidance and warning of a junction, the latter based on a concrete tile coated with a layer of hard rubber.

In Stuttgart a new type of guidance surface has been developed which combines a distinctive sound with a tactile surface. The material used is “Hohlkörperbodenindikator” (hollow body floor indicator), which research has shown to be the best indicator for blind people. This surface is being installed at stops on a light rail route (U2) in Stuttgart. In Munster, tactile surfaces are supplemented by “orientation posts”. These are 900 mm in height and display a tactile direction arrow in the form of an equal-sided triangle with a concave base. Tactile letters or Braille on the triangle show the desired direction.

Research into ways of helping blind people navigate around unfamiliar areas continues. The NOPPA system (Navigation and Guidance System for the Visually Impaired) for example, is an electronic travelling aid using a mobile terminal which can connect to real time navigation/guidance information via the Internet. Though still at the development stage, electronic aids of this kind may offer much more comprehensive guidance information for blind and partially-sighted people than can be achieved by purely physical measures.

In the Netherlands, ProRail (the company responsible for rail infrastructure) has developed and is experimenting with “speech beacons”. By means of a handheld receiver a visually impaired passenger is able to find his or her way around complex structures such as railway terminals. It is intended that in the future this system will be installed in all major rail stations in the Netherlands.

In the UK the Royal National Institute for the Blind has developed an electronic wayfinding system called RNIB React. The user carries a small trigger module which emits a radio signal. When the user walks within range of a React sign, the radio signal triggers a spoken message which gives information (like visual signs or architectural features) that blind or partially-sighted people would otherwise miss. The system can provide messages in up to eight different languages and can also be adapted to operate devices; for example, opening an electronic door, raising a barrier or operating a remote bell or buzzer.

2.6 Car parking

It is usual in European countries for special car parking arrangements to be made for disabled car users. This includes permitting disabled car users who hold a blue badge to park on-street in places where parking is not otherwise allowed.

Parking bays should be wide enough to give space for a wheelchair user to transfer from chair into the car that is about 3.6 m wide compared with a standard bay width of 2.4 m. Where there are several bays together some space can be saved by having one shared extra space (1.2 m) to two bays.

Where parking bays are on-street parallel to the kerb they should be 6.6 m long to allow for access to the rear of the vehicle, where wheelchairs are often stored. Where the parking bays are at an angle to the kerb, 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. All bays designated for disabled car users should be clearly marked with a large wheelchair symbol on the ground and cross-hatching on the 1.2 m space at the side. On–street bays and bays in open off-street parking areas should also have a post mounted sign. An adjacent flush dropped kerb should be provided to give access to the pavement.

Whether on or off-street,(for example in shopping centres as well as in general public car parks) enforcement is essential to ensure that parking bays (marked with the wheelchair symbol) are not used by other motorists, or otherwise obstructed.

The recommended numbers of parking spaces for disabled motorists vary according to the type and capacity of car parks. The following examples are taken from the UK Department for Transport's guidelines[5]:

(i) For car parks associated with new employment premises and providing for employees and visitors:

5% of the total capacity.

(ii) For car parks associated with existing employment premises:

2% of the total car park capacity, with a minimum of one space.

(iii) For car parks associated with shopping areas, leisure or recreational facilities and places open to the public:

A minimum of one space for each employee who is a disabled motorist, plus 6% of the total capacity for visiting disabled motorists.

Other countries have different recommendations - for example the French regulation (1994) envisages one space per 50 parking spaces and a minimum of ten spaces for car parks with over 500 spaces. When deciding on the number of spaces to be allocated, it should be remembered that the number of disabled car users as a proportion of all car users is likely to increase in the future.

The reserved spaces in whatever type of car park should be placed at the closest point possible to the place they are intended to service. This is particularly important in pedestrianized town centres where, because of the distances involved, it may well be appropriate to make provision just for disabled motorists within the pedestrian area rather than on its periphery.

Increasingly, variable message signs (VMS) are being used to tell people whether there are spaces available in public car parks. It would be helpful if these signs could also show whether there are any spaces for disabled motorists available as well, as is done at Woluwe shopping centre in Brussels.

2.7 Longer road journeys

Although much emphasis is, and should be, placed on making the local road environment accessible and safe for disabled people, their needs on longer journeys should not be forgotten. The Federal Government in Germany, for example, has produced guidelines that should ensure that wheelchair users have unimpeded access to emergency telephones and that motorway service areas include parking spaces for disabled motorists and accessible facilities including toilets. Where motels are provided they should include rooms equipped for disabled people.

2.8 Summary

It is important, when considering how to improve the road and pedestrian environment, that the approach should be comprehensive. The reconstruction of Kralja Milana Street, one of the main streets in Belgrade, provides an example of this approach, with the provision of

non-slip pavement surfaces, removal of obstacles (including news stands and other street clutter), control of irregular car parking on pavements, provision of well-designed pedestrian crossings, tactile guidance and warning paths and improved street lighting.

NOTES

1. Footpaths are defined as pedestrian ways without a contiguous road, footways (or pavements) run alongside roads. Design standards will generally apply to both.

2. “Streets for everybody”, Swedish Association of Local Authorities (1993).

3. “Tactile footway surfaces for the blind”, TRL Contractor Report 257, TRL Crowthorne, UK (1991).

4. BILOS und Seine Effektivität, Report on a symposium held in Hamburg (1991).

5. “Inclusive Mobility. A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure”, Department for Transport, London (2002).

3. INFRASTRUCTURE

3.1 Introduction

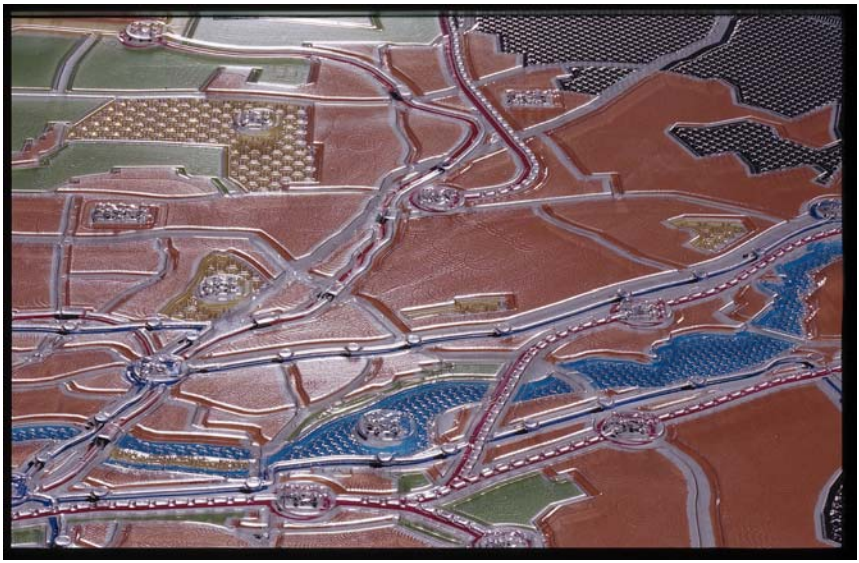
In Chapter 1, information on national and local transport services was discussed, but there is increasing provision of more localised information: guides and maps, for example, of town and city centres and of terminals and interchanges.

Kaiserslautern (Germany), for example, has produced a city guide, available in print and on-line which shows the accessibility of public buildings, health centres, leisure facilities, shops etc.

Redevelopment of existing transport infrastructure often results in significant changes in accessibility perhaps over a period of years, if the project is a major one. In Linz (Austria), the central railway station is being redeveloped as a principal interchange for regional and local public transport. In order to keep the public informed on the progress of the project a specific homepage has been designed which shows the current status. The homepage has also been designed for the needs of blind and partially-sighted people, so it can be read by screenreaders or via Braille-Lines.

Also in Austria, the city of Graz has provided very detailed tactile maps of the principal public transport interchange, which facilitate orientation in this fairly large place and helps blind people to find their way around the interchange.

Photo 5. **Tactile map at main rail station in Nuremberg**



Source: Courtesy of Verkehrs-Aktiengesellschaft (VAG), Germany.

3.2 Getting into the building

The physical location of transport infrastructure - bus stations, rail stations, etc. – varies enormously: ground level, below ground, above ground, one level, multi-level and so on.

The basic principles in designing access, however, remain the same whatever the specific physical characteristics of the building[1]. Expressed in a different way, a single step at the entrance to a station or a kerb without a ramp in the road outside can make the most carefully-designed terminal inaccessible to people with certain disabilities.

Ideally, doors should be avoided at the entrance to the station, but this is not always feasible, for example for reasons of climate. Where doors are needed they should be automatic, linked either to a weight sensor or sensors mounted above the door.

The clear width of the door(s) once open must be sufficient to allow easy access for anyone, including people in powered wheelchairs, walking with a helper or pushing a double-buggy. Recommendations on minimum width vary from one guideline to another, but to be on the safe side a clear width of 1 200 mm should be provided. Where double doors are installed each door should be a minimum of 800 mm (or preferably a little more - 830-900 mm) wide.

Glass doors must be marked with a brightly coloured banding at least 150 mm deep placed with the lower edge of the band between 1 400 and 1 600 mm above ground level. Glass should not be used below a height of 400 mm to avoid damage from pushchairs and wheelchairs. If revolving doors are used, there should always be an ordinary door as well. Many disabled people, including wheelchair users, find revolving doors difficult or even impossible to use.

Obviously the way into the building has to be fully accessible and step free. Where the height change between the pavement or road outside and the floor level of the station is comparatively small, a ramp (in addition to steps) will be adequate. The ramp should have a fairly shallow gradient, ideally about 1 in 20 certainly no steeper than 1 in 12. The maximum length between level landings, where a wheelchair user could rest to regain his or her breath, should ideally be no more than 6 m^2 and the ramp itself should be at least 2 000 mm wide, so that two wheelchair users can pass one another. The level landings should be at least 1 500 mm long. There should also be clear, level areas at the start and end of the ramp at least 1 500 mm long and to the full width of the ramp.

Ramps should be built with handrails on both sides, these being set at about 850 to 950 mm above the surface of the ramp. The handrail should be circular in cross-section and about 45 mm in diameter. If fixed to a wall there should be a clear space between rail and wall of 60 to 70 mm. A second lower handrail, set at 650-700 mm above the ramp surface, can be helpful for children and people of reduced stature. Where the ramp is open-sided a tapping rail or kerb for long cane users should be provided along each (open) side at a

height of 100 mm. This kerb can also act as a wheel deflector for wheelchair users.

Photo 6. **A clearly marked pedestrian way, with dropped kerbs, through a bus station**

Source: Courtesy of Cranfield University, Cranfield School of Management, United Kingdom.

Even where a ramp is provided, there should also be stairs. Some people, often those with arthritis and back pain, find it easier to climb stairs than to use a ramp. In designing any stairs, whether two steps or twenty, the same principles apply:

- All the steps in a flight should be uniform.
- The risers should be between 100 and 150 mm high; 130 mm is preferred.
- Treads should not be less than 300 mm deep and treated with a non-slip surface.
- Nosings (step edges) should be slightly rounded (6 mm radius) without any overhang and colour contrasted across the full width of the stair.
- Risers should be vertical.
- The minimum width between rails should be 1 200 mm.
- The maximum rise of a single flight of stairs should be 1 200 mm.
- Rest areas between flights of steps should be at least 1 300 mm long, preferably 1 500 – 1 800 mm.
- There should be a minimum of three steps in each flight.
- Handrails (dimensions similar to those mentioned above for ramps) should be provided preferably on both sides of the stairs and should extend at least 300 mm beyond the start and finish of the flight of steps, preferably 600 mm.
- Approaches to steps should have a tactile “warning surface” to alert blind and partially sighted people.

Open tread staircases should be avoided: some people feel unsafe on them and they are more difficult for visually impaired people to use.

Where there is a substantial difference in height between the pavement and the interior of the station or where space is limited a ramp may not be appropriate and a lift will have to be provided.

Photo 7. **Open tread stairs are a hazard for many disabled people and should not be used**

Source: Courtesy of Cranfield University, Cranfield School of Management, United Kingdom.

The size of the lift will obviously be dependant on the numbers of people expected to use it but there are minima which must apply if the lift is to be used by a wheelchair passenger.

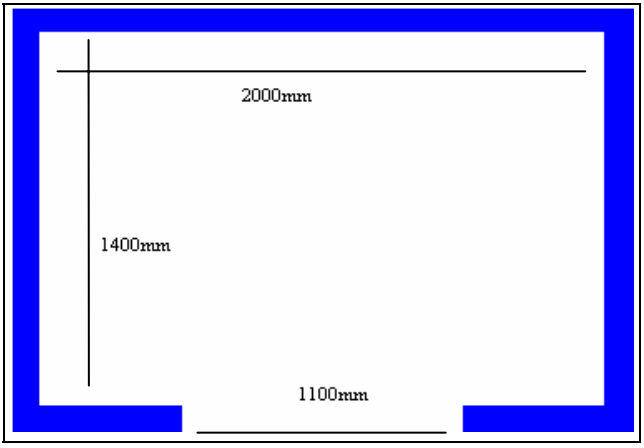
The European Lift Standard (April 2000) defines minimum internal dimensions measured between the structural lift car walls. The standard defines three sizes of lifts with internal dimensions ranging from 1 000 mm wide by 1 250 mm deep (accommodation for one wheelchair user) up to 2 000 mm wide by 1 400 mm deep (one wheelchair user plus several other passengers). These are minimum dimensions and, in fact, the smallest size would not accommodate a large wheelchair or one in which the occupant had to sit with his or her leg(s) stretched out horizontally. It is therefore recommended that where space permits the minimum depth should be 1 400 mm (preferably 1 500 – 1 800 mm) and the width should be at least 1 400 mm but preferably 2 000 mm, as shown in the diagram.

The European standard also gives a minimum door width of 900 mm and a clear internal height of 2 300 mm. The door itself

Photo 8. **Lift access to U-Bahn, Munich**

Source: Courtesy of Münchner Verkehrsgesellschaft mbH (MVG), Munich, Germany.

should have a height of 2 100 mm. The door width of 900 mm is acceptable when the lift has facing doors (a roll-through lift) but where there is only a single door this should be 1 100 mm wide.



The internal height of the lift should be 2 300 mm, 2 100 mm at the entrance door.

To allow easy access into and out of the lift there should be a clear space outside the door sufficient for a turning circle of 1 700 mm (minimum 1 500 mm).

The lift call buttons on the outside of the lift should be between 850 mm and 1 200 mm from the floor - similar dimensions should apply to the control buttons inside the lift. The buttons themselves should be at least 19 mm across their smallest dimension and protrude from the wall. Usual convention is for the emergency buttons (call and stop) to be at the bottom of the control panel.

