European Cooperation in the field of Scientific and Technical Research

COST 335

Passengers' Accesibility of Heavy Rail Systems

Final Report of the Action

European Commission
Directorate General Transport

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Cataloguing data can be found at the end of this publication.
Luxembourg: Office for Official Publications of the European Communities, 1999.
ISBN 92-828-8223-3

Printed in Belgium

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Executive summary

This report is the output of a collaborative European project in which experts from seventeen countries and four international organisations took part. The participants represented railway operating and manufacturing industries, governments and academic experts in the field and representatives of disability organisations.

The purpose of this report is to provide guidance on best practice in meeting the needs of rail travellers with reduced mobility. The material in the report is drawn both from actual operating experience and from research in the participating countries and has been brought together by people with many years of experience in the subject.

The primary audience for this report is the rail industries and the public authorities responsible for transport.

For the purpose of this report, a disabled person is someone who encounters barriers in his or her environment, including transport, which prevent him or her from full and active participation as citizens. This could include people who have impairments, whether long-term or temporary, intellectual, emotional, sensory, communicative or physical, and these may be visible or hidden.

- Disabled people represent around 13% of the population of Europe. This is approximately 63 million people.
- The range of disabilities includes:
  - mobility disabled people (including wheelchair users and people unable to walk far, or at all)
  - sensory impaired people (including people who are totally blind or deaf)
  - people with cognitive and learning difficulties
  - other forms of disability, such as asthma or orientation problems.

- The share of the elderly in the total population of Europe is expected to rise from 21% now to around 31% by 2020, and to around 34% by 2050. Those aged 80+ are predicted to rise from 4% of today's population to some 10% by the year 2050. Thus, the elderly will be a larger part of the population - but with better health conditions than at present.
- When we also take account of accompanying persons and able-bodied people with temporary mobility restraints (such as young parents with baby buggies or with luggage) who would also benefit from accessible railways, we can see that accessibility already affects 35-40% of the population (170 to 194 million people). This potential market for railways could rise to at least 200 million people by the year 2020.

It will progressively become impossible for railways to resist this change. Indeed, given the large numbers of potential passengers involved, it is in the railways' interests to make positive developments to attract the extra passengers.

With regard to access to the train and to the facilities and services provided on the train, the key issues to be addressed are:

- Boarding/alighting through the doorway and the interface between platform and train floor;
- Circulation within the train;
- Seating and/or sleeping accommodation;
- Access to the facilities and services on the train (toilets, catering etc.);
- Provision of information (on board and outside the train).

Railway operators and rolling stock manufacturers must consider the needs of potential users and ensure that the train and the facilities and services provided on the train are accessible to all. This can only be achieved by basing

rolling stock design on functional criteria obtained from the knowledge of human capabilities (design-for-all).

Steps and gaps are a real barrier to persons in wheelchairs and even to persons walking with great difficulties.

Boarding aid devices such as ramps or lifts (at present operated by staff from the platform or from the coach) must be considered as a temporary measure to overcome gaps and steps between station platforms and trains. They pose problems of reliability, staff availability, safety and traffic management. Train operators need to consider technical issues, human factors and economic factors to improve welcome of their customers in the short term.

A real improvement of accessibility to trains for all passengers can only be made when station platforms and coach floor heights are at the same level and the horizontal gap (if greater than 50 mm) is filled by a bridging plate.

Good access benefits passengers because it is easier and safer to board and alight the train, and benefits the operator as it can reduce the stopping-time at stations.

In many ways access to rail travel for many people depends on the lay-out and facilities at railway stations and how well these are maintained. This report sets out its station design and procedure recommendations to planners and transport professionals. Many barriers to rail travel occur at transport interchanges. All rail journeys start and end at railway stations. Therefore it is clear that measures taken to improve access at railway stations are extremely important to the overall journey.

As part of this project a design handbook for accessible stations has been developed. The intention was to create a user-friendly handbook with examples of existing best practice for those responsible for planning and developing

both existing and new stations. The recommendations are not intended to be prescriptive, or to limit innovation. And the drawings provided in the handbook are examples only and are not intended to illustrate the perfect solution.

For the Stations Handbook, certain general features of station design such as visibility, design of steps and ramps are identified, and the design principles to apply to these features are outlined. Then the journey of a passenger through the station is followed, outlining the principles for each specific station feature encountered on the journey.

Everyone travelling by rail needs information in order to travel in safety, in comfort and independently. They need to evaluate the possible choices and then make informed decisions about the journey.

Disabled passengers may need more information than others because they cannot make assumptions about access to the different stages of their journey. In addition, the traditional ways that the rail industry provides information may not suit a disabled passenger – who may have, for example, a sight or hearing impairment and needs the information presented in a format accessible to him. In whatever form information is made available it should meet the four criteria: clear, concise, accurate, timely.

This report shows the various stages of a journey from A to B, the sort of information people need at each stage, and how that information should be provided, including specific information for disabled passengers.

All rail industry staff need training – from the Board to the train cleaning crew. This report shows what the training should cover, in particular for:

- senior and middle management,
- design and development staff,
- front-line staff.

An effective way to instruct staff about the problems and barriers that disabled passengers encounter on their journey is to chart the journey a disabled passenger would make and to identify the barriers en route. In addition, staff need to be fully trained in health and safety issues relating to equipment used, and in the preferred way that disabled people wish to be assisted.

Just as the customer service qualities of job applicants are taken into account in staff recruitment, so attitudes towards disabled people should be considered. Recruiting the right staff to begin with will help ensure than any training provided is effective.

In the context of this study it has not been possible to do a comprehensive cost-benefit analysis, the reasons being that no single equation is possible because every railway in Europe has a different starting point. It may, however, be obvious that because an increase in accessibility results in an increase in the total quality of the rail service, such a service will attract more passengers and therefore generate more income for the transport operator.

The cost can be distinguished between the expenditure involved in making existing rolling stock accessible by retrofitting, and the cost of building new trains on the basis of an accessibility design. Generally, retrofitting is usually more expensive than building new trains, and the additional cost involved for new accessible rolling stock is considered to be relatively minor.

Experience with accessible bus transport in various countries has shown an increase in patronage of some 15%. Conclusions from a 1993 study undertaken in the Netherlands on the effects of accessibility showed that with a minimum scenario of accessibility improvements, the number of journeys by people aged 55+ in rail transport will increase by two additional trips per person per year.

From consideration of the general needs of the rising population of disabled and elderly people across Europe, and the guidance and examples given in this report, it is clear that increases in passenger numbers *can* therefore be achieved through making public transport accessible to disabled people. However, this requires much more than just providing boarding equipment for wheelchair users to get on a train.

What is required is a commitment to a two-fold strategy:

a) The removal of *all* barriers to travel by rail, for *all* members of society.
b) Positive marketing plans to promote rail travel, particularly targeted at individuals and groups who are inhibited by their disability from considering rail travel.

The potential demand can only be reached through a strategy of progressive removal of the barriers to travel affecting disabled and elderly people.

To turn the potential into real demand, railways must develop marketing strategies which segment the demand, identify the key user benefits and communicate with the target markets.