To help visually impaired people, buttons should be labelled with raised characters in both Braille and text and, for all users, there should be a visual acknowledgement that a call has been registered and when it has been answered. Pre-recorded announcements of direction of travel of the lift and of the floors should be provided.

3.2.1 Escalators

These are not popular with some disabled people: they cannot be used by people with assistance dogs or, of course, wheelchair users, but others can and do use them. To make them safer and more user-friendly for ambulant disabled people the direction of travel should be clearly shown at the top and bottom of each flight using red and green signs. Lighting should be provided near to floor level with a visible change in lighting at the bottom and top of each flight and edges of the ‘steps’ should be clearly marked in a contrasting colour and tone.

The recommended widths for an escalator are between 600 and 1 100 mm, with step heights at a maximum of 240 mm or 210 mm if the escalator would be used as an emergency exit when stationary. The steps should form level areas at the top and bottom of the escalator of 2 000 mm and 1 600 mm respectively and there should be clear level space beyond both ends of the escalator of at least

2.5 m, substantially more in heavily trafficked places; London Underground, for example, uses a minimum of 10 m. The moving handhold on the escalator should be between 900 mm and 1 100 mm above the nose of the steps. It should be clearly contrasted and should move synchronously with the escalator. The recommended running speed for escalators is 0.5 m/second, except where the escalator covers a very substantial change in levels, in which case the speed may be increased to 0.65 m/second.

Approaches to the top and bottom of escalators should have a change of floor texture or tactile strip to alert blind and partially sighted people.

3.2.2 Travelators

These are helpful where there are long distances to be traversed but they should not be at a gradient of more than 1 in 8 (12%). The speed of movement should be kept low: 0.5 m/second is recommended. The width should be 1 500 mm and the moving handrails should be colour contrasted with their surroundings and extend approximately 700 mm beyond the beginning of the walkway. Travelators can be used by some wheelchair users but may pose more of a problem for people using walking aids or with an assistance dog, so a parallel passageway should be provided.

3.3 Moving within the building

The size and complexity of transport buildings varies enormously from small bus and rail stations to huge interchanges and international airports. Designs for the interiors of those buildings will reflect their size, complexity and the numbers of passengers using them, but there are some design guidelines that should apply whatever the size and type of terminal.

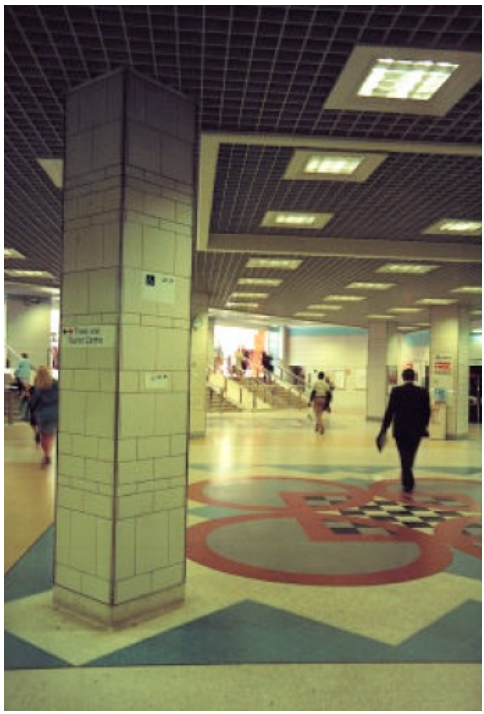
3.3.1 Wayfinding in buildings

It is difficult for people who are blind or partially sighted to find their way through buildings. Comprehensive clear signage will help some partially sighted people, but not those who have very limited

vision or who are blind. A system has been developed by the Royal National Institute for the Blind (RNIB) in the UK called InfraVoice to overcome this problem. InfraVoice signs are placed at junctions within a building to give information on what is ahead and to the left and right. The signs emit an infrared beam; when the user enters the beam the user automatically picks up a message on his or her personal receiver. The information, which can only be heard by the user, is similar in content to that which appears on visual signs, so enabling the user to find his or her way through the building.

The InfraVoice system has been installed at a number of locations in the UK and is being trialled at railway stations in Paris and Lyon. It can be used with the RNIB React system mentioned earlier (Section 2.5).

Photo 9. **Interiors with complex design schemes can be confusing for people with impaired vision**



Source: Courtesy of Cranfield University, Cranfield School of Management, United Kingdom.

Photo 10. **The Apex transmitter signals intention to board vehicle**

Source: Courtesy of Dopravni podnik hl.m.Prahy, a.s., Prague, Czech Republic.

In Prague a system called Apex has been developed that enables a passenger to activate audible information about approaching trams and buses by means of a specially designed transmitter. This system allows people to inform the driver that they intend to board the vehicle.

3.3.2 Pedestrian clearways

As a general principle, station furniture should be designed to minimise obstruction to the main pedestrian flows. Facilities such as telephones, vending machines, seating, litter bins, etc. should all be placed in such a way that, although easy to see and to reach, they do not obtrude into the pedestrian flow corridors.

At a minimum there should be a 2 000 mm pedestrian footway clear of all obstacles. It should include a directional tactile surface to help blind people (and appropriate warnings of any changes in level) and any station furniture or structural features such as columns supporting the roof in the vicinity must be in contrast (colour and tone) to their surroundings. If there are columns in the main pedestrian flow corridor, they should be marked with two horizontal bands 140 to 160 mm wide, preferably of alternative yellow and black stripes, with the lower band 800 mm from the ground and the upper one 1 600 mm. For secondary circulation spaces such as short passages to toilets, offices or service areas a reduced width (minimum

1 200 mm) may be acceptable. Footways should have a clear overhead height of 2 300 mm.

It is essential, particularly in the large complex buildings, that good directional signage is provided. It should be clear, easily visible and capable of being understood by passengers with intellectual disabilities**.**

3.3.3 Facilities and services

Buying a ticket

Where there is a ticket office it should:

- Have one position suitable for wheelchair users (and people of reduced stature) with a desk height of between 75 and 85 mm. There should be sufficient clear knee space below the counter for wheelchair users to come right up to the counter.

Photo 11. **Check-in facility for wheelchair users at Oslo airport**

Source: Courtesy of the Norwegian Association of the Disabled.

- All positions where there is a security screen between the ticket salesman and passenger should have an induction loop.
- Handrails along the queuing positions which passengers who find it difficult to stand can lean against.
- Counter tops should have a lighting level of 250 lux.

These guidelines also apply to information offices and desks.

Photo 12. **All operable parts of ticket machines must be reachable by wheelchair users**

Source: Courtesy of the Department for Transport, United Kingdom.

Many terminals, whether or not they have a ticket office, will have ticket machines. The scope for designing these so that they are awkward to use is immense and frequently used. As with ticket offices, designers should remember that wheelchair passengers will want to use the machines; therefore, none of the operating elements of the machine - push buttons, coin/note slots, ticket dispenser should be more than 1 200 mm from the ground.

Operating buttons should be at least 19-20 mm in diameter, protrude sufficiently to enable use by people who use palm pressure and contrast in colour from the face of the machine.

Tickets and change should be easy to retrieve for people who have limited manual dexterity.

Instructions on how to use the machine, and the process of actually using it, must be kept simple and clear. Ideally this should be just a three-stage process: choose ticket - tender fare - collect ticket (and change if any). To assist people with intellectual disabilities, the way to use the machine should be shown by symbols and illustrations. The face of the ticket machine should be well lit (200 lux).

The Swedish Consumers' Association (Sveriges Konsumentrad) has recently produced a comprehensive report on accessible service machines, which includes ticket machines. The report points out that it is often easy to eliminate design features which make the use of machines difficult or impossible for disabled people. Examples include poor lighting, a small display or font size and lack of contrast. The report goes on to suggest that it should be possible to standardise the basic features of ticket machines such as the design of the keypad, the location of various controls and the dialogue with the machine.

Many transport systems require tickets to be validated before the journey is started. Much the same principles apply to validation machines: they must be clearly identified and within reach of passengers in wheelchairs.

Where there are ticket barriers at least one gate should be available at all times for use by wheelchair passengers, people with guide dogs and others with heavy luggage or pushchairs. Ticket slots in barriers must be clearly visible.

There have been a number of recent developments in ticketing which are helpful for older and disabled people. In a number of places electronic “smart card” ticket systems are used (for example in Belfast, UK and Tampere, Finland) which can automatically provide different fares for a given journey (e.g. concessionary fares for disabled people, war veterans etc).

An interesting innovative system has been introduced by the public transport operator Translink (Northern Ireland) on its Easibus service in Bangor. For disabled and older people there is a travel club which they can join if they wish the bus driver to know what assistance they might need when using the Easibus. Each member of the club (which is free to join) receives a colour-coded card which, when shown to the driver, indicates the type of disability the holder has, e.g. orange card = walking difficultly, yellow card = sight difficulty etc).

3.3.4 Waiting for buses, trains, etc.

A lot of disabled and older people find standing for any length of time uncomfortable or even impossible, so providing seating at appropriate points throughout the terminal is very important. It is worth remembering that some of the distances people have to negotiate within a terminal are considerable. At Heathrow Airport interchange passengers may have to walk as far as 1.3 m between gate areas.

Research by Leeds University[3] found that only 40% of wheelchair users and 20% of ambulant disabled people using walking sticks could manage to walk 180 m without a rest. Quite large proportions of the ambulant disabled could not manage more than 60 to 70 m without a rest.

Therefore, as a general guide, seating should be located so that people don't have to walk more than about 50 to 60 m without the opportunity to sit down and rest for a moment.

There are a lot of different types of seating, some more suitable than others for people with different kinds of disability. There are five broad types of seat:

1. Perch-type seats against which passengers can lean or "half sit" for a short period of time. They require minimal maintenance, take up very little space and are attractive to some passengers with arthritis, stiff joints or back problems who find it difficult to get up from a low seat.

2. "Flip-up" seats, which also have the advantage of saving space and do not become wet when it rains.

3. The traditional wooden bench, with end (and possible intermediate) armrests, is more comfortable for sitting on for extended periods than either the perch-type or the "flip-up" seat. Wood is a relatively "warm" and non-slip surface which dries quickly and does not encourage vandalism.

4. Wire-mesh or perforated metal seats installed in rows fulfil largely the same role as the traditional bench. A brightly-coloured coating (possibly the provider's corporate colour scheme) helps visually impaired passengers and makes the seats less cold and slippery. Arms help passengers to get up from the seat.

5. For indoor waiting rooms where there is not a serious problem with vandals, a more expensive form of upholstered seating can be provided.

Seat heights should be about 450 to 480 mm (and not less than 420 mm) for conventional seating, about 550 to 600 mm for flip-up seats and about 700 to 800 mm for perch-type seats. If possible and space permits the three basic types of seating should all be provided. Whatever type of seating provided, sharp edges and corners should

be avoided, and for conventional seating, arm rests should be provided at a height of 200 mm above the seat.

Photo 13. **A simple bus shelter with seating in Grenoble**

Source: Courtesy of the Syndicat Mixte des Transports en Commun de l'agglomération grenobloise, Grenoble, France.

At terminals where passengers are likely to wait for quite a long time, enclosed waiting rooms should be provided. They should be heated/air conditioned, free of draughts but well-ventilated and have easy access doors. Most importantly, both visual and audible information should be relayed to all waiting rooms.

3.3.5 Refreshment facilities

Many terminals have restaurants, cafés and bars but not always designed with the needs of disabled people in mind. Key design criteria include:

- Gangways and spaces between tables sufficient to allow wheelchair access: 1 300 mm, if possible.
- Tables designed for wheelchair users with space under the table for adequate leg room – approximately 700 mm high, 500 mm deep and 600 mm wide. This means a table-top height of about 730 mm.
- Furniture, trays and crockery that contrast with their surroundings.

There seems to be an increase in refreshment rooms designed with fixed furniture - seats and tables. If designers really insist on doing this, some spaces must be left for wheelchair users to sit at a table.

3.3.6 Toilets

It is most important that terminals and stations and other transport - related buildings used by the public should have toilets for disabled people. These should be designed to accommodate people in wheelchairs. There are usually national building regulations which specify the design standards for toilets for disabled people, but there are common requirements:

- 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.

As a general rule toilets for disabled people should be no less available than ordinary toilets for able-bodied people.

3.3.7 Other infrastructure

The previous sections have dealt with relatively large and complex infrastructure, but there are other, smaller types of transport infrastructure that need to be designed carefully.

Bus and tram stops may be no more than a pole with a timetable board attached (sometimes not even that) but bearing in mind that people do have to wait at them, sometimes for more than just a minute or two, the following should be taken into account:

- Shelters to keep the worst of the weather off waiting passengers are helpful, but they should be designed so that people inside them can see the approaching bus or tram.

- They should be lit, or if that is not possible, situated in a well-lit area.

- Modern shelters often make use of glazed areas, which is good from the point of view of increasing ambient light in them, but can make them a hazard for people with impaired vision. Where glazing is used, a bold, brightly coloured band 140 to 160 mm wide should be placed on the glazing about 1 500 mm from the ground.

- Seating should be provided, ideally some at the conventional height (450 mm) and some perch seating (700 to 800 mm high - see Section 3.3.4).

- Timetable information should be provided at a height of between 1 000 mm and 1 700 mm from the ground - this really should be lit, if at all possible.

- To assist people with intellectual disabilities, timetables should make use of symbols and illustrations.

Whether or not a shelter is provided, timetable information should be given perhaps on the pole which also has the bus or tram stop flag. The flag itself should contain the route numbers of the services using the stop in clear bold numbers on a contrasting background (black on white or dark blue on yellow). The numbers should be at least 50 m high and the flag itself should be a minimum of 450 mm wide by 400 mm high. The bottom of the flag should be no lower (but not much higher) than 2 500 mm from ground level. If services using the stop are fully accessible, the international wheelchair symbol can be used on the timetable information.

3.4 Boarding the vehicle

3.4.1 Bridging the gap

The previous sections have discussed ways in which it is possible to improve a journey through rail, bus stations and other termini. Before moving on to consider the vehicles themselves, there is the matter of bridging the gap between the platform or pavement and the vehicle itself.

For able-bodied people a step up or across, say from platform to train is, at worst, a mild inconvenience: a slightly greater inconvenience if encumbered with heavy luggage but still not too difficult. For a person who can only walk with difficulty or who uses a wheelchair a relatively small gap may simply be non-negotiable. For a person who is visually-impaired it may be dangerous.

Research has shown that virtually all ambulant disabled people can manage a step height of 200 mm[4]. However, particularly when boarding a heavy rail vehicle, there is a horizontal gap that has to be negotiated as well as the vertical step. Recent research for the UK Department for Transport[5] found that the step height and gap width when added together should not exceed 200 mm. While keeping to this dimension helps people with walking difficulties it is much too large to be negotiated by a wheelchair user without assistance. Research for the design of the South Yorkshire Supertram[6] showed that the maximum horizontal gap possible for wheelchair users was 45 mm and the maximum vertical gap was 20 mm.

In an ideal system the design should be such that the interface between the platform and the boarding/alighting point on the vehicle - whether bus, tram or train - meets this standard. In practice this is often not possible though there is no reason why it should not be achieved in newly-built systems.

Photo 14. **Direct train/platform access for wheelchair users**

Source: Courtesy of the Department for Transport, United Kingdom.

An increasing number of bus stops are being built as raised bus boarders - raised to the height of the entrance of the bus when the (air) suspension is knelt - usually about 240 to 250 mm. For example, in Euskirchen and Hürth (Germany) kerbs at many bus stops have been raised to 240 mm, while in Dresden they have been raised to 230 mm, which give virtually step-free access onto the vehicle. In Mâcon (France), kerbs at bus stops are raised to 210 mm, giving a horizontal gap of 200 mm (maximum) and a vertical gap of 110 mm. Provided the bus is able to draw up close and parallel to the bus boarder, a wheelchair user will be able to board or alight without assistance. A common problem which prevents this is the existence of cars parked at or close to the stop. This can be overcome by using cape-type bus stops, but these are still few and far between and for other reasons, such as interference with general traffic flow, may not always be appropriate.

The alternative then is to provide a ramp to bridge the gap between bus (or tram/light rapid transit). A raised boarding platform is still an advantage when a ramp is used because it reduces the gradient. Research in 1999[7] suggested that the maximum gradient for a short ramp of this kind - about one metre in length - should not be more than 1 in 11 (9%) for self-propelling wheelchair users. Powered wheelchair users can manage steeper gradients: 1 in 6 (17%) is generally acceptable. The report prepared by COST 322 recommends a gradient of 13% up to a ramp length of one metre, but this may be too steep for manual wheelchair users unless they have assistance. More recent UK standards recommend a maximum of 1 in 10 (10%) for ramps up to 600 mm in length.

There are various types of ramp, in ascending order of cost:

- Manual demountable: carried on the bus and put in position when required.
- Manual: usually a “book leaf” type which is folded out by the driver or attendant.
- Powered: electro-mechanical.

The decision on which type should be used will depend on the amount of use expected as well as the cost. Manual ramps will only be appropriate for lightly used bus services; for those with heavier use and for rail-based vehicles powered ramps should be provided.

One consequence of the use of a ramp is that there must be sufficient space on the boarding area to allow the ramp to be fully extended and for the wheelchair users to manoeuvre onto or off the end of it. A minimum space (width) of 2.5 m is recommended.

The newest light rail rolling stock operated by the Swiss Federal Railways is fitted with GPS-controlled sliding steps. This system enables the steps to be adjusted to the relative platform height/distance from the vehicle at each station, thus minimising the train-platform gap.

Enabling wheelchair users to board buses and trains is perhaps the most obvious feature of local transport accessibility, but the needs of blind and partially sighted people must also be taken into account. Their difficulties are not, generally, physical access but relate to actually identifying the vehicle and finding the vehicle door. In Mâcon, distinctive paving stones are placed on the boarding area at the location of the forward door of the bus. In Prague, a sophisticated acoustic system (APEX) has been developed for blind people, which enables them to identify, when a bus or a train is approaching, which service it is (route and destination) and to inform the driver, if they wish to board the vehicle.

3.4.2 Heavy rail

The vertical gaps between buses, light rapid transit and their platforms are usually quite small, but this does not apply to some heavy rail systems. In the UK and Ireland railway station platforms have generally been built to a greater height than elsewhere in Europe and it is possible to provide wheelchair access by means of a portable ramp. Use of it does, of course, require the presence of station or on-train staff who can deploy the ramp. Where staff are known to be present there is no reason why a disabled traveller should need to give advance notice of his or her journey. However, where stations are either unstaffed or only staffed part of the time, advance notice of the need for assistance will be necessary.

Elsewhere in Europe the vertical distance platform to rail carriage is often too great for a ramp to be used. A number of train operators now use mobile platform lifts - for example at French, Dutch, Austrian, Italian and Swiss stations. Prototype train-mounted lifts have been developed and tested, notably in the Netherlands and in the longer term this method may be preferable to station-based lifts. The Swiss and Austrian lifts, for example, are hand operated and can deal with a height difference of 1.5 m but, as the Helios[8] report noted, the use of the lift is “a little scary for passengers with vertigo”. Further examples of provision for wheelchair access to trains are provided under the SJ Swedish State Railways programme for measures to assist disabled people, including both platform and train-based lifts.[9] In Germany

Deutsche Bahn AG is working on the design of a train-based boarding aid and some local and regional train carriages are now fitted with these boarding aids. In Hofheim, for example, the Rhein-Main-Verkehrsverbund has modified 37 train carriages with lifts and toilets for disabled travellers. In France, an on-board lift is the subject of current research, including the feasibility of fitting lifts into existing trains. It is expected that new trains will have on-board lifts fitted *ab initio*.

In Italy, the national rail operator (Trenitalia) has recently introduced a mobile electric vehicle, rather like a golf buggy, which incorporates a lift for wheelchair passengers. The vehicle has two ordinary seats (one for the driver and the other for a passenger) together with a special platform for the wheelchair user. There is also space for luggage. The platform is employed as a lift, with a maximum rise of 1 100 mm, to enable the wheelchair passenger to board the train. The vehicle has been tested at Rome Termini Station, and it is expected to be put into operation at other main stations in the Italian rail network by the end of 2006.

Some organizations representing disabled people believe that only on-train solutions can offer satisfactory access in the long term. However, an extensive review of access to rail vehicles (light and heavy rail) carried out in Germany concluded that there is no long-term viable alternative for regional services to gradually adapting (raising) platform heights and lowering vehicle floor heights in conjunction with automatic gap-bridging devices (attached to the vehicle) or platform ramps. It is worth mentioning that this study found that the cost of a lift fitted to the rail vehicle was approximately five times that of one fitted on the platform (€20 000 versus €4 100). Netherlands rail services have also experimented with train-installed lifts, but again have found that although useful for wheelchair users they are expensive. However, Finland rail services have used train mounted lifts for a considerable time and there they are considered to be a viable system. In the Netherlands it has been decided to use a uniform height of 84 cm from the top of the rail for all new rail platforms. Consideration is being given to bringing existing platforms up to this level along the busiest rail corridors. Whether the access

means used is a lift on the train or a mobile ramp, safety concerns require that they should be operated by railway staff, where there are significant vertical or horizontal gaps.

Photo 15. **Trenitalia wheelchair lift for rail passengers**

Source: Courtesy of Soc. Trenitalia – BU Passeggeri Nazionale ed Internazionale – Assistenza (clienti disabili), Rome, Italy.

3.4.3 Getting onto aircraft

Airports are designed with the need for easy movement by wheeled luggage trolleys and so are generally convenient for wheelchair passengers to move around, but problems can arise when it comes to boarding the aircraft.

At larger airports, with medium size or bigger aircraft, access from gateroom to the aircraft is by jetty which will be step-free: the problem arises with smaller aircraft or where there is no jetty system. However, there are stair-climber devices available to help people who are

unable to manage steps. The AAT system, which is in use at Stansted and Glasgow (UK) airports, enables a user to sit on the seat (or transfer to it from their wheelchair): attendants can then move them up or down the steps to and from the aircraft.

An alternative to this is a “bus” which raises itself to the height of the plane door; examples are at Paris Charles de Gaulle airport and at Washington Dulles.

A further alternative for access to smaller (commuter) type aircraft is the use of a low-level loading bridge of the type developed in Canada and suitable for use with aircraft such as Dash 8’s, SAAB 340’s and BAe 146’s. The loading bridge, which would be used by all passengers, is electrically operated, provides smooth step-free access and has contrasting lighting to assist visually impaired passengers.

3.4.4 Other features

On all rail platforms, there must be a tactile warning strip laid parallel to the edge of the platform with a width of 400 mm and set back at least 500 mm (preferably 600-700 mm) from the platform edge. The edge of the platform should also be clearly marked with a contrasting colour, usually white or yellow.

The surface of the platform should be non-slip and should not have a cross-fall greater than that needed to ensure good drainage (usually 1:30 or 1:40). That slope should be away from the tram or train in order to avoid accidental rolling of wheelchairs or prams onto the rails[10].

Many platforms, whether for trams, trains or buses, will have other furniture on them. Where this is the case, furniture such as ticket machines, litterbins, seating should be placed so as to leave an unobstructed area of two metres width along the boarding edge of the platform. If the platform is open and raised, it should have railings or fencing of some kind along its rear edge and this should include a kerb or “kicking board” which can help long-care users. This board

should be 150 mm in depth with the top of it 200 mm above the platform surface.

Large and complex platforms should include a tactile map at their entrance (as on some stations on the Brussels metro) which blind people can use to orientate themselves.

A good level of lighting should be provided on boarding areas and elsewhere in stations and terminals. Based on the recommendations of COST 335 the following levels should be provided:

Platform:	optimum 100 lux; standard 50 lux; minimum 20 lux
Stairs:	standard 120 lux (more intense at beginning and end)
Ramps:	standard 50 lux; 100 lux at beginning and end (possibly adapted to surroundings)
Underpass:	optimum 100 lux; standard 50 lux
Station Environment:	optimum 100 lux; standard 50 lux; minimum 20 lux (e.g. car drop-off zone).

Good lighting, apart from being essential for people with low vision, also gives a greater feeling of personal security for all passengers. It should be designed to obviate any dark areas or corners and with gradual transition from light to less light areas. Wherever possible, buildings should be designed to make maximum use of natural lighting, though care should be taken to minimise glare and strong reflections off surfaces.

Maintenance of the infrastructure is important. Lighting should be kept in full working order, pedestrian surfaces including tactile paving should be kept in good condition, otherwise the value of the provisions to assist disabled people will be diminished.

Photo 16. **Tactile information wall panel, Brussels**

Source: Courtesy of Société des Transports Intercommunaux de Bruxelles (STIB), Belgium.

NOTES

1. There are a number of publications which provide detailed guidance on the design of accessible buildings related to transport. These include:

   "Barrierefreier ÖPNV in Deutschland", Verband Deutscher Verkehrsunternchmen (April 2003).

   "Inclusive Mobility. A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure", Philip R Oxley, Mobility and Inclusion Unit, Department for Transport UK (2002).

2. There is some variation between countries on this distance. In France and Sweden, the recommended maximum is 10 m; in the USA, it is 12 m for a 1 in 20 gradient, 9 m if the gradient is steeper. The Netherlands railway station standard is a maximum 8 m for a 1 in 16 gradient, while the recommended maximum by the German Federal Ministry of Transport is 6 m.

3. "Ergonomic standards for disabled people in pedestrian areas: results from Leeds observation work 1988/89", Transport Research Laboratory Working Paper, TRL, Crowthorne, UK (July 1989).

4. Flores JL, and Minaire P, "Epidémiologie du handicap: étude fonctionnelle d'une population", LESCO, INRETS, Lyon, 1986 and also Oxley PR, and Benwell M, "An experimental study of the use of buses by elderly and disabled people", Transport Research Report 33, TRL, Crowthorne, UK (1985).

5. "Significant Steps – Summary", Department for Transport, London (2004).

6. Fowkes A, Gallon C and Oxley P.R., "Supertram Ergonomic Study", Cranfield University 1992.

7. Oxley PR, Alexander J, Barham P and Wood N. "Phase II Study for Mobility", Cranfield University (1999).

8. "The Design and Operation of Accessible Public Transport Systems", HELIOS Report (November 1996).

9. See COST 335 "Passengers' accessibility of heavy rail systems" (p. 123), Brussels (October 1997).

10. See P79, "Principles for Travel Centre Design", Ministry of Transport and Communications, Finland (1997).

4. VEHICLES

Although private car ownership and use is increasing among all sectors of the population, it tends to be below average for disabled and older people. Thus the provision of accessible public transport vehicles is of particular importance to people in these groups.

Many countries have produced detailed regulations and guidelines on the design of accessible public transport vehicles: examples of these are quoted in the following sections of this chapter and in the References. For some modes there are European Commission Directives which, inter alia, set standards for accessible design and there are also detailed design guidelines prepared under the EC's COST initiative, which include low-floor buses, coaches and trains.

The CEN/CENELEC Workshop 16 has recently (2004) published a report on the design of accessible public transport systems which covers all collective transport[1]. It is intended to provide guidance to writers of relevant standards relating to collective transport on how to take account of all passengers with reduced mobility, especially older people and people with disabilities. The scope of the guidance is broad, covering transport-related infrastructure as well as the vehicles themselves.

The detailed means by which public transport can be made fully accessible will obviously vary depending on the type of vehicle – bus, coach, rail carriage etc – which is being considered. However, there are some issues which apply to all types, particularly measures needed to ensure that people with learning or cognitive difficulties can use these transport services. The key areas include communication of information both before and during journeys; clear unambiguous

signage both in vehicles and at stations, terminals etc; simple instructions on the use of equipment such as ticket machines; travel training for people with learning or cognitive difficulties and training for staff in how to communicate with, and offer appropriate help to people with these disabilities.

There are a number of sources of information and guidance on how to make transport services usable by people with cognitive impairments. These include papers produced by Inclusion Europe[2], the European Commission's MAPLE project[3], UNAPEI[4], Mental Health Europe[5], Mencap[6] and the Disability Rights Commission[7].

4.1 Buses and Coaches

For many people with limited access to a private car, buses are usually the most frequently used mode of public transport. Many countries have been progressively improving the design of buses for many years; initially with changes intended to help ambulant disabled people, subsequently (in some countries) with designs that enable people in wheelchairs to use them.

In Germany, for example, over 80% of all buses ordered by the members of the Association of German Transport Operators are low-floor, usually with a kneeling device and a ramp. In Greece, low-floor trolley buses have been ordered for the Athens area. The UK legislation is in place to require all new buses and coaches to be accessible. In London all buses are now low-floor wheelchair accessible vehicles since early 2006.

It is worth distinguishing between buses and coaches because the basic designs of these vehicles are rather different and therefore have implications for the methods by which full accessibility can be achieved. It is also sensible to distinguish between design guidelines that assist ambulant disabled and sensory-impaired people and those that make wheelchair access possible.

The essential difference between buses and coaches is the floor height. Even quite old designs of buses did not have floor heights

more than about three-quarters of a metre, while coaches, especially those used for holiday tours and excursions have floor levels well in excess of one metre.

Photo 17. **Ramp access to a bus in Grenoble**

Source: Courtesy of the Syndicat Mixte des Transports en Commun de l'agglomération grenobloise (SMTC), Grenoble, France.