The railways of Europe have much to gain and little to lose from a planned approach to accessibility. Substantial market growth can be achieved, and the potential market for accessible rail travel is already at least 170 million people.

1. Introduction

This report is the output of a collaborative European project in which experts from seventeen countries and four international organisations took part. The participants represented railway operating and manufacturing industries, governments and academic experts in the field and representatives of disability organisations.

The purpose of the report is to provide guidance on best practice in meeting the needs of rail travellers with reduced mobility.The material in the report is drawn both from actual operating experience and from research in the participating countries and has been brought together by people with many years experience in the subject. The primary audience for this report is the rail industries and the public authorities responsible for transport.

The report states clearly that providing full accessibility is not only a necessity on social grounds, it is also both a necessity and an opportunity on economic and marketing grounds.

Disabled and older people represent a significant and growing part of Europe’s populations whose desire to travel for business and for leisure represents a potential major new source of revenue for the railways. It is also important to recognise that making facilities and services better for disabled people makes them better for everyone.

The final target is clear and unambiguous: there must be full accessibility for disabled and elderly people to Europe’s rail networks. Strategic guidance is given on how this might be achieved.

However, the report also recognises that the industry has, in many areas of Europe, a legacy of old stations, infrastructure and rolling stock and also heavy financial

burdens. As a result, a number of compromises and interim solutions are also demonstrated, which can provide substantial improvements in accessibility relatively quickly and at lower initial cost.

The guidance covers the needs of people with a wide range of impairments: physical, sensory and intellectual. Organisations of disabled people in the participating states have contributed their comments to the draft. The guidance does include a great deal of material specific to the needs of wheelchair users. This is not an indication that they are of greater importance – or indeed as numerous as people with other kinds of impairment. It is simply because in design and operational terms wheelchair users represent the biggest challenge for the industry.

The guidance is not intended to be a definitive text book on accessibility. Circumstances will vary and there is no substitute for involving disabled people at national or regional level in the development of specific projects. It will, however, we hope, stimulate fresh ideas and highlight key issues that will help those responsible for the future of Europe's railways to ensure that they are inclusive of the needs of all our citizens.

2. The case for accessible railways

This chapter summarises the key demographic details and social and legislative trends relating to Europe. These data indicate a substantial *potential* demand, of strategic importance.

2.1. Definition of disabled person

A disabled person is someone who encounters barriers in his or her environment, including transport, which prevents him or her from full and active participation as citizens. This could include people who have impairments, whether long-term or temporary, intellectual, emotional, sensory, communicative or physical, and these may be visible or hidden.

In the last decade many European countries have learned that disability is not only about wheelchair users and, more importantly, that some environments can cause disability in a broader range of the population.

Most people with visual impairments are not totally blind. They have residual vision and require strong colour contrast, adequate lighting, easy to find signs and large lettering to make best use of their vision. People who have speech impairments find it easier not to have to ask for information - and if they are also deaf they will not be able to hear audible announcements. Clarity of visual information helps everybody.

Not all people with hearing impairments are totally deaf. Many of them use hearing aids and require clarity of spoken announcements. A great number of passengers may have difficulty with loudspeaker announcements because of the noisy station environment (train passing along the platform, for example). Clearly spoken information with visual supports helps everyone.

Orientation problems are not only caused by intellectual impairments. Many passengers are strangers in the area or in the country. Many passengers do not know the language and they also need support in finding their way. Pictograms may solve some language problems. Other solutions are the design of stations, especially the physical layout. Too many tunnels and stairs and 180 degree turns will cause disorientation to many a passenger.

And too many shopping kiosks blocking the route may confuse even the most experienced passenger. Feeling lost in a strange station is not limited to passengers with intellectual impairments.

People are increasingly developing allergies, including asthma, and clean air and the use of non-allergenic materials is vital if they are to travel by train. Providing well defined areas of “clean air” is good for everyone.

People with mobility impairments include people walking with canes or crutches, as well as elderly people who walk slowly and cannot carry heavy luggage. They experience difficulties passing over high steps, walking along distances and even using escalators. Accessibility can also benefit a wider range of the population. People with reduced mobility include families with small children and a lot of luggage, including perhaps a pram or a push-chair. And everyone with a suitcase in each hand has difficulty entering a station if the door does not open automatically. It is therefore obvious that everyone will profit from level access and from the increase in comfort. Department stores have understood this for a long time.

And we can all expect to develop mobility, sight, hearing or even intellectual impairments, if we are looking forward to an old age. So the measures proposed in this report are of benefit to us all.

2.2. Numbers and scope of disabled and elderly people

- Disabled people represent around 13% of the population of Europe. This is approximately 63 million people.
- The range of disabilities includes:
  - people with mobility impairments (including wheelchair users and people unable to walk far, or at all)
  - sensory impaired people (including people who are totally blind or deaf)
  - people with learning difficulties
  - other forms of impairment, such as asthma or orientation problems.
- Disability increases with age; approximately two-thirds of disabled people are elderly.
- The share of the elderly in the total population of Europe is expected to rise from 21% now to around 31% by 2020, and to around 34% by 2050. Those aged 80+ are predicted to rise from 4% of today's population to some 10% by the year 2050. Thus, the elderly will be a larger part of the population - but with better health conditions than at present.
- When we also take account of accompanying persons and non- disabled people with temporary mobility restraints (such as young parents with baby buggies or with luggage) who would also benefit from accessible railways, we know that accessibility already affects 35-40% of the population (170 to 194 million people). This potential market for railways could rise to at least 200 million people by the year 2020.
- Without accessible policies, railways can therefore only target 60% of the population.

Figure 2.1. People with reduced mobility

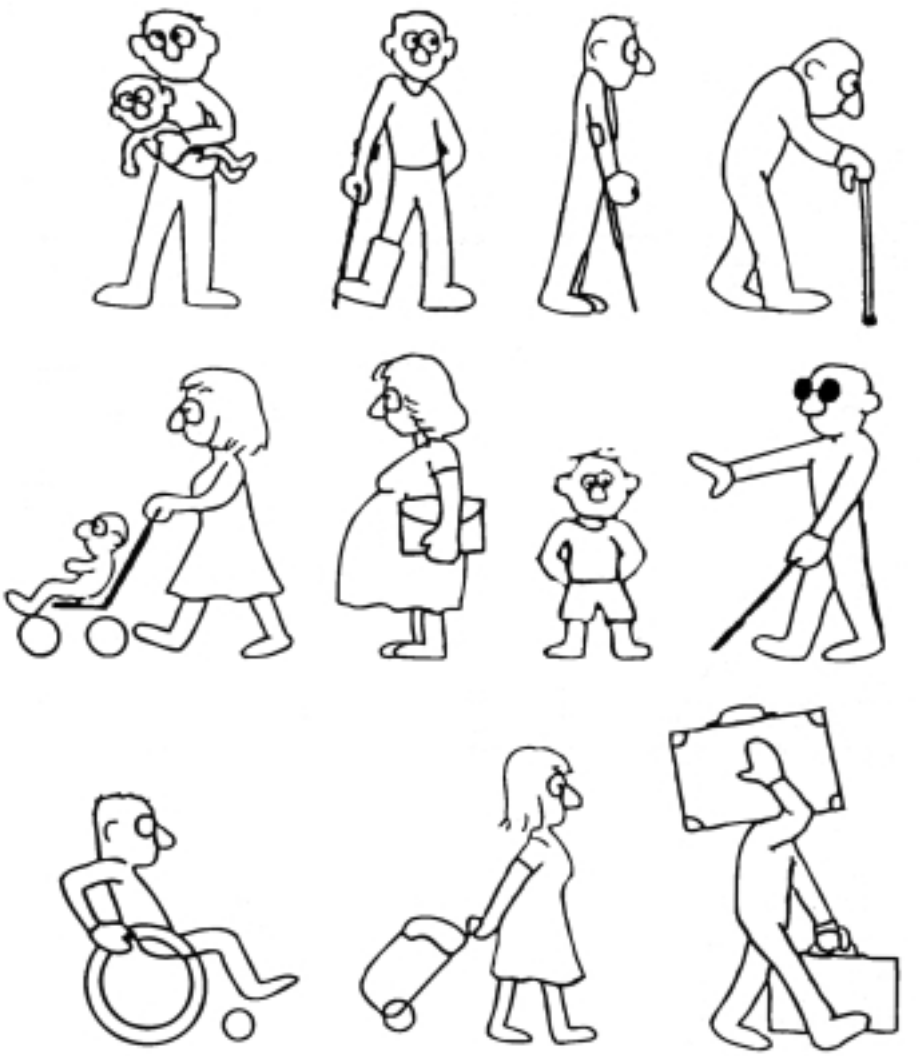
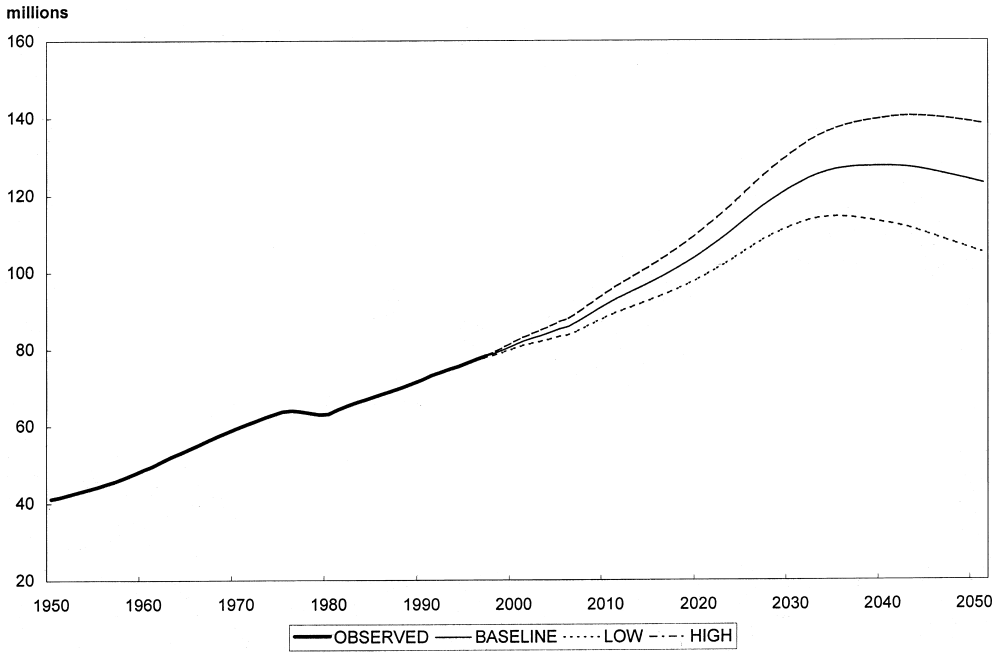


Figure 2.2. Population aged 60 and over - EUR 15



2.3. Social and legislative framework

There has been a progressive increase, over the past two decades, in the social awareness of the requirements of disabled people throughout Europe and in other parts of the world.

This progression has moved from, initially, making provision for disabled people on a welfare oriented basis, towards an increasing demand from disabled people to have equal access to all facilities as a matter of human rights.

All countries now increasingly recognise disabled people as an important part of the population, who are now demanding full integration into society, and full access to all forms of activity: education, employment, and social and leisure activities. It is also recognised that accessible transport is the key to making these facilities available; without the essential transport links, there is no access.

Now this social trend is being underpinned by human rights and anti-discrimination legislation. Reference is made to Resolution 48/96 of the United Nations containing Standard Rules on the Equalization of Opportunities for Persons with Disabilities (1994).

Examples of national legislation are:

- the Act on Facilities for the Disabled on Public Transport (1979) [Sweden]
- the Americans with Disabilities Act (1990)
- the Commonwealth Disability Discrimination Act (1992) [Australia]
- the Disability Discrimination Act (1995) [United Kingdom]

All of these make some provision for accessible transport.

Other countries are considering legislative frameworks along similar lines.

At the European Union level, various initiatives recognise the needs of disabled and elderly people. The principles have been particularly recognised in:

- The Commission Communication on Equality of Opportunity for People with Disabilities (1996).

  This sets out the European Community Disability Strategy and notes, *inter alia*, that many transport systems continue to be inaccessible or accessible only with difficulty and that the principle of “design for all” has cross-sector benefits.
- The Resolution of the Council and of the representatives of the governments of the Member States of the European Union meeting within the Council on Equality of Opportunity for People with Disabilities (1996).

  This underpins politically the principle of equality of opportunity in the development of comprehensive policies in the field of disability.

- The Resolution of the Council on Equal Employment Opportunities for People with Disabilities (1999).

  This calls on Member States of the European Union, within the framework of their national employment policies and in co-operation with the social partners and non-governmental organisations of disabled people, to place particular emphasis on the promotion of employment opportunities of people with disabilities.
- The European Union White Paper on European Social Policy (1994).

  This calls for EU-wide actions to meet the challenges of an ageing population.
- The European Union White Paper on the Common Transport Policy (1992).

  This calls for a Community action programme to include proposals for measures to improve accessibility for disabled people to all modes of transport.
- The Citizens' Network Green Paper of 1996 which stated that accessibility is a major criterion for quality of service.
- The European Union White Paper on a New Strategy for Revitalising the Community's Railways (1996).

These issues are again present in the Key Action on Sustainable Mobility and Intermodality of the Fifth RTD Framework Programme launched by the European Union.

As a result of all these social and legislative initiatives it will progressively become impossible for railways to resist this change. Indeed, given the large numbers of potential passengers involved, it is in the railways' interests to make positive developments to attract extra passengers.

2.4. Identifying the potential demand

A number of studies are being conducted at local level to quantify the actual increase in passengers which would

result if public transport were to become fully accessible to disabled people.

At this stage of development, some of the studies have related to other forms of public transport, but they are nevertheless indicative of positive trends in ridership.

Most of the studies to date have resulted in three clear findings:

a) There has been a discernible increase in the number of disabled passengers resulting from the provision of accessible vehicles.