Modern designs for buses used on local and some inter-urban services have become progressively lower until the point has been reached at which it is possible to board with just one step and for a substantial part of the interior then to be step free. In turn this means that it is then possible, with the use of a small ramp at a comparatively shallow gradient, for a wheelchair passenger to board the vehicle.[8]

Because of the high floor of modern coaches, ramped access is not practical. Access for wheelchair users has to be by lift, which has implications for both vehicle design and costs.

The EC initiative, COST 349, has recently completed (October 2005) its research into the design of wheelchair accessible coaches.

In addition to reviewing conventional lift-equipped coaches, COST 349 also examined some innovative designs. One of these (Wrightbus, N.I.) has a low-floor section at the front end of the vehicle, by the driver, where there is wheelchair space with a few passenger seats just one step up. This area, because it is low-floor, can be accessed by a ramp. Prototype vehicles have been trialled in service in Northern Ireland since late 2004.

Photo 18. **Manual ramp on a low-floor bus**

Source: Courtesy of Bernmobil, Bern, Switzerland.

Alternative designs, in which a wheelchair lift is provided at the front entrance of the vehicle are now in production. Although there are relatively few accessible coach services in operation at the moment, there are such services operating in Sweden where the coaches carry goods as well as passengers, in Spain (Badajoz-Alicante) and in the UK (Bath-Heathrow-London). Badajoz has also introduced (in July 2000) what is believed to be the first scheduled international accessible service between Badajoz and Evora in Portugal.

The Bus and Coach Directive (2001/85/EC) which came into force in Member States in August 2003, requires that new urban buses (Class I) should be fully accessible, though the date from which that will apply is a matter for each member country.

Until new buses which are compliant with the Directive are acquired, features that can be implemented to improve access to non-accessible buses include the measures set out below (4.1.1). The following sub-section (4.1.2) outlines the design requirements for buses that are fully (wheelchair) accessible.

4.1.1 Measures to assist ambulant disabled people

For people with impaired sight:

- Clear marking of the edge of any steps (contrasting band on leading edge of step).
- Colour contrasted hand rails and stanchions.
- Colour contrasted bell pushes.
- Audible announcements (of next step, terminus, etc.).
- Audible announcements at bus stops of service number/destination of the next bus (see 3.3.1).
- Adequate space in the priority seating for guide dogs.

For ambulant disabled people:

- Any interior steps to be between 120 mm and 200 mm and all of the same height (± 10 mm).
- Gangway width to be a minimum of 450 mm (preferably 550 mm as recommended by the French organization COLITRAH (now COLIAC)) up to a height of 900 mm above the floor increasing to a width of 550 mm at a height of 1 400 mm above the floor.

- Stanchions / handrails to be at intervals of no more than 1 050 mm apart down the length of the bus (COLITRAH (COLIAC) recommends a minimum of 1 000 mm).
- Bell pushes within reach of a seated passenger (1 200-1 400 mm above the floor).
- Priority seating with a minimum clear space of 650 mm (720 mm is recommended by VDV in Germany); this gives sufficient space for people with stiff legs to get in and out and sit down easily.
- Compulsory kneeling of low-floor vehicles at all stops, as, for example, in Munster (Germany).

For hearing impaired people:

- Visual display “bus stopping”.
- Visual display of name of next stop.

In general, all surfaces should be slip resistant and all entrances and exits should be well lit and have appropriately placed hand rails.

Photo 19. **Colour contrasts in bus interior**

Source: Courtesy of Department for Transport, United Kingdom.

4.1.2 Measures to assist wheelchair users

- Minimum gangway width from entrance to wheelchair space of 750 mm, preferably 800 mm or more (see also 4.1.1).
- A wheelchair space, clearly marked as such, with a flat surface without obstacles and with minimum dimensions of 1 300 mm x 750 mm as well as space to manoeuvre.
- It is safer for the wheelchair passenger to sit with his or her back to the direction of travel; there should be a back rest (from 350 mm to 1 400 mm in height, 300 mm wide) against which the wheelchair can rest, a horizontal rail at a height of 850 mm -1 000 mm to one side of the space and a bell push within easy reach. On the gangway side there should be a device (for example a stanchion) to prevent the wheelchair swinging into the gangway.
- The general consensus is that on low-floor buses, there is no need for the wheelchair and occupant to be secured.

4.1.3 High floor coaches

Unlike low-floor buses, where a wheelchair passenger can wheel directly in from the boarding area, access onto a high-floor single-deck coach has to be by lift. There are some double-deck coaches, for example those used in Sweden, where access to the lower deck can be by ramp.

Where a lift is used, it should be integral with the coach. A possible alternative to an integral lift is a stair climber, though the usual step configuration at coach entrances makes this a difficult option to design in to a coach. Using a stair climber would mean that the wheelchair passenger would have to transfer to a boarding chair (similar to that used on aircraft and some trains) to get to a seat. The integral lift can be designed so that the passenger travels in his or her own wheelchair, which is an advantage for some who find transferring difficult or painful. The US evaluation[9] of these systems show, however, that the integral lift is the most expensive option.

Photo 20. **Access onto a high-floor coach is possible with an on-board lift**

Source: Courtesy of Department for Transport, United Kingdom.

As mentioned earlier (Section 4.1) the COST 349 initiative will provide further and detailed guidance on wheelchair accessible coaches and their associated infrastructure. The draft report contains recommendations on:

1. Vehicle features, including entrances and exits, seating, wheelchair access, handrails and handholds, lighting and information on the coach.

2. Infrastructure, including the design of coach/bus stops, stations and interchanges, facilities at stops and stations, security, lighting and guidance on the use of access audits.

3. Information for passengers both before and during the journey and training requirements for operators' staff.

4. Costs and benefits of providing fully accessible coaches.

Photo 21. **High-floor coach with ramp access to low-floor area**

Source: Courtesy of the Ministerie van Verkeer en Waterstaat, The Netherlands.

4.2 Taxis

Taxis can provide a vital link in the transport chain for the disabled and older traveller. The ECMT and the International Road Transport Union (IRU) launched a joint project on Improving Access to Taxis in

2005 to explore together with industry the different aspects of accessible taxis and their design. This work follows up to their earlier joint study, published in 2001, on the economics of operating accessible taxis[10].

The 2001 report recognised that there was no single universal solution to designing an accessible taxi, but, because this mode is very important for many disabled people, vehicle manufacturers should be encouraged by governments to address accessibility in the design of all taxis. Regional and local authorities should be encouraged to secure the provision of accessible taxi services in their areas and to consider whether there might be justification for direct or indirect subsidies to enable disabled people to use them where there is no accessible alternative.

Whether the decision is to have all taxis fully accessible or only a proportion, it should be possible to define some design standards which when applied will ensure that whatever the type of vehicle, it will meet requirements for wheelchair access and for easy use by other disabled people.

Various different strategies have been adopted by European countries in the development of accessible taxis but they can be broadly divided into two groups:

i. A proportion of the taxi fleet is made fully accessible, usually by the use of minivan-based vehicles, with the remainder of the fleet being ordinary saloon cars (e.g. in Finland).

ii. Requiring that all taxis, whether purpose-built or based on minivans or multi-purpose vehicles should become, in due course, fully accessible (as in the UK).

A number of research studies on the design of accessible taxis have been undertaken, the most recent being work commissioned by the UK Department for Transport[11]. Key findings from this research include:

1. Doorways through which a wheelchair passenger can enter: minimum 1 595 mm high and 850 mm wide.

2. A step height of 100 mm.

3. Ramps of no more than 1 000 mm length, giving a gradient of no more than 7% (approx.1 in 14), ideally 5% (1 in 20).

4. Minimum unobstructed space for a wheelchair passenger in a side entry taxi of 1 300 mm wide by 1 340 mm long.

5. Minimum roof height of 1 625 mm.

6. All taxis to have a powered swivel seat (particularly helpful for older people with arthritis or similar conditions who find it difficult to get into a fixed seat).

7. Seat heights in the range 430 mm to 460 mm.

There are a number of other requirements including colour contrasted hand holds, positions and dimensions of grab handles and lighting levels.

In Spain, the C.E.A.P.A.T. technical guidelines also include a recommended 1 350 mm minimum height and 800 mm width for access to a taxi and a space 1 200 mm x 700 mm (800 mm, if possible) with headroom of 1 400 mm for the wheelchair space. Thus it can be seen that there is already some degree of agreement between countries on minimum acceptable standards for taxis.

There are some good examples of accessible taxis based on conversions of small vans, for example, Fiat Scudo in Spain, but in most places in most countries good examples of fully accessible taxis are few and far between. Passenger safety for wheelchair users must also be considered. Unlike low-floor buses, where it may not be judged necessary to secure passenger and wheelchair, it is essential to do this in taxis. It is also most important that wheelchair passengers should travel facing either forwards or backwards but never sideways. Training in disability awareness is very important in order to ensure

that disabled passengers are correctly seated and carried in safety. Training is discussed in Section 7.4.

Photo 22. **Taxis can be designed or modified to carry wheelchair passengers**

Source: Courtesy of Department for Transport, United Kingdom.

4.3 Trams and light rail

Trams are operated in many continental European cities. Some are still of the traditional relatively high floor design, not easily used by ambulant disabled people and completely inaccessible to wheelchair users. However, they are gradually being replaced by modern designs, for example, those developed in Germany (where about half of cities and towns with trams have low-floor vehicles) and in France.

Ultra-low floor trams have been developed (e.g. in France, the Tramway Saint-Denis-Bobigny and the Tram Val-de-Seine) which provide wheelchair access without ramps or lifts, but low floor versions usually do require a boarding aid. The tram system in Grenoble, France, uses vehicles with a (minimum) floor height of 350 mm and with ramp access available at the centre door. The new train system in Dublin (LUAS) provides level boarding with a minimum gap at the platform edge. Each vehicle has two designated wheelchair spaces and a further eight seats designated for mobility impaired people.

Light rail or light rapid transit represents a half-way house between tram and traditional heavy rail. It is normally built to the same gauge as heavy rail but with lighter vehicles and much more frequent stops. The majority of these systems are comparatively recent and generally provide good levels of access for all disabled people including wheelchair users. As they are usually built with dedicated infrastructure (boarding platforms) there is no reason why they should not permit direct access for wheelchair passengers without the need to use a ramp. New light rail vehicles in Hannover have an automatic adjustment of their floor height according to their loading, which minimises the difference between platform and vehicle floor level.

Aside from the question of access, other requirements for the design of trams and light rail are really similar to those for buses: adequate gangway widths, space allocated for wheelchair passengers, colour contrasted handrails and step edges, audible and visual information. Doors should be clearly contrasted by colour from the rest of the vehicle so that passengers who are partially-sighted can locate them without difficulty.

The requirement needed by some tram and light rail vehicles (and some buses) is a press-button on the outside of the vehicle, which when pressed opens the doors. This should be placed at 90 mm from platform height, raised from the surrounding area and should be illuminated. It should be large enough to be pressed by the palm of the hand (i.e. about 20 mm diameter).

As trams have a longer operational life than buses, it may be worthwhile considering modifying existing high-floor vehicles with a central low-floor section. This has been done in several places in Germany (including Nuremberg, Mulheim and Cottbus), giving vehicles a low-floor proportion of 15 to 30%, so that disabled passengers can board and alight at least through one door. In Hannover, several of their older vehicles have been rebuilt with a wheelchair-accessible centre entrance. These vehicles are marked on the outside to distinguish them from vehicles that have not been rebuilt. Another way of achieving access more quickly is to construct low-floor trams which can be coupled to non-convertible power cars, as has been done in Berlin.

Other innovative rail or tracked systems, for example, monorail and guided bus systems, should also be designed to give full access for disabled and older people including wheelchair users.

4.4 Heavy rail

Many of the design requirements for heavy rail are similar to those for light rail, but because some journeys made on heavy rail will be long, there are some additional requirements.

Perhaps the most important of these, aside of course from providing adequate space in carriages for wheelchair passengers, are accessible toilets.

These should be located close to the wheelchair position (and to any priority seating) and should be designed for ease of use by all disabled passengers. Thought should be given not just to the interior layout and facilities, but also to the approach to the toilet, making sure that there is sufficient space for a wheelchair to manoeuvre to and into the toilet area. The Helios report[12] noted that the accessible toilets on Austrian inter-city trains were somewhat difficult for a wheelchair user to negotiate because of a narrow corridor (1 080 mm) and poorly positioned seating in the approach area to the toilet.

There are various ways of designing the layout of an accessible toilet, but the following[13] items and standards should be followed:

- The doorway into the toilet cubicle should be at least 900 mm wide.
- There should be sufficient space inside for a wheelchair to be positioned in front of the lavatory or to one side of it so that it is possible for a disabled person to move from wheelchair to the lavatory seat from the front or the side.
- The surface of the lavatory seat when lowered should be not less than 475 mm and not more than 485 mm above floor level.
- The toilet cubicle should have facilities to enable a person in a wheelchair to wash and dry his or her hands without moving from the seat of the lavatory.
- There should be two control devices to enable a disabled person to communicate in an emergency with train staff, one placed no more than 450 mm above the floor, the other placed between 800 mm and 1 200 mm above the floor.
- There must be adequate hand holds and hand rails, including a hinged handrail at the side of the lavatory where the wheelchair space is.

There are a number of examples of new rail vehicles with well designed fully accessible toilets, as for example the German ICE rolling stock and the Pendolino trains recently introduced in the UK. In Switzerland, the operating elements panel of toilets in trains (flushing, water, soap dispenser, air dryer) have been standardised in all trains so that blind and partially sighted passengers can find and use them more easily.

Further information on access to rail services is contained in the proceedings of the COST 335 Seminar (referenced earlier) which includes a section on rail rolling stock design.

Photo 23. **Wheelchair accessible train toilet**

Source: Courtesy of FLIRT S-Bahn, Germany.

Many countries have set national standards for access to their rail services and related infrastructure. A good example of this is the Dutch Standard Station Complex Accessibility (see References, Section 3), which sets out in considerable detail the design requirements that should be met to give disabled people access to rail services. The corollary to this is that disabled people need to be made aware of the improvements - see Section 1.7.

In 2003, Deutsche Bahn AG introduced its 'Services for Mobility Impaired Passengers'. These include a Customer Service Centre for disability matters. Deutsche Bahn's aim is to optimise travel conditions for disabled people on all journeys, including specifying accessible vehicle designs, barrier-free stations, introducing staff training and

providing appropriate information. Portuguese Railways have recently created a new post, the Ombudsman; an official appointed to hear complaints from passengers with disabilities, to support them and to provide them with any help they may need.

4.5 Aircraft

Travel by air has increased more than any other form of public transport and seems likely to continue to do so. It is important therefore to ensure that disabled people are able to use aircraft.