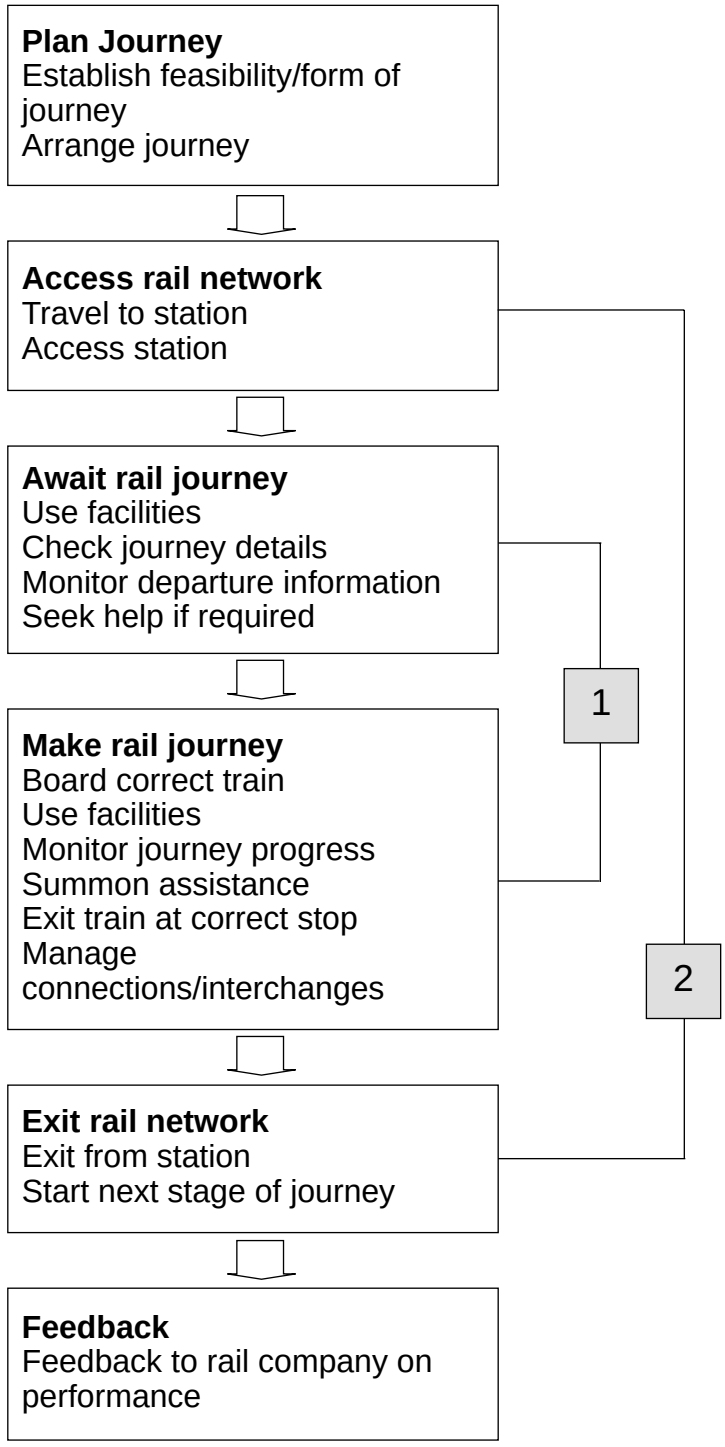
   This has not just been in relation to wheelchair users, where the previous situation was of low ridership due to vehicle design, but also among other people with mobility impairments and those with sensory impairments.

b) There has also been increased ridership of non-disabled people.

   This has included parents with baby buggies, passengers with heavy luggage and many other groups. This makes clear that improvements for disabled people also provide better access for all passengers.

c) By far the best results are obtained when *all* aspects of access are addressed. These include:
   - the rolling stock design and facilities
   - infrastructure, including station design and facilities
   - interoperability of the total system
   - intermodal transfers at stations and termini
   - information - often the key to success
   - staff involvement and training
   - as well as, of course, the surroundings of the stations, including the park and ride facilities and the distances within stations.

Figure 2.3: Main stages in a rail journey



2.5. Removal of barriers to travel

This work has been addressed in detail by several multi-national and multi-functional working groups within the study. The reports of these working groups, covering Rolling Stock Design, Stations, and Information and Training, follow in chapters 3 - 7. It is, nevertheless, important to state here the main barriers which particularly affect disabled and elderly people.

These include:

I. The physical barriers to rail travel
   Access to trains
   Access to stations and station facilities.

II. The financial barriers
   Is the journey affordable?
   Is the fare structure competitive?, etc.

III. The information barrier
   Is the information available?
   Is it comprehensible?, etc.

IV. The confidence barrier
   Can the total journey, there and back, be made with certainty?
   Will there be trained staff to help me when I need them?

V. The time barrier
   Can booking arrangements be made in time?
   Can the train be reached in time, with the help of staff, when needed?

These five elements, of which passengers' confidence is the most important, make up the concept of total accessibility, for all.

The chapters and case studies which follow make many recommendations for the removal of these barriers on all

these aspects. These recommendations are based on both research into the best ways to meet specific needs, and examples of good practice and design being operated in particular areas.

However, the role of governments, both national and European, is crucial to railway operation. Governments have the power to take political, legislative and financial initiatives. COST 335 commits participating countries to removal of barriers to rail travel for disabled people and the initiative offers real hope of government support.

3. Rolling stock design

Passenger accessibility is a very important issue that needs to be addressed when designing rolling stock for rail systems. With regard to access to the train and to the facilities and services provided on the train, the key issues to be addressed are:

- Boarding/alighting through the doorway and the interface between platform and train floor;
- Circulation within the train;
- Seating and/or sleeping accommodation;
- Access to the facilities and services on the train (toilets, catering etc.);
- Provision of information (on board and outside the train).

Railway operators and rolling stock manufacturers must consider the needs of potential users and ensure that the train and the facilities and services provided on the train are accessible to all. This can only be achieved by basing rolling stock design on functional criteria obtained from the knowledge of human capabilities.

3.1. Requirements for passengers with reduced mobility

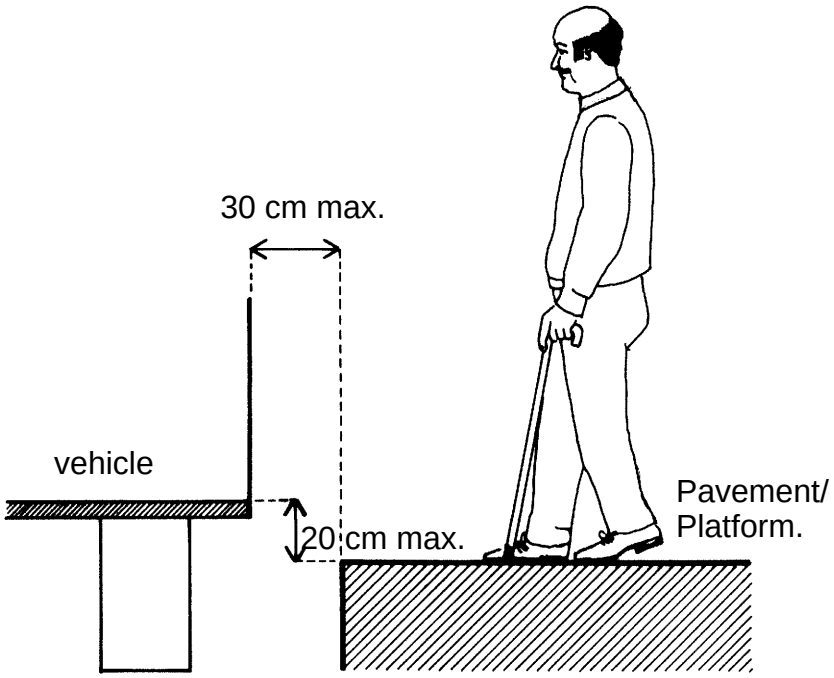
3.1.1. People with mobility impairments

People with mobility impairments most at risk when considering access to the train are those with walking difficulties and those with gripping problems resulting from impaired upper limbs, arthritis, small size etc.

Stepping over the gap between the platform edge and the first step in a coach doorway, and climbing any other steps is a difficult manoeuvre for people with walking difficulties, even if ergonomically designed handrails are provided. The maximum gap and step dimensions that can be tolerated

are shown on figure 3.1. Shorter gaps should be looked for, so that they require less effort and concentration.

Figure 3.1. Gap or step requirements for motor impaired people (source Oxley, 1985)



Access along a corridor, through a vestibule and interior door may require a wider throughway for people who have walking difficulties than for wheelchair users, especially for those with walking sticks or crutches. The preferred minimum width for a throughway would be 1 m. However, for circulation within the train the requirements for a wheelchair user should be manageable by other people with mobility impairments.

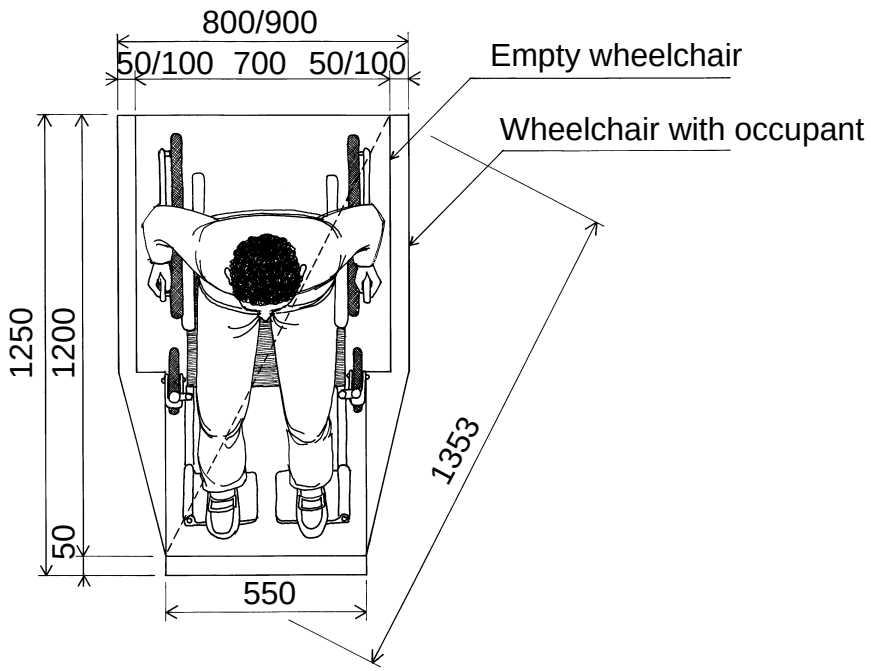
Handrails and handholds provide essential help at doorways into coaches and for circulation within the train, especially when the train is moving. In order to provide an efficient grip, attention should be paid to their position and shape. More details are given in the following sections.

Push buttons (call for stop, door opening, emergency etc.) should be designed and located for easy identification and operation.

3.1.2. Wheelchair Users

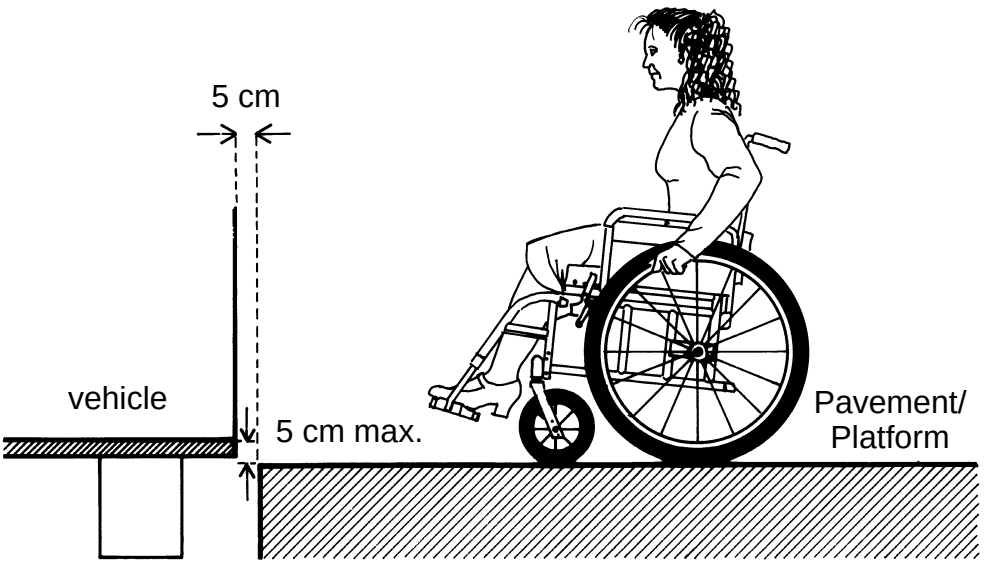
Wheelchair shapes and dimensions vary considerably. Manually operated wheelchairs are the most common in use, although electrically powered models are becoming more numerous in many European countries. For the practicability of access to trains, the minimum acceptable dimensions for an occupied wheelchair are derived from the unoccupied wheelchair dimensions in ISO Standard 7193 (figure 3.2), but take into account the heavier weight of electric wheelchairs (total load at least 300 kg).

Figure 3.2. Figure of wheelchair-measurements



Crossing a gap is the greatest difficulty for a wheelchair user, mainly due to the small front wheels. The maximum recommended gap dimensions are shown on figure 3.3.

Figure 3.3. Maximum gap dimensions for wheelchair users without assistance



Going up and down a ramp is another demanding manoeuvre for a wheelchair user without assistance. Useful information has been gathered from experience with access ramps in low-floor tramways and buses. Wheelchair users can cope with steeper gradients than for street infrastructure, provided that a handrail can be grasped in the doorway or corridor and that the upstands at both ends are minimal. However, the maximum gradient that can be managed is dependent on the length of the slope, the requirements for which are detailed in the following sections. It must be stressed that assistance may be needed to passengers using a manual wheelchair and having weak strength in their arms.