The European Civil Aviation Conference (ECAC) has made recommendations concerning fittings within new-build aircraft to serve the needs of disabled people[14]:

- All aircraft with 60 seats or more must carry an on-board wheelchair.
- In aircraft with 30 or more seats, at least 50% of all aisle seats have to be equipped with moveable arm rests in order to make them accessible for people with reduced mobility.
- Wide-bodied aircraft with more than one aisle must be equipped with at least one spacious lavatory for the special needs of people with reduced mobility, (DPTAC in the UK has produced design guidelines for aircraft toilets).
- Aircraft with 100 or more seats must be equipped in a way that at least one foldable wheelchair can be stowed inside the passenger cabin.
- Aircraft with 60 or more seats with a special lavatory for people with reduced mobility must carry one on-board wheelchair all the time.
- Aircraft with 60 or more seats not yet equipped with a lavatory for people with reduced mobility have to carry an on-board wheelchair when such a passenger applies for it at least 48 hours before departure.

Photo 24. **Specially designed wheelchairs can be used to assist passengers on vehicles with narrow gangways, including aircraft**

Source: Courtesy of the Canadian Transportation Agency.

These requirements are very similar to those adopted under the US Air Carrier Access Act, 1989 and the regulations set out in the Canadian Code of Practice (1997).

It should also be noted that many other design requirements on aircraft are no different to those that apply to other vehicles. Thus floor surfaces should be glare-free and slip-resistant, handrails on integrated boarding stairs should be sturdy, rounded and slip-resistant as should grab rails in toilets.

The air carrier should also provide large print and Braille supplemental passenger briefing cards on an aircraft that includes a recommendation that passengers make sure they receive a personal briefing. Where a video film is used for safety or information purposes, it should include signing for passengers with impaired hearing. As far as possible, all information relating to emergency procedures should be intelligible to people with learning disabilities. The Code of Practice, prepared by the UK Department for Transport recommends that, subject to national regulations, assistance dogs should be permitted to travel in the passenger cabin at no extra charge[15].

4.6 Ferries and ships

Ferries and ships operating on inland waterways are an important link in the travel chain in some countries. Many vessels are large enough to have the facilities such as toilets, restaurants, etc., found at land-based transport terminals, and these facilities should be accessible to all passengers including wheelchair users. Where vessels operate in tidal waters care should be taken to ensure that slopes on access gangways do not become too steep for wheelchair users as tides ebb and flow. The gangways should wherever possible conform with the general requirements for ramps, as described in Section 3.1.

For the purpose of safety, new passenger ships should be designed in such a way that there is barrier free passage for older and disabled people in public areas on board and in escape routes to muster stations.

The International Maritime Organisation (IMO) has produced recommendations on the design and operation of passenger ships to meet the needs of older and disabled passengers[16]. Many of the

requirements are similar to those found in other transport systems, including wheelchair-accessible toilets and cabins, clear signage, slip-resistant surfaces, etc. Where vehicles are carried, the IMO recommends that there should be barrier-free access from the parking area to the passenger facilities, which will often require an elevator. The IMO also recommends that at least one place per 100 passengers carried should be reserved for a wheelchair user who wishes to travel in his or her wheelchair, and that 4% of the ship's passenger seats should be suitable for disabled people.

Ferries and other ships, like heavy rail rolling stock, have a long life: 30 or more years. So it is important to ensure that their design is good. A number of countries have made considerable progress in improving access to and on maritime vessels. In Germany, for example, ship operators have voluntarily taken into account the needs of disabled passengers including the provision of lifts between decks and fully accessible toilets.

Norway has been developing and improving access on its ferries for more than 20 years. Since 1975, all larger vessels (with a capacity of 75 car units or more) have been built with lifts, accessible toilets and designated car parking spaces near the lifts. It is recognised that it is not practical or economically viable to require full access on smaller ferries, but at least accessible toilets can be located close to the deck area assigned for disabled passengers.

Where ferries have cabins, a proportion of these should be accessible to disabled people, including wheelchair users. As is pointed out by the UK's Disabled Persons Transport Advisory Committee it is important that these cabins have facilities to enable disabled passengers to summon assistance in the event of illness or other emergencies[17].

The IMO recommendations mentioned above form the basis for the requirements set out in the European Council Directive 98/18/EC on safety rules and standards for passenger ships. The Directive stresses the importance of applying appropriate measures to ensure the safe access of persons with reduced mobility to ships and high-

speed passenger craft operating on domestic services in Member States. Details of these measures are given in Annex III to the Directive and include requirements on easy and safe access to, from and within the ship, signage, provision of visual and audible announcements and alarm systems designed to alert all passengers with reduced mobility, including people with sensory and learning disabilities.

The requirements apply to ships, the keel of which is laid on or after 1 October 2004, but also say that where the keel has been laid before that date the guidelines should still be applied as far as it reasonable and practicable in economic terms.

4.7 Cable Cars and funiculars

Especially in Alpine countries, cable cars and funiculars play an important role in providing access for tourists and visitors. Generally the requirements for good access are similar to those that apply to light rail systems. For example, the platforms must be accessible by ramps (which can be difficult to provide at existing stations because of lack of space), elevators or at least wheelchair lifts.

Information about the service should be provided audibly as well as visually, especially where there are additional stopping points between the valley and summit stations. As in many cases there are staff on the stations and on the cars, the gap between the platform and the vehicle can be bridged with a portable ramp. Where there are no staff and the operation is automated, this (horizontal) gap must be bridged with a sliding or folding step. An example of this can be seen at the FUNIC Biel-Magglingen system in Switzerland.

Metal grating is often used on platforms at cable car stations. Where grating is used, the mesh must not be larger than 10 x 20 mm in order to ensure that assistance dogs can walk over it safely. The Swiss Federal Office of Transport, in cooperation with the Swiss Office for People with Disabilities, has produced some functional requirement profiles (in French and German) for cable cars and funiculars[18].

NOTES

1. “Accessibility in Collective Transport Systems”, CEN/CENELEC Workshop Acts, Brussels (April 2004).

2. Recommendations on Requirements and Needs of International Rail, Buses and Coaches, “Passengers with Intellectual Difficulties”, Inclusion Europe, Brussels.

3. “Improving Mobility and access for people with cognitive impairments”, The MAPLE Project, DG Employment and Social Affairs, European Commission, Brussels (2004).

4. “Revue de Presse du Pictogramme S3A (Symbole d’Accueil, d’Accompagnement, d’Accessibilité)”, UNAPEI, Paris (2004).

5. “Transport of People with Mental Health Problems”, Mental Health Europe, Brussels (2005).

6. “On the move”, Factsheets on training, accessible information, why is transport so important?, MENCAP, London.

7. “Easy Read”, Disability Rights Commission, London.

8. COST 322 Low Floor Buses, Brussels (1995).

9. “Evaluation of Technology and Department Alternatives for Providing Regularly Scheduled Intercity Bus Service to Mobility Impaired Travellers”, Nathan Associates Inc (November 1997).

10. “Economic Aspects of Taxi Accessibility”, ECMT, IRU, Paris (2001).

11. “The Determination of Accessible Taxi Requirements”, Richardson J and Yelding D, for Mobility and Inclusion Unit, Department for Transport, London (2004).

12. “The Design and Operation of Accessible Public Transport Systems”, Report by Thematic Group 8, Helios (November 1996).

13. Based on the Disabled Persons Transport Advisory Committee’s Rail Working Group recommendations (1998).

14. “Access to Air Travel for People with Reduced Mobility”, ECMT, Paris, France (1995).

15. “Access to Air Travel for Disabled People – Code of Practice”, Department for Transport, London (2003).

16. “Recommendations on the design and operation of passenger ships to respond to elderly and disabled persons’ needs”, IMO Circular, MSC/735 (June 1996).

17. “The design of large passenger ships and passenger infrastructure: Guidance on meeting the needs of disabled people”, Disabled Persons Transport Advisory Committee (November 2000) provides detailed information including access at terminals and shore to vessel transition.

18. Information on cable cars and funiculars can be found at: www.bav.admin.ch/mobile/f/anforderung.htm

5. NEW AND INNOVATIVE TRANSPORT SERVICES

Special services designed specifically with the requirements of disabled people in mind have been available for many years. To some extent their role is changing, in part because of the increase in fully accessible mainstream public transport and in part (at least in some areas) because of the reduction in conventional bus services in rural areas.

For disabled people living in urban areas – and some rural areas as well – the gradual introduction of accessible low-floor scheduled bus services means that many will be able to transfer from using special services to mainstream services. This will not apply to all disabled people however. Some will still need the door-to-door facility and the additional assistance (and time) that can be provided by specialist services.

The other aspect of change arises from the reduction of mainstream services that is occurring in some lightly populated areas. In such places there is scope for widening the passenger base for specialised services by enabling them to carry non-disabled passengers as well.

As is clear from some of the examples mentioned in this chapter, services designed particularly with disabled people in mind are increasingly being developed as part of an integrated public transport system. This approach is to be encouraged. A system that combines both accessible mainstream public transport and more specialised services is likely to be more cost effective than operating two separate systems and will encourage social inclusion of disabled and older people.

The variety of special services is almost infinite, but they can be categorised to some extent.

5.1 Demand-responsive: individual transport

This is the group of services that provide transport for an individual (plus companion) door-to-door. They fall into two categories; voluntary car schemes and accessible taxi (or "Taxicard") schemes.

Voluntary car schemes, in which the passenger is carried in the volunteer's own car are quite widely used for taking people to out-patient treatment at hospitals. The volunteer will usually be paid a mileage allowance to cover running costs of the vehicle, while the service is free to the user. Such services can be very useful in rural areas where conventional modes of transport, accessible or otherwise, may be thin on the ground. These services, since they rely on the cars owned by volunteers are not appropriate for wheelchair users who cannot transfer from their chair to a car seat, though quite a lot of wheelchair users can transfer and so use ordinary cars.

Some community transport services (see 5.3) also provide a car service with a vehicle adapted to carry a passenger in his or her wheelchair.

Accessible taxis can, of course, be used by any disabled person provided they can afford the fare. That, for many disabled people, is the problem: the fares are more than they can afford. To help overcome this problem various schemes have been introduced to make taxis available to disabled people at a heavily subsidised rate.

This type of service is frequently found in Scandinavian countries especially Sweden and in the UK, where the largest is the London Taxicard scheme. To be fully effective the service must be provided by fully accessible taxis. In the UK this is normally done with the accessible purpose built ("London") cabs, elsewhere multi-purpose vehicles or minibus taxis are used. In Gothenburg, special minibuses provide for some of the demand-responsive trips, but the majority are undertaken by regular taxi cabs. It was the use of these taxi vehicles that enabled the service to increase the number of passengers carried to over 800 000 per annum. It doesn't really matter much what type of

vehicle is used as long as it is accessible and, most importantly that the taxi driver has had disability awareness training.

Providing a service of this kind can be expensive for the funding authority (local and/or central government) so it is important to try and ensure that the people using it really do need it. Some form of eligibility criteria should be used and even then it is very likely that an upper limit on the number of trips any one individual can make over a given time will have to be imposed.

Having said that, there is some evidence to suggest that an accessible taxi-based service for disabled people can be more cost-effective than a shared-ride demand-responsive minibus service (see 5.2). In planning and developing these types of service, it would be prudent to consider all the forms and systems; the most effective, in terms of both use of resources and delivery of a good level of service to the individual, may be found by a combination of services rather than just one.

5.2 Demand-responsive: shared transport

Often known as dial-a-ride or dial-a-bus, this service also provides door-to-door service, using minibuses which should be equipped to carry passengers in wheelchairs. They are booked in the way that taxis are - by telephone - or possibly by regular (“standing”) order and the theory is that the control office of the service will be able to organise the requests for trips in such a way that more than one individual is carried at the same time. This shared ride concept, if it could be achieved, would reduce the cost per passenger carried, in theory to less than the cost of an equivalent taxi journey.

In practice this often does not happen, with the result that the cost per passenger trip is higher than the equivalent taxi trip. However, taxi drivers cannot be expected to exercise the level of special care and assistance needed by some disabled people. Dial-a-Ride drivers will not only assist passengers from their door to the vehicle, but may also help them to finish dressing. They may, as for example in Copenhagen, carry special equipment to enable a wheelchair

passenger to negotiate a flight of stairs. It is this level of necessary extra care which, as accessible taxis become more commonplace, should be used to determine whether Dial-a-Ride is appropriate, and if so who should be eligible to use it.

In Barcelona, a door-to-door service was first started in 1978. Subsequently, it has developed into two separate services. One of these (known as the “Routine” service) provides regular timetabled services to take disabled people to and from activities such as official occupational centres, training centres and sporting activities. The other (the “Sporadic” service) is an on-demand service to take people to visit their doctor, to go shopping or to leisure activities. The Routine service uses accessible buses with a lift at the rear; the Sporadic service uses accessible taxis.

In rural areas in Switzerland, there is an on-demand bus service, called Publicar, operated by postal bus services. This acts as a supplement to conventional rural bus services and, since the implementation of the Federal Act on the Elimination of Discrimination against People with Disabilities (1.1.2004), newly acquired buses used on the service have to meet the needs of disabled people.

In Germany the Anruf Sammeltaxi (AST) runs as a feeder service to regular public transport services. The AST stops when requested at fixed stops or, for additional payment, will take a passenger to or from any address within the service area. Passengers who are picked up at the interchange point with the regular bus services book their journey with the AST driver; passengers who are departing from within the service area have to book 30 minutes in advance.

Photo 25. **Door-to-door accessible minibus service**

Source: Courtesy of Société des Transports Intercommunaux de Bruxelles (STIB), Belgium.

5.3 Community transport and shared transport services

This is the category of services, common in the UK and Ireland, again usually using lift-equipped minibuses, which provides collective transport for disabled people. They will provide a service from an individual's home to a facility such as a day centre or luncheon club or to an accessible town centre for shopping. The essential difference between these services and the ones described in Section 5.2 is that they do not cater to individual requests for a journey, but take individuals to a collective or joint activity.

Community transport services are usually funded, at least in part, by local government and are available for use by a wide range of people, not just disabled or older. It is their general availability which distinguishes them from the host of transport services provided by disability associations for the use of their own members.

Although these services are specific in the sense that they are provided by and for the members of a specific association, they nevertheless represent a transport resource which may not always be used in the most effective way. When considering the planning and provision of special services, it is always sensible to include these "disability association" services in the planning process.

5.4 Variations on a theme

Between the special services, of the types described above, and mainstream public transport services there is scope for services which, while not being exclusively designed for disabled people, nonetheless offer a level of service beyond that normally associated with conventional public transport.