Passing along a corridor and through a doorway requires a clear width greater than the width of the occupied wheelchair to allow space for hands and elbows.

Access to the wheelchair space and to wheelchair accessible facilities (including the vestibule) may require

sufficient space to enable a wheelchair to be turned through 180°.

Push buttons should be reached, identified and operated easily.

Unobstructed clearance should be provided underneath a table or wash basin that is to be used by a wheelchair user.

Safety for wheelchair users during a train journey should be ensured at the same level as for other passengers. The wheelchair must be positioned facing or back to the direction of travel to maintain its stability. A restraining device for the wheelchair or for the occupant is not considered necessary for safety, as the dynamic forces in a train are lower than in road vehicles.

Access to catering services and other facilities: Where catering services and other facilities (telephone, fax machines) are available in the train, access to them should be provided by direct access to the appropriate area. Where it is not possible (existing or refurbished rolling stock) it must be provided by other means such as a trolley service or a special service upon request.

When toilets are fitted in a train, an accessible toilet must be provided adjacent to the wheelchair accessible area.

Further details are provided in the following sections.

3.1.3. Sight Impaired People

Blindness implies a total or near total loss of the ability to perceive form. Low vision implies an ability to utilise some aspects of visual perception, but with a greater dependency on information received from other sources.

To assist sight impaired people, highly visible and tactile indications should be used on or adjacent to all power-

operated controls throughout the train. The height of the tactile indications above the floor level should be consistent.

When designing on board and external information using pictograms and text, consideration should be given to:

- Colour and tonal contrast
- Colour/tonal combinations
- Intensity of light and luminance
- Legibility of text characters: type size (which depends on the viewing distance and angle), typeface style, contrast
- Glare and reflections.

3.1.4. Hearing Impaired People

Hearing impairment can affect the whole range or only part of the auditory spectrum which, for speech perception, the important region is between 250 and 4,000 Hz. Hard of hearing persons are those with mild to severe hearing loss but who can benefit from amplification.

Sound systems with loudspeakers should be designed with the aid of professional advice. Providing more loudspeakers allows for a reduction in volume without reducing penetration of the sound. Attention should be paid to the quality of recording devices when used.

Passengers who have hearing aids with “T” (telephone) switches can amplify sound via low-cost induction loop systems.

3.1.5. Safety issues

Safety and emergency situations need special consideration when disabled passengers are on board the train. For example, visually impaired people may not notice a flashing light, hearing impaired people will not hear train failure and emergency announcements, and people with

mobility impairments may need assistance in case of emergency evacuation of the coach.

- In the case of failures and emergencies, train staff must inform the passengers and give oral instructions. Recommendations for information systems appropriate for sight and hearing impaired people are described in the report. However, train staff must always make sure that the information has been received.
- Controls for assistance and emergency alarms are fitted in the coaches. Special control systems must be provided in the accessible toilet as well as in the designated area for wheelchair users. Recommendations on their appropriate location and design are given in this chapter.
- Disabled passengers may need special assistance for evacuation in case of emergency. Particularly difficult situations may be encountered if the train has to be evacuated to the ground level and even more so within a tunnel.
- Failure of mechanical or electrical systems may be encountered on a train during a journey. It is important that any special access equipment incorporates emergency means of deployment so that wheelchair users can be safely disembarked from the train.

Appropriate emergency procedures must be produced and approved and all the train staff and rescue teams must be trained in the use of the procedures.

It may be worth considering the procedures and special equipment in use with:

- Eurotunnel for the Shuttle,
- SLTC (Societe Lyonnaise de Transport en Commun) for the accessible underground line in Lyon (France).

3.2. Access to the train

3.2.1. General Remarks

Designing good access to the train provides advantages not only for disabled people but also for all other passengers and for the operator.

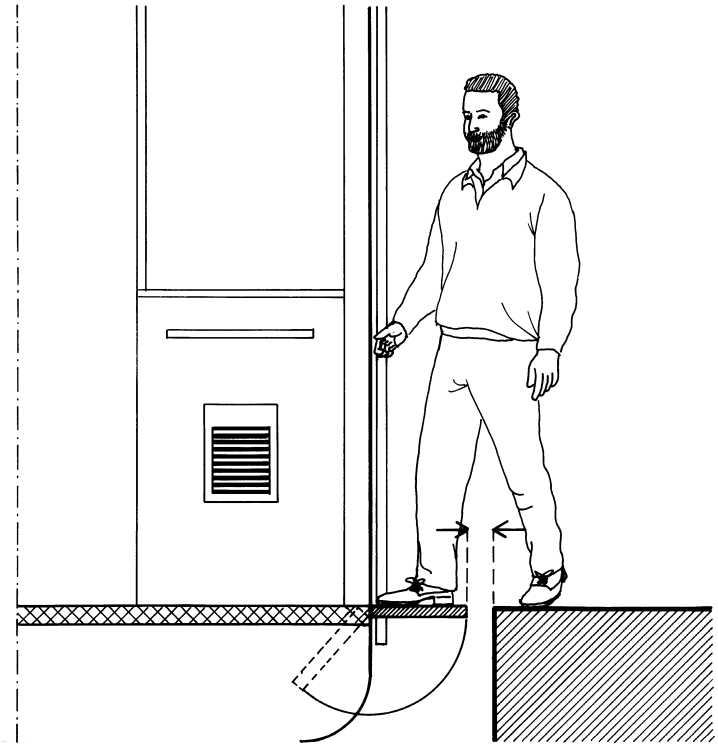
Good access benefits passengers because it is easier and safer to board and alight the train, and benefits the operator as it can reduce the stopping-time at stations.

Whereas underground and some suburban railways operate on dedicated infrastructure, most main line and long distance trains share the infrastructure with freight traffic, which puts constraints on their design. Steps and gaps are often difficult to avoid, which causes considerable problems to disabled people, especially to wheelchair users.

A real improvement in accessibility for all passengers can only occur if platform and coach-floor heights are at the same level (figure 3.4). Unfortunately to achieve this ‘level access’ on existing railways would mean in most instances new installations and/or new trains.

The requirements given below are for future main line trains operating over existing infrastructure. All new railway systems should comply with the optimum requirement for a level access between platforms and trains.

Figure 3.4. Level access for new railways



3.2.2. Access Doors

Train access doors must fulfil the following requirements:

- Contrasting colour and tone should be used for easy identification of the doors, steps and handrails.
- The entrance should be well illuminated.
- Access doors must be clearly identifiable by sight impaired people.

  Spaces between coaches should be distinctively different from access doors.
- Access doors must have an effective clear throughway of at least 800 mm. *The preferred minimum dimension is 850 mm.*
- Door opening and closing should preferably be automatic or remotely operated.

- Door operation, if not automatic, should be by means of simple control devices (push-buttons, levers etc.) in contrasting colour and tone to the background (red should not be used as this is associated with stop or danger). Control devices should be operable with the palm of the hand and must not require a force greater than 10N to operate. The highest point of any control device must be at a maximum of 1300 mm above the floor, *although 1200 mm is preferred.*
- Control devices should be illuminated for easy identification and have tactile indicators in a contrasting colour on or adjacent to them.
- A system to lock the doors automatically while the train is in motion must be provided. Also, the system must only enable doors on the platform side of the train to be opened when standing in a station.
- An audible signal and a visual signal (flashing light etc.) should be provided both inside and outside the coach as a warning that the doors are about to close.

3.2.3. Steps, Handrails and Handles

Train access doorways must fulfil the following requirements:

- The vertical gap between the platform and the bottom step, and the height of each step, when there are more than one, must not be greater than 200 mm.
- Steps should have an effective tread depth of 280 mm and must not be less than 200 mm.
- Overhanging step nosings should be avoided.
- A horizontal gap should not exceed 300 mm.
- Doorways with more than one entrance step must be provided with non-slip handrails on both sides of the doorway, fitted internally as close as practicable to the coach outer wall. *100 mm is the preferred maximum distance.* They must reach to a height of between 800

mm and 900 mm above the bottom step and must be parallel with the line of the step nosings (see figures 3.5, 3.6, 3.7). A vertical handrail must also be provided for motor impaired people when stepping on and off the train (see figure 3.5).

- Doorways with only one entrance step must be provided with vertical, non-slip handrails on both sides of the doorway, fitted internally as close as practicable to the coach outer wall. They must extend from 700 mm to 1200 mm above the threshold of the first step.
- All handrails must be round in section with a diameter of between 30 and 35 mm and must have a clearance of at least 45 mm to any adjacent surface for easy grasping. Also, they must be in a contrasting colour to the background surface for easy identification.

Figure 3.5. Steps, handrails and handholds

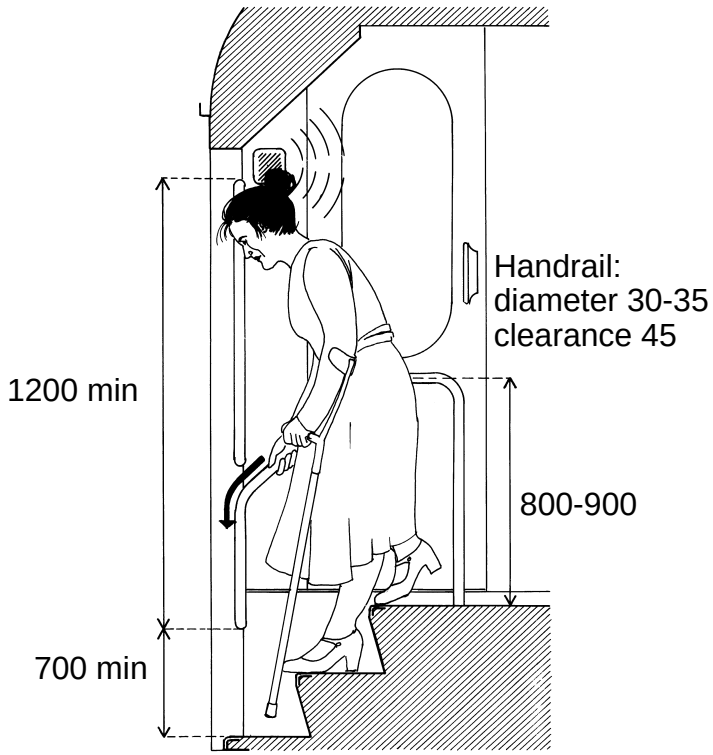


Figure 3.6. Steps, handrails and handholds

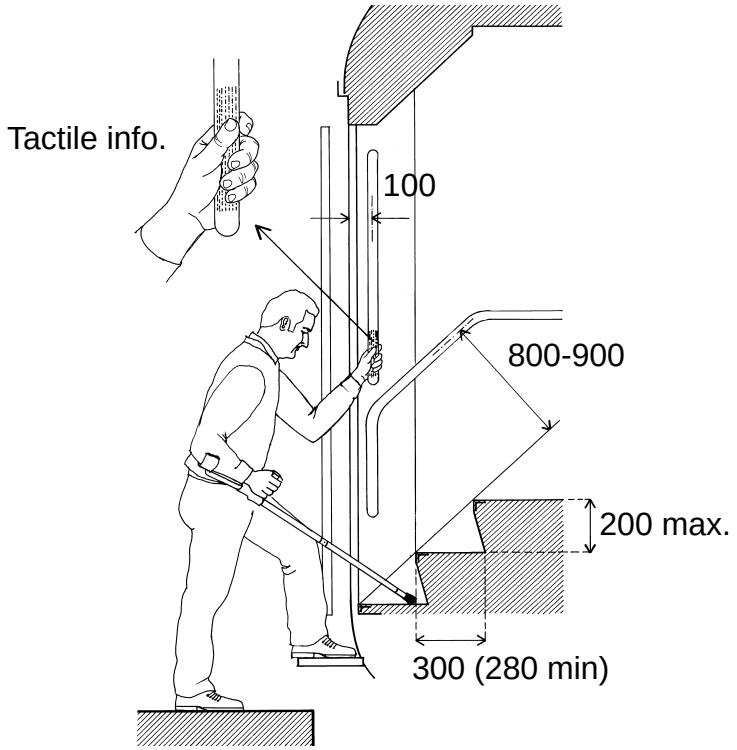
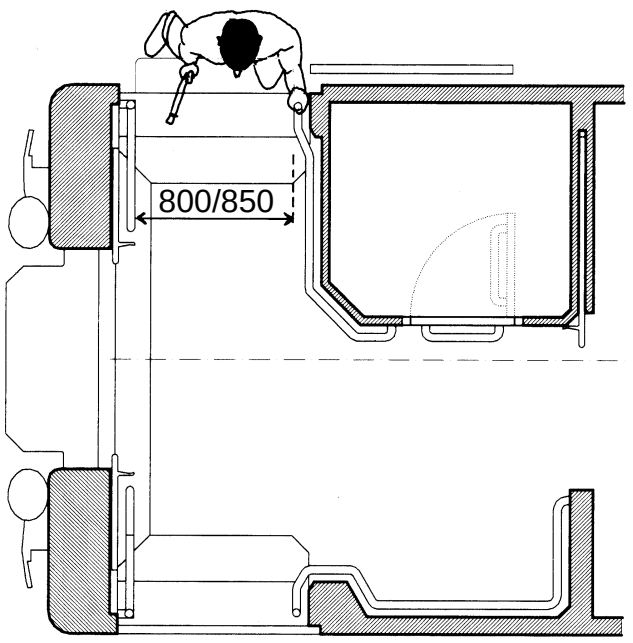


Figure 3.7. Steps, handrails and handholds



3.2.4. Special access requirements

To allow a person in a wheelchair to board and alight the train without additional help, the horizontal and vertical gaps between the platform and the train floor must *not be greater than 50 mm* (figures 3.8, 3.9)

Figure 3.8. Wheelchair users' abilities to pass over horizontal and vertical gaps