Probably the most widely-known example of this is the Swedish Service Bus system, which has been adopted by a number of other countries. The attributes of this class of service can be summarised as:

- Use of fully accessible buses, usually small-medium size.
- Time tabling of the service which allows more time at stops than on a conventional service.
- Routing of the service which is planned to serve places where there will be numbers of disabled passengers - residential homes, clinics, daycentres, etc.
- Flexible pick-up / set down points - hail stop where appropriate and possibly a degree of route diversion.
- Well-trained drivers (and other staff).

A further variation on the Service Bus concept was introduced in Gothenburg in 1996. This is known as the Flexline, and was first started as a test service under the EU SAMPO project. A Flexline is a form of demand-responsive transport and the line has a number of meeting places (not stops). Booking is done by telephone and the

caller is rung back by the service control when it is time to go to the meeting place. There are also telephones in a shopping centre and at some other important destinations in order to make booking possible for the return trip. The Flexlines have proved to be particularly popular with older people.

It is possible that the role of this kind of service will diminish as more of the mainstream services become fully accessible, but it is probable that in some areas and at some times they will remain as a useful means of providing a better level of service to disabled passengers than can be achieved by conventional means. Certainly there is evidence, *vide* a recent study of six towns with Service Routes in Finland, that these services improve the mobility of many disabled people.

The other aspect of special services is their integration into mainstream transport. The Mobinet system in the Dutch town of Voorst is an example, with wheelchair accessible minivans acting as shuttles to regular public transport services. Door-to-door service is available to anyone who wants it, but people who are not disabled pay a premium fare for it.

5.5 Other innovative services

There are some other ways in which transport can be provided in an unconventional manner, some of which are of value to disabled people. Examples include the taxitrain service which is being operated in the Netherlands and in Sweden, and the use of taxis as a replacement for buses on the outer parts of bus routes during evenings (as in Germany). Taxi bus systems - using a minibus or multi-purpose vehicle as a shared ride taxi - may be an effective way of providing service in low density rural areas.

In Lincolnshire (UK) the County Council introduced their Dial-a-Ride Partnership (DARP) in 2003. This service is intended to reduce the isolation of mobility impaired people in rural areas of the county – not just people with a disability but also those who are socially isolated, for example, young able-bodied people who cannot drive and

who have little or no access to mainstream public transport. The scheme offers door-to-door transport, but also acts as a feeder to mainstream coach and train services. In addition, the schemes can also provide group transport.

Merseytravel (Liverpool, U.K.) has started the ALTER-eco service which uses a fleet of six wheelchair-accessible battery-electric minibuses operating a network of routes that link residential areas with centres of employment, medical facilities etc., and with the local Shopmobility outlet. Shopmobility provides free hire of mobility aids such as powered wheelchairs and scooters.

In the District du Pays de Saint-Brieuc, a system known as "Taxitub" has been introduced[1]. Known as a "virtual" transport system, Taxitub serves 14 communes in Saint-Brieuc, with vehicles sent out in response to telephone calls for service which can be made anything from ten days to 45 minutes ahead of the required journey time. If no requests are received for a particular journey, then that journey is not made. The service acts primarily as a feeder to conventional transport services.

No doubt there are other innovative schemes in operation in Europe. The point is that when considering the development of special services, planners should be aware of, and take due account of the range of systems that could be provided.

In the section on the Road and Pedestrian Environment (Chapter 2) the development of pedestrianised areas in town centres was mentioned. The walking distances in these areas can be substantial, certainly more than can easily be accomplished by ambulant disabled people.

The Praxitele system[2] which uses small self-drive or automatically controlled electric cars offers one possible solution to this problem. A further development of this type of service, known as the "Cybercar", has been tested recently in the French city of Bayonne. Another system, quite widely used in the UK, is the Shopmobility scheme,

which provides powered wheelchairs or manual wheelchairs with a pusher for use by ambulant disabled people who cannot walk very far.

Yet another innovative system is the electric buggy service which was operated in Woking town centre by the local Community Transport department of the borough council[3]. This was designed to help people who can walk a reasonable distance, but who still found it difficult to walk across the whole town centre. This system was rather similar in some ways to the electric buggy service provided at some of the larger airports. The vehicles used for these services, which are either derivatives of electric golf buggies or of small industrial vehicles, are not ideal for use by disabled people, but the principle of the service is a good one.

Innovation is not limited to the services themselves but also applies to the ways in which services are used. One current development which could be of considerable benefit to disabled people is the contactless smart card used for payment of fares on public transport. In the longer term, this type of card could be used for payment of car parking and road toll charges and perhaps for other purposes. The smart card based system introduced in Tampere in 1997 using contactless cards can, in addition to being used for bus journeys, can also be used for entry to various leisure activities such as libraries, swimming pools etc.

NOTES

1. See “Taxitub: Définition, contenu, Coûts et repercussions”, by Francois Josse, p. 238-242, proceedings of the Conference of the International Association of Transport Regulators, Strasbourg (October 1996).

2. Parent, M and Fouconnier, S, “Design of an electric vehicle specific for urban transport”, INRIA, Le Chesney, France (1995).

3. Oxley P R, and Alexander J, “Electric Buggies – Concluding Report”, Cranfield University (1996).

6. PRIVATE CARS

Most of this guide is concerned with public transport but, no matter how much some politicians might wish it, the private car is and will remain a major element in the personal mobility of disabled people. As was said in the introduction to this paper, disability is related to age and the sector of the population that has the most rapidly growing car ownership is that of retirement age.

It is not the purpose of this publication to describe how cars can or should be adapted to meet the needs of older and disabled people. Important though that is, it is a subject for another and different report. From the point of view of this paper there are two aspects that should be considered: advice and guidance for disabled people who wish to travel in cars either as driver or passenger, and, sensible provision for disabled car users while travelling and at their destinations.

6.1 Advice and guidance

The onset of disability whether traumatic or gradual can change the ability of an individual not just to drive a car but to even get in and out of one as a passenger. A few disabilities – uncontrolled epilepsy is the most obvious - will, for reasons of safety, prevent an individual from driving, but in the majority of cases a disability prevents driving a conventional car but certainly need not prevent driving a suitably adapted car. The key word is “suitably” and it means not just appropriate in the sense that the individual can use the controls to drive the vehicle but also that the controls themselves are well and safely designed.

The range of disabilities, and therefore of abilities, is wide and so too is the range of adaptations to car controls to meet the needs of

people with impaired functions. The only sensible way to approach this is to make assessment and advice available to all who need it. CARA in Belgium was one of the first places to offer this type of service, to advise people whether they could drive safely and, if so, what type of adaptations they would need both to get into and out of the car and to drive it. Assessment and advice centres have now been established in many European countries, most recently in Greece (the HNIOXOS services) and, with the support of Fiat, in Italy.

Photo 26. **Even small cars can be adapted for use by disabled people, including wheelchair users**

Source: Courtesy of Direcção Geral de Transportes Terrestres, Ministério do Equipamento; do Planeamento e da Administração do Território, Portugal.

Photo 27. **Sophisticated controls now enable many people with severe levels of disability to drive safely and in comfort**

Source: Courtesy of the Department for Transport, United Kingdom.

It is not possible to provide a blueprint for a successful driving assessment and advice centre within the confines of this publication, but some sources of information on this are included in the References section. In outline, though, a centre should:

i. Be staffed by experienced and expert driving assessors; medical knowledge may be an advantage in some cases, but is not necessary for dealing with many disabled drivers.

ii. The centre should have a good range of vehicles and of adaptations for both primary and secondary controls.

iii. It should have access to private road space, on which drivers can try out adapted vehicles at no risk to themselves or other road users.

iv. It should provide advice not just on driving but on a wider range of mobility aids and should be able to give advice on other aspects such as grants that may be available to help with buying a car, where to obtain insurance, etc.

v. It should include advice on, and examples of, aids for disabled car passengers.

There is a related issue, which may affect the assessment and advice centres. This is the increase in older drivers, which is common to all developed countries, and which may possibly pose safety issues in the future. Again, this is an issue that should be the subject of a separate report, but it is possible that assessment centres may extend their services to assess the ability of older drivers to continue driving safely.

Increasingly, rental cars are available fitted with comparatively simple adaptations that enable disabled people to drive them. Portable hand controls (for braking and acceleration) can be fitted to most cars with automatic controls. Foot pedal extensions can be fitted to enable a person of short stature to drive the vehicle. Other simple low-cost adaptations include “clip-on” panoramic rearview mirrors (for drivers who find it difficult or painful to turn their head) and steering wheel spinners or knobs. Vehicle rental companies should not discriminate against disabled or older drivers – for example by charging an additional insurance premium – unless it can be shown that there is a genuinely higher risk of accidents arising.

6.2 Travelling and arriving

Much of what is needed by disabled people when travelling by car is the same as that needed by every other driver. There has been a substantial increase in recent times in the use of information technology or transport telematics as mentioned in Chapter 1, and this increase will continue. Many of these systems - route guidance, parking aids, sensor systems that detect when a driver is becoming drowsy, emergency alert systems - are of particular potential benefit to disabled and older drivers, **provided they are properly designed**.

How those design standards can be achieved is also a matter for a different report, but there is a considerable and growing body of research on these issues, much of it coming from research supported in the 1980s and 1990s by DGXIII of the European Commission. (See References section on this topic.) All that can be said here is that anyone involved in the development of car-based IT systems should take full account of the needs of older and disabled car users. As with so much else, the design of a system that meets their needs will meet the needs of everyone else as well.

There are, aside from this issue, two more specific matters that should be taken into account: provision of parking space and access into areas from which private cars are normally excluded.

General standards for parking space were given in Section 2.6, but there is a specific issue relating to pedestrianized areas in town centres. These are growing in popularity and can provide a very pleasant environment for pedestrians, but some are very large in scale. Shopping or other journeys within these areas can involve a considerable amount of walking - some areas may be as much as two or more kilometres end to end. Obviously, such distances cause problems for more severely disabled people, so in developing or extending these areas, careful thought should be given to appropriate parking spaces for disabled motorists either immediately on the edge of the pedestrian area, if it is a small one, or within the area, if it is large.

7. THE ROLES OF GOVERNMENT

Both national and local government should have responsibilities for the development of accessible transport and infrastructure. The balance between the two will differ one country from another but in broad terms responsibilities can be apportioned as described below.

7.1 National government

National government is responsible for national laws and regulations defining access in the environment - highways, pedestrian areas, public buildings, commercial and retail premises, etc. These may take the form of town planning regulations or specific laws or decrees. They provide the statutory or mandatory framework within which local and regional authorities carry out their duties and transport operators plan and provide their services. They should also ensure that appropriate research on ways and means of meeting the mobility needs of disabled and older people is undertaken.

The ECMT Access and Inclusion Group prepared a paper in 2003/2004[1] which set out guidelines on implementation at the national level to improve accessibility and safety based on an extensive review of policies in European and other countries.

It was noted that twenty years ago, legislation concerning disabled people was usually based on promoting social integration, reducing discrimination and contained little that specifically dealt with improving mobility. In more recent times legislation has become much more targeted and more detailed in setting out requirements for transport to be made fully accessible.

It is suggested that whether done as primary legislation or by subsequent regulations the important elements are:

1. Precise technical standards for vehicle design.

2. Where appropriate, standards for access to and within transport infrastructure and related pedestrian areas.

3. A realistic time-scale for the implementation of vehicle regulations.

4. Similarly so for the built environment, but with allowance for using alternative ways of providing access or facilities for disabled people where changes to building structure are not feasible.

As a precursor to legislation, Governments should:

1. Clearly define the objectives of the legislation, including commissioning and use of research designed to determine the needs of disabled people and the most appropriate ways of meeting them.

2. Consult with national disability organisations.

3. Consult with the transport industry, including quantification of any costs and benefits that will arise as a consequence of the legislation.

There are several recent examples of Government publications that provide guidance on the development of accessible transport. These include:

"Towards Accessible Transport" produced by the Finnish Ministry of Transport and Communications in 2003. This sets out the Government's role and objectives for achieving full accessibility including encouraging municipalities, funding strategies and research. The policies cover all modes of public transport, including air and maritime, as well as the use of private cars by older and disabled people.

The French Government (Ministère de l'Equipement, des Transports, du Logement, du Tourisme et de la Mer) announced its "National Accessibility Charter" in December 2003. The Charter, which has been signed by leading transport undertakings and local authorities, is intended to guarantee that access will be built into new or redeveloped facilities; that national funding will only be made available on projects which include access for disabled people; and that provisions are taken for a continuing dialogue with, inter alia, disabled people.

"Barrier-Free Public Transport in Germany", published in April 2003 and sponsored by the Federal Ministry of Transport, Building and Housing and the Association of German Transport Undertakings, gives detailed guidance on the design of accessible public transport, infrastructure, information and service.

In addition, a Federal Act on the Elimination of Discrimination against People with Disabilities has been in force in Germany since 1 January 2004. The Act places particular emphasis on public transport, prescribing that it should be equipped to meet the needs of disabled people by 2023.

In the Netherlands CROW (Kenniscentrum voor Verkeer) has published (October 2005) a handbook on the accessibility of collective public transport. An earlier report by the same organisation, on design for accessibility including guidelines for pedestrian footways and areas, all types of street furniture, bus and tram stops and car parking was published in 2002.

In addition to these comprehensive standards and guidelines, there are also publications dealing with specific modes of transport including maritime and air services. Some of these are listed in point 4 of References and Further Reading.

National government should also be the source of information and guidance on matters relating to access and mobility for disabled people which, while not considered appropriate for legislation, should be provided as a consistent standard throughout the country. An

example might be the design of tactile guidance surfaces for visually impaired people. While there is no legal requirement to provide these it is obviously sensible that wherever they are provided they should be of the same design.

"Inclusive Mobility" produced by the UK Department for Transport (2002) provides detailed guidance on the design of all ground-based transport-related infrastructure, including the provision of information. This report was produced after extensive consultation with organisations of disabled people.

In Switzerland, a joint working group from the Federal Office of Transport, the Public Transport Union and the Swiss Office for Disabled Persons and Public Transport has drawn up a "Functional Requirement Specification". The specification covers rail (stations, stops and vehicles), buses and trams (again covering infrastructure, information and vehicle design), ferries and cable cars.

7.2 Public procurement

Apart from regulation and guidance, National government and other public authorities can exert substantial influence over the provision of accessible infrastructure and vehicles through their public procurement policies. The recent EC Public Procurement Directives (2004/17/EC and 2004/18/EC) allow public authorities to include social and environmental considerations in public contracts on works, services and supplies. Technical specifications for contracts should take into account accessibility and design for all criteria for disabled people and can be included as conditions in the final choice of tenders.

Related to this issue, the European Commission – funded Build-for-All project has recently started. One of its key activities will be to produce a toolkit for public authorities. This toolkit will include a framework guidance manual and code of practice to assist public authorities in the design of their public procurement tenders, the technical specifications, incorporation of essential accessibility criteria relating to the environment and guidance on step-by-step

implementation and assessment. The project will also produce a reference document which will give contact details and references for a wide body of existing material on accessibility and built environmental issues and on information sources on expertise available across the EU.

A new and interesting development, initiated by the Netherlands Ministry for Social Affairs, is for a company contracted by the Ministry to organise longer distance (city-to-city) journeys for disabled people, including ensuring that assistance is provided for the traveller wherever it is needed. The traveller will pay his or her own fare, but the cost of organising the trip and making assistance available will be borne by the government. This service is intended to help overcome travel problems until such time as public transport services become fully accessible and can be used by disabled people without the need for assistance.

In May 1999, the ECMT adopted a Charter on Access to Transport Services and Infrastructure. The text of this Charter is given in Annex 4 of this report. Briefly, the Charter states that all projects considered for public funding (at national or international level) must, as a condition of this funding, agree to incorporate full accessibility for all disabled people into the design and construction of the project. These projects should be monitored to ensure compliance with the principles of accessibility and continued public funding should be made conditional on these principles being met satisfactorily.

7.3 Local and regional government

Local and Regional government carry out duties laid on them by National government, where appropriate to enact local regulations and by laws concerning access and mobility. To monitor the provision of accessible infrastructure and transport services and to ensure that they meet appropriate legal requirements and standards.

In many countries, local authorities have direct control over local public transport services and should therefore be able to influence their development to the benefit of disabled people. In some countries,

most of the local public transport is in private ownership and therefore beyond direct control of local government, but there may be scope for the local authority and local transport operators to enter into "quality partnerships". In these arrangements, the two parties jointly undertake to improve the quality of local services - and better access for disabled people should be an important part of this. An example would be a local authority agreeing to provide raised bus boarders and covered seating at bus stops and the bus operator matching this by introducing low-floor wheelchair accessible buses.

There are many examples of effective co-operation between local government and local public transport operators. Grenoble (France) has had a long history in developing fully accessible bus and tram services and associated infrastructure. The public transport authority (SMTC) works closely with the operator (SEMITAG) with frequent meetings to discuss all aspects of all projects including development of accessible services. Representatives of the 23 local authorities in greater Grenoble also attend these meetings where plans and projects are discussed prior to any final decision being made. The policy of creating a system fully accessible for disabled people in Grenoble dates back to the 1970s and has involved extensive and continuing consultation with organisations of disabled people.

There are other examples of effective co-operation including involvement of disabled people, for example, in Nuremberg (Germany) where the transport operator appointed an Accessibility Commissioner more than 30 years ago, in Gothenburg, where the Regional Council (part owner of Västtrafik, which puts out tenders for public transport services) has a Committee for Mental and Physical Disabilities and in Barcelona where the City Council created the Municipal Institute for Disabled People, which has as its objective the creation of full access for disabled people.

The European Disability Forum (EDF) has started a two year (2005-2006) pilot project, Agenda 22, which has the objective of ensuring that disability issues are included as a mainstream policy at the local and regional levels. This policy should be created as a human rights based approach to disability. It is intended to establish

four pilot areas in each of the nine countries involved in the project, the purpose of each of these pilot projects being to produce a disability policy plan in co-operation with the existing regional/local disability organisations and with the relevant public authorities.

Co-operation between local authorities and transport providers can form the basis for mobility action plans. These should set out the long term plans for achieving full accessibility of both the transport services and the infrastructure.

The European Commission also has a role to play. In some areas it has a direct responsibility for matters of concern to disabled people. An example of this is the Directive on special provisions for vehicles used for the carriage of passengers containing more than eight passenger seats. In other areas, even though it may have no regulatory responsibilities, the EC can lead by example in the sense of sponsoring research and information exchange (e.g. through COST actions on access to buses, coaches and to rail services).

7.4 Training

Training all staff who come into contact with members of the public in disability awareness is essential. Without this, the best of technical aids to accessibility may fail to fulfil its potential value. Unfortunately, to quote the HELIOS report[2], “the adequacy of training rarely meets the needs of passengers in most Member States and whilst this situation is improving, it urgently needs to be addressed”.

A set of Guidelines for Transport Personnel developed in the context of the ECMT-UITP Task Force on Improving Accessibility of Public Transport is to be published in early 2006[3]. This provides comprehensive guidance on the subjects that should be covered by staff training and should be used by transport operators as the basis for their training programmes.

Photo 28. **Training course for drivers**

Source: Courtesy of the City of Tempere, Finland.

There are many good examples of training. In the context of a project in the Netherlands on the improvement of knowledge and perception of staff of public transport companies, a training programme of 3.5 hours has been developed to show the staff what it means to travel with a handicap. Staff members experience for themselves how disabled people can best be helped. This is done actively, including through use of a video and discussions and getting the trainees to go through a course set out with obstacles which they have to negotiate in a wheelchair or as a blind person. The training is given by disabled people with travelling experience.

Regular workshops involving staff from the transport operator's staff and disabled peoples' organisations can be an effective way of maintaining and improving disability awareness. In Stuttgart, the training of drivers includes having them use a wheelchair and spectacles to simulate blindness and partial sight. Belfast Translink includes a programme, launched in co-operation with the RNID (Royal National Institute for Deaf People), to give transport staff sign language training. When a staff member has completed this training, they receive a clearly visible badge identifying their skills to passengers with hearing impairments.

It is important that the training should include ways of assisting people with learning disabilities and mental health problems to use public transport safely and with ease. As mentioned in Chapter 4, there are a number of national and international organisations that provide guidance on how to meet the needs of people with these types of disability.

The other aspects of training, which are receiving more attention, include that of travel training for disabled people themselves. These programmes are designed to give disabled people, particularly those with learning difficulties, the confidence to use local public transport independently. An example of this kind of training is the Leeds Buddying Scheme. This provides one-to-one training for disabled and older people with physical, sensory or learning difficulties, mental health service users and those with long-term illness. A personal travel-training plan is prepared for each client and, on completing the

course successfully, the client is then encouraged to become a volunteer for the service and support other people through the process of travelling independently[4].

Another approach to this issue has been developed in Merseyside[5], where the Passenger Transport Executive has produced an Educational Resource Pack designed for use by schools with special needs pupils. It is designed to develop the necessary skills to travel on public transport safely and independently.

7.5 Seamless travel

There is a third and continuing role for government. Much of the advice and information contained in this publication is specific to various aspects of the travel process or to particular modes, but one thing which is very important is to bring all these examples of good practice together. Hardly any journeys just involve using one mode of transport; at the very least a journey is likely to include walking (or wheeling) and a vehicular trip. Longer journeys will probably involve more than one mode of vehicular transport, or at least changes within the same mode: bus to bus or train to train.

Obvious though it may seem, it is worthwhile stressing that any journey is only as good as its weakest link. There should, therefore, be a conscious effort on the part of government, local and central, to ensure that accessible transport services link together. The physical process of making a journey should mirror the "*chaîne signalétique*" approach advocated by COLIAC (formerly COLITRAH)[6] for information; a carefully planned sequence without breaks or interruptions.

Until comparatively recently such an approach would have seemed unrealistic, even irrelevant, because so much needed to be done to make any single link in the transport chain accessible. This is changing, rapidly so in some countries, but the full value of accessible links will not be realised unless journeys are considered as a whole, rather than as a series of discrete movements.

To achieve this continuous accessible transport will require the continued collaboration of government (national and local), vehicle manufacturers, operators and disability organisations. In other words, the physical chain of accessible transport has to be paralleled by an administrative chain.

In further developing their policies for improving access to all modes of transport, government should not lose sight of the over-arching need to provide seamless transport for disabled travellers, and to achieve it by a combination of appropriate regulations and encouragement for collaboration between all the organisations concerned.

7.6 Raising awareness

It is important that disabled people should be made aware of improvements in accessibility. Government publications, like those mentioned earlier in this section, can help in this process, but the most effective means is at the local rather than the national level.

There are various ways in which this can be done. One way is to have a “campaign week” as was done in Hamburg in July 2001. Called “Mobility for Everyone – simply HVV” the campaign aimed to improve communication between HVV staff, disabled and non-disabled passengers, and to provide the latest information on the measures implemented to adapt public transport in the Hamburg area to the needs of disabled people.

Throughout the campaign week a specially fitted-out bus visited institutions and facilities for disabled people as well as various public places in order to inform people about improvements to stations, stops and vehicles. A key feature of the campaign week were the journeys made together on public transport services by staff from the operating companies and disabled passengers. While en-route the disabled people could explain the sorts of problems they encountered when using bus and train services and the staff could make the passengers aware of the problems they faced in their daily operations: very much a two-way learning process.

In the UK, Warrington Borough Council employed an adult with learning difficulties "who used the local bus services as a mystery traveller". He was then able to identify the difficulties encountered when travelling and to report back to the Council, so they could then provide the appropriate forms of assistance for other people with learning disabilities who could be encouraged to use local public transport.

Good publications can also help in raising awareness of what is available. Transport for London, for example, publishes a magazine "Transport for All" to promote and provide information for disabled travellers. It is available in large print, Braille, tape and in various languages. Internet-based information and journey planning services, like those mentioned in Section 1, and education packs prepared for disabled school children can all help in raising awareness of what services are accessible and available.

NOTES

1. "Improving Accessibility of Transport: Report on Implementation at the National Level of Measures to Improve Accessibility of Transport", ECMT, Paris (May 2004).

2. "The Design and Operation of Accessible Public Transport Systems", (p. 74).

3. "ECMT-UITP Guidelines for Transport Personnel on Improving Access to Public Transport", ECMT, Paris (2006).

4. The Leeds Buddying Scheme is run by Metro, the West Yorkshire Passenger Transport Executive.

5. Merseytravel, Liverpool operates this scheme.

6. See Section 1.4.

ANNEX 1

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ANNEX 2

CONCLUSIONS AND RECOMMENDATIONS OF THE ECMT-UITP REPORT ON IMPROVING ACCESS TO PUBLIC TRANSPORT

[CEMT/CM(2003)6/FINAL]

Ministers:

- Approved the Conclusions and Recommendations of the joint ECMT-UITP report.
- Agreed to disseminate them to local authorities and public transport operators.
- Re-affirmed their commitment to improving the accessibility of public transport.
- Agreed to examine existing laws and legislation to ensure that they provide a supportive national framework within which local authorities and transport operators can work together to improve accessibility of the transport system.
- Agreed that ECMT should review progress on implementing the above recommendations in due time with UITP.

1. CONTEXT

Governments and public transport operators share a common goal to ensure that public transport is accessible to all, and that the pedestrian and traffic environments are designed and managed to enable people to reach and use public transport safely and with confidence. Public transport has a key role to play in improving accessibility for all individuals, thereby minimising social exclusion and enhancing social cohesion. In this pursuit, government and the public transport community must work together to reduce not only physical, but also psychological barriers (cognitive, information, fear, discrimination) to safe and seamless travel in cities.

The importance of improving accessibility to transport systems is clear: at any one time, an average of 25% of the population may have a degree of reduced mobility due to a physical or mental disability, impaired sight or hearing, or through having to carry heavy bags or travel with small children. Further, physical and sensory disabilities are often related to age and, as is well known, the proportion of the older population in western countries is growing and will continue to do so well into the 21st century.

The present and future needs of people with reduced mobility cannot be ignored. To do so would be to exacerbate inequality of access to a wide range of facilities and, from the point of view of the transport service providers, to miss out on a substantial sector of the market for public transport. Indeed, benefits from improvements in transport accessibility are accrued not just to the disabled and ageing communities, but to all clients of the transport system. Providing access for disabled people to public transport is not an isolated endeavour: it is a crucial part of a quality approach to public transport services, which ensures that all passengers are provided with a high standard of public transport.

Much progress has been made toward meeting the goal of better accessibility in local areas. However, implementation of policies to improve accessibility for all clients of the transport system has proven difficult and slow in many urban regions.

2. ECMT-UITP TASK FORCE

To better ascertain the difficulties involved in improving accessibility to public transport, the ECMT and the International Public Transport Union (UITP) together established in 2001 a joint Task Force on Improving Access to Public Transport. The broad mandate for this Task Force, which was comprised of representatives of national and local Governments as well as transport operators, was to examine how urban public transport vehicles, systems and associated infrastructure can be further improved so that they provide better access to people with mobility difficulties.

Specifically, the three main objectives given to the Task Force were to:

- Identify examples of partnerships between public authorities (at different levels) and transport operators which can improve access for all and deliver other advantages for local public transport services (increased patronage, reduced congestion).

- Draw up guidance on good practice for training transport personnel to understand and respond to the needs of passengers with mobility difficulties.

- Propose solutions to particular problems that occur in improving access, including liability in case of accident, specific technical solutions for boarding aids and the integration of accessible vehicles in the urban environment.

Drawing from *inter alia* the ECMT's 1999 guide to good practice, "Improving Transport for People with Mobility Handicaps", and the 2001 ECMT Consolidated Resolution (no.2001/3) on accessible transport, as well as UITP's revised position on accessibility issues, adopted in 2000, the Task Force examined accessibility initiatives in the transport systems of four cities: Grenoble, Prague, Göteborg and Liverpool. Task force members met with local and transport authorities as well as the public transport operators in these cities to better

understand how policies to improve accessibility are made and implemented.

3. CONCLUSIONS AND RECOMMENDATIONS OF THE ECMT-UITP TASK FORCE

Whilst the organisational structure of public transport and local authorities varied in the four cities examined, a number of key conclusions can be drawn from their experience in improving the accessibility of their transport systems.

Role of national governments in improving accessibility of local public transport

- National legislation requiring the provision of fully accessible public transport over a period of time provides a framework within which local authorities and transport operators can work together to achieve accessibility. The existence of such legislation is important in all circumstances and is essential when public transport services are provided solely or largely on a commercial basis.

- Although implementation of measures to improve the accessibility of public transport is mainly a matter for local authorities and operators, national government has an important role in setting the legal framework, providing incentives and producing guidance on standards of good practice.

Co-operation between local authorities and public transport operators

- Close, continuing and frequent co-operation between local authorities, local transport authorities and transport operators is essential. Where these are all public authorities, or where there is control over private operators, there is no evidence to suggest that formal, contractual agreements are essential.

- Where operators are independent, authorities should stipulate clearly the accessibility level required in agreements that are contractually enforceable between the public transport authority and the operators.

Planning for accessibility

- Forward planning, with a time horizon of approximately ten years, is necessary. More detailed plans should cover a period of five years, and should be updated on an annual basis.

- There should be regular monitoring of progress towards achieving forward plan objectives. Monitoring should cover improvements to public transport infrastructure, introduction of fully accessible vehicles (buses, trams, trains) and use made of accessible services by disabled people and others with reduced mobility.

Co-operation with disabled people in defining and developing better accessibility to transport

- Collaboration and consultation with disability associations on all aspects of accessible transport is essential. This should cover vehicles, infrastructure and information. The public transport authority should have a focal point specifically charged with dealing with all disability issues. Care should be taken to ensure that consultation covers the whole range of disabilities: physical, sensory and cognitive.

Ensuring full accessibility: vehicles, infrastructure, and stops

- In urban areas, gapless and stepless boarding should become the norm. This requires action by both local authorities and operators. Infrastructure modifications should be undertaken to allow such boarding, either by making existing high platforms accessible or by arranging street-level infrastructure to maximise the benefit of low-floor vehicles. The authorities responsible for the transport infrastructure should conduct

accessibility audits of bus and tram stops as well as related infrastructure using consistent standards. The objective should be to match the introduction of accessible vehicles with appropriate infrastructure. If this is not done, much of the value of accessible vehicles will be lost.

- While the development of accessible bus and tram stops is essential, it is also important to ensure that the surrounding pedestrian environment is also accessible. This responsibility rests primarily with the local authority.

- The effective enforcement of parking restrictions at and around bus stops is absolutely necessary, otherwise the benefit of low-floor, step-free access is lost. This requires stringent, consistent and enforced policy at the local authority level.

- In order to make construction provisions more effective, affordable and easier to design, it is desirable for local authorities, operators and vehicle manufacturers to rely on some degree of standardisation in wheelchair dimensions and restraint devices for transport purposes. Wheelchair manufacturers should adopt existing ISO standards, and associations of wheelchair users should make their constituencies aware of the standards on which public transport vehicle manufacturers are basing their designs for wheelchair accessibility.

Specialised services

- Specialised services will continue to be needed by some of the most severely disabled people, as well as to provide connecting services for those people otherwise unable to reach public transport. It should not, however, be regarded as an acceptable substitute for accessible public transport, but rather as a complement to it.

Training

- Ensuring that drivers and other public transport staff have disability awareness training is essential to the effective delivery of accessible services.

Information

- As services become fully accessible, operators should ensure that accurate up-to-date information and publicity are made available in appropriate (audio/visual) formats for disabled people. Good, comprehensive information is essential if disabled people are to be encouraged to use accessible services. Information should cover the whole transport chain: pre-journey and during the trip.

- Some operators believe there are problems associated with particular features of accessible vehicles, notably buses. Use of a ramp and securing of wheelchair passengers are examples. Continued exchange of information and good practice on these aspects of operation between authorities and operators would be helpful.

Costs and benefits

- Clearly there are costs associated with creating a fully accessible public transport system, but it should be remembered that there are financial benefits to be had from increased use of the public transport services.

- Additional investment and financing costs should be incorporated into long-term transport development plans to the extent possible, and discussed and shared based on responsibility and jurisdiction.

- Opportunities should be sought for cost-effective improvements to accessibility based on better enforcement of existing traffic laws (e.g., fines for illegal parking in and around bus stops).

ANNEX 3

CONSOLIDATED RESOLUTION No 2001/3 ON ACCESSIBLE TRANSPORT

The ECMT Council of Ministers, meeting in Lisbon on 29th-30th May 2001,

CONSIDERING that the integration of older and disabled people in the occupational and social life of the community very closely depends on whether they are able to move about freely and easily for journeys to and from work or for any other purpose.

NOTING THAT:

- Demographic changes will result in a significant increase in the number of older people in ECMT Member and Associate countries in the coming years.
- There is a growing demand for travel among older and disabled people and others whose mobility is impaired.
- Significant progress has been made to render some modes of transport more accessible to everyone.
- Despite this progress much remains to be done.

AGREES THAT in order to give a new impetus to improving the situation across all Countries it is useful to consolidate previous Ministerial Resolutions and other relevant work in a single document (see Annex).

RECOGNISING THAT:

- Accessibility contributes significantly to the welfare and comfort of the entire population and constitutes an important element in the promotion of public transport and in the implementation of sustainable development.

- Difficulties in mobility may be due to a permanent disability (sensory, physical or cognitive) or to a temporary condition or disability (pregnancy, accident) or to external circumstances (accompanying young children, carrying luggage, etc) or age; this resolution concerns all these categories but for simplicity, the term “older and disabled people is used” in the text.

- Well designed accessibility of buildings, the environment, roads and transport, whether public or private, enables people with mobility difficulties to move freely and independently.

- More accessible transport increases educational, employment and recreational opportunities and can reduce social services and welfare costs to governments and communities.

- Accessibility is not only a social issue but also a very important commercial issue, and the population in question, which is significantly larger than the number of disabled people, represents considerable commercial potential.

EMPHASISES THE FOLLOWING PRINCIPLES:

- All policy initiatives or developments in transport and land use planning should include an evaluation of their potential impact on safety and accessibility of older and disabled people.

- All links in the transport chain need to be improved so that an accessible environment is created door-to-door and increased efforts must be made to connect the different means of transport and thereby create an integrated, safe and accessible transport system.

- In particular, all new investments in transport must take account of and plan for the needs of older and disabled people in accordance with the Charter adopted by Ministers in Warsaw in 1999.

- Close co-operation between governments, public authorities, manufacturers, operators and the people concerned is essential.

MAKES THE FOLLOWING RECOMMENDATIONS:

Governments should:

Generally

Objectives

- Define clear, concrete and measurable objectives to improve safety and accessibility of older and disabled people, with a programme of specific actions.

Training

- Work with transport authorities and companies, tour operators, travel agents and others to ensure that staff who are in contact with the public are aware of and sensitive to the problems encountered by older and disabled people when using transport.

- Ensure that the designers and decision-makers in all relevant transport fields are trained in the principles and requirements of accessibility.

Information and communication

- Use their influence to improve systems of information provision for older and disabled people and ensure that all those concerned by the issue are consulted.

- Endeavour to ensure that transport authorities and companies, tour operators and travel agents include, as an integral part of their services, information for older and disabled people on the facilities available to them, including the different links in the mobility chain.

- Continue to make efforts to improve the clarity of signing and signalling systems and to harmonise at international level, particularly where safety is an issue.

- Work towards introducing dynamic, audible and visual announcements capable of providing information in real time.

Research

- Endeavour to strengthen their research and development activities in relation to the accessibility and safety issues for an ageing population.

Transport planning

- Work to improve co-ordination between the competent authorities at national, regional and local level in order to assure a coherent approach to the accessibility and safety of transport infrastructure and pedestrian facilities.

- Together with governments and international organisations a set of guidelines on good practice should be developed including on the function and design of the road system, as well as lighting, intersections and pedestrian facilities.

Personal vehicles

Parking facilities

- Enable people with severely reduced mobility who have difficulty in moving about and using public transport to park their vehicles where parking is otherwise restricted.

- Where necessary, provide reserved parking spaces for such people by means of appropriate road signs. These spaces should be designed in accordance with recognised design criteria.

- Provide those eligible for such facilities with a parking badge in accordance with (for EU member states) or similar to (for non-EU member states) that of the model defined by the EU; as a minimum the badge should contain the international symbol for disabled people and the name of the badge holder.

- Give the same parking facilities to holders of this document coming from another Member or Associated member country as they do to their own nationals.

- Take the necessary steps to ensure that police and other parking enforcement authorities are fully informed about the nature of this arrangement.

Legal requirements for seat belt wearing

- Mutually recognise exemptions from wearing seat belts for disabled nationals from other countries.

Design of vehicles

- Facilitate and encourage the design of vehicles for all which take into account the needs of an ageing population.

- Work together with other governments, ECMT and industry to draw up a set of design guidelines for vehicles.

Driving licences

- Study and draw up guidelines on the conditions for issuing and retaining driving licences for older and disabled drivers.

Air travel

- Improve access to air travel by:
  - Implementing the ECAC guidelines on aviation and airport access.
  - Focusing more attention on improving transport links to airports.

Rail, light rail and tram systems

- Make renewed efforts to stimulate improved accessibility to railways as well as light rail and tramway systems by:
  - Implementing the COST 335 guidelines for heavy rail in both domestic and cross-border services.
  - Ensuring that all new tram and light rail systems build in full accessibility from the outset.

Public transport

Buses

- Continue to facilitate and stimulate the positive trend towards the introduction of fully accessible buses by:
  - Implementing the recommendations of the COST 322 report on low-floor buses.
  - Assisting the competent authorities to provide the conditions whereby buses can get close to stops and the resources to implement and enforce this.
  - Continuing to work with people with disabilities and industry to implement appropriate solutions to the requirements both of wheelchair users and other older and disabled.

Coaches

- Urge manufacturers and operators to develop, provide and use vehicles capable of meeting the needs of older and disabled people.

- Ensure that coach classification systems include a set of criteria for levels of accessibility provided.

More flexible public transport services

- Promote the development of new types of intermediate services between public transport and specialised services such as demand responsive public transport services which can be used by the general public but are especially planned to meet the needs of older and disabled people.

Specialised transport services

- Assist in providing specialised door-to-door transport services for those most severely disabled people who experience particular difficulties and who cannot use public transport.

Taxis

- Implement the recommendations agreed by the Joint IRU-ECMT Task Force for taxi services, and in particular:

- Encourage regional and local authorities to secure the provision of accessible services in their areas.

- At national, regional and local levels as appropriate investigate the need for direct and indirect subsidies to enable people with mobility handicaps to make use of taxis where there is no accessible alternative.

- At national, regional and local level consider the possibility of incentives (financial and/or legislative) to encourage the purchase and operation of accessible vehicles.

- In cooperation with other Governments and international bodies and in consultation with industry and with older and disabled people, draw up design parameters for accessible taxis (based on ISO standards for wheelchair dimensions).

REQUESTS:

Member countries to:

- Disseminate this Resolution widely in their countries.
- Implement this Resolution and the related documents to which it refers.
- Report regularly on progress towards implementation and on general improvements in accessibility.

Associate countries to:

- Subscribe, as far as possible, to the principles and recommendations contained in this Resolution.
- Discuss implementation and other policy issues with ECMT Member countries.

The Committee of Deputies to:

- Continue to work closely with governments, industry, older and disabled people to review progress on implementing these recommendations.
- Update regularly the Guide to Good Practice and other reports.
- Take new initiatives, wherever needed, to improve safe and accessible mobility for older and disabled people.

PREVIOUS ECMT RESOLUTIONS SUPERSEDED BY PRESENT CONSOLIDATED TEXT[1]

97/4 Reciprocal Recognition of Parking Badges for Persons with Mobility Handicaps.

97/3 Comprehensive Resolution on Transport for People with Mobility Handicaps.

94/2 Access to Taxis for People with Reduced Mobility.

91/8 Information and Communication.

90/4 Access to Buses, Trains and Coaches for People with Mobility Handicaps.

89/68 Access for Pedestrians.

87/63 Transport for Disabled People.

85/54 Transport for Disabled People.

81/45 Transport for Handicapped Persons Obliged to Use Wheelchairs.

78/38 Transport for Handicapped Persons.

NOTE

1. Resolutions available at **www.cemt.org**

ANNEX 4

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT
CONFÉRENCE EUROPÉENNE DES MINISTRES DES TRANSPORTS

CHARTER ON ACCESS TO TRANSPORT SERVICES AND INFRASTRUCTURE

This Charter was adopted by the ECMT Council of Ministers on 19 and 20 May 1999 in Warsaw.

It underlines the political commitment in Europe to ensuring that all new transport infrastructure should be constructed to take into account the needs of people with disabilities.

1. The number of disabled people is growing

Disabled people make up a significant and growing part of Europe's population. With the ageing population, this number will increase substantially over the next 50 years. By 2020, there will be twice as many people over 65 in Europe as there were in 1960.

2. Everyone must have an opportunity for independent living

It is an unequivocal and agreed political objective to create a Europe in which all citizens, regardless of disability or age, have the opportunity for independent living. To achieve this, public buildings, the transport systems and infrastructure must be barrier-free.

3. New infrastructure must take account of the needs of people with disabilities

There are many new transport and infrastructure projects being planned or constructed in Europe. The lifetime of transport equipment and infrastructure can be extremely long and projects being considered now will remain in service well into the next millennium. It is therefore essential that these are built to meet the needs of disabled people. In any case, improvements in accessibility add to the system's quality and usually benefit all travellers.

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT
CONFÉRENCE EUROPÉENNE DES MINISTRES DES TRANSPORTS

4. Governments must ensure access

All governments have a clear responsibility to ensure that these projects are designed and constructed to the highest standards of accessibility.

5. Accessibility principles must be followed

Fundamental principles applying to any project must include:

a) All projects considered for public funding (at national or international level) must, as a condition of this funding, agree to incorporate full accessibility, to approved standards or recognised best practice, into the design and construction.

b) The design concept, from its earliest stage and throughout the design process, must be vetted and approved by experts in accessibility, including people with disabilities. National governments will propose and approve suitable sources of advice. Where national governments do not have sources of advice, the EU or the ECMT will provide them.

c) The accessibility requirements must incorporate, as a minimum:

- full access for wheelchair users (up to and including those using wheelchairs of ISO standard dimensions) including, where appropriate, accessible toilet facilities and lifts;
- features to aid people with difficulties in walking, gripping, reaching or balancing (including non-slip surfaces, hand rails and handholds);
- facilities to assist blind and partially sighted people (including consistent use of colour contrast, clear signing and lighting, non-reflective surfaces, audible as well as visual announcements and tactile and audible guidance and warning surfaces and systems (where appropriate);
- facilities for people who are deaf or hard of hearing (including visual as well as audible announcements, induction loops and clear signs).

6. Public funding will be conditional

Projects will be monitored for compliance with accessibility principles. Continued public funding will be made conditional on achieving satisfactory progress with the inclusion of access features.

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Improving Transport Accessibility for All

GUIDE TO GOOD PRACTICE

Making transport vehicles and infrastructure more accessible to everyone continues to be both an important objective and a major challenge for transport authorities, operators and service providers worldwide.

Accessibility has long been considered as a transport concern only for individuals with particular mobility difficulties. But it is now increasingly recognized as an integral part of high-quality, sustainable transport systems, with benefits accruing to all clients.

Much has been done to improve the accessibility of transport systems in recent years. One of the key factors in progress has been the indispensable exchange of experience – both good and less successful – among countries having committed to working towards better accessibility.

The ECMT has prepared this *Guide to Good Practice* in order to facilitate such an exchange of experience. It addresses both countries where improvements to accessibility are under way, and those that are just now making that commitment.

With examples from recent experience in a wide range of countries, this Guide updates the ECMT's 1999 Guide, pointing to areas where progress has been made as well as to those where challenges persist.

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