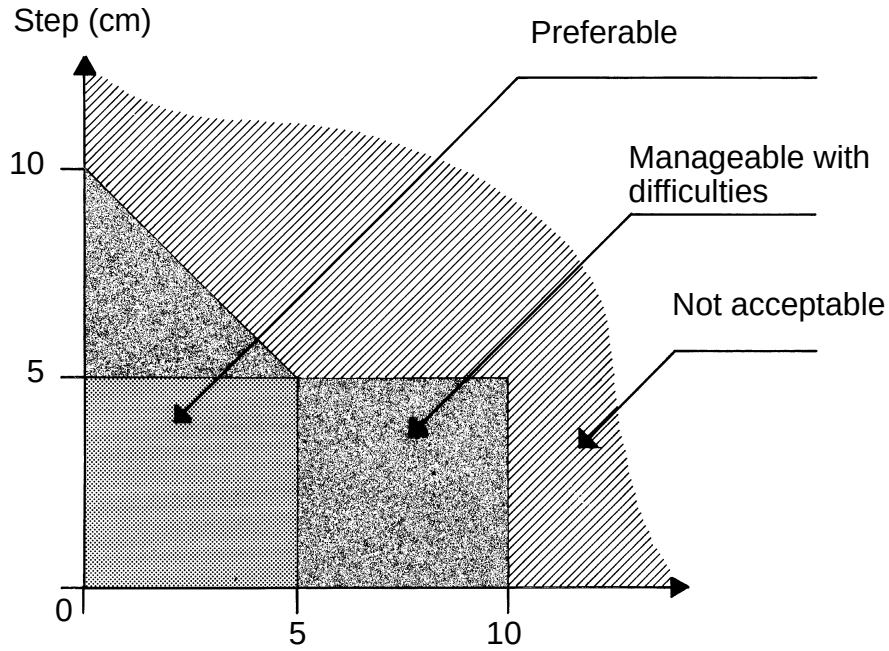
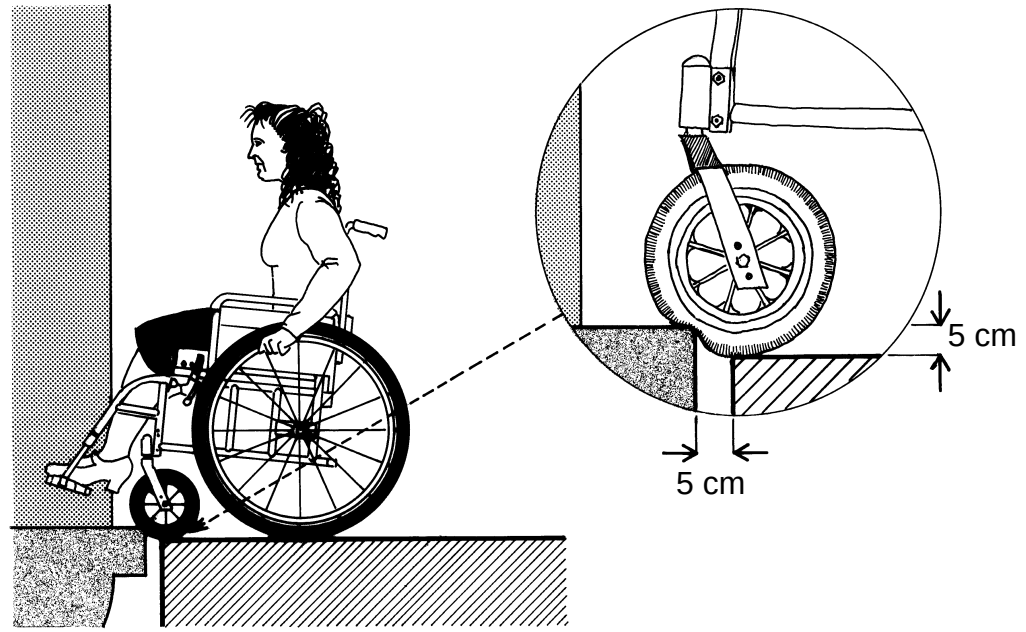
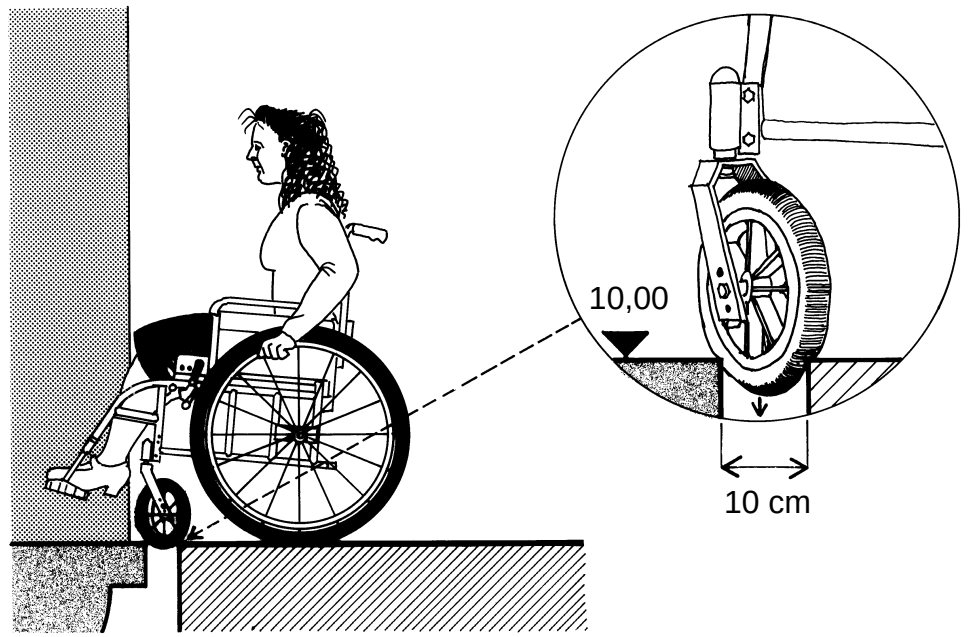


Figure 3.9. Recommended horizontal and vertical gaps for wheelchair users





Greater gaps in existing railway systems must be bridged with special devices. Several alternatives may be considered allowing, among other things for operating constraints, to ensure accessibility of the coaches fitted out to accommodate passengers in wheelchairs namely and those with severe mobility impairments:

- Access or bridging ramp: a ramp either manually put into place by staff or deployable by mechanical means and operated by staff or passenger.
- Bridging plate: a fully automatic device, integrated in the coach floor which ensures step-free access when the gap is small.
- Platform lift, operated by station staff to overcome a significant height,
- On board lift, integrated in the doorway and operated by train staff to overcome a significant height.
- Partially raised platform, located where the accessible coach door(s) stands at stop.

This issue is developed in chapter 4.

3.3. Circulation within the train

3.3.1. General remarks

Relevant facilities and installations, priority seating for use by disabled people, luggage stacks for passengers boarding with luggage, prams etc. should be accessible to all passengers. In order that disabled people should not have to walk any distance through the train, they should be situated near to the entrance doorways. Internal doorways designated for wheelchair access must provide sufficient throughway and space for necessary manoeuvres (see paragraphs 3.3.3 and 3.3.4).

An ideal solution is to locate the service facilities and installations (for example restaurant, catering) in one or two

coaches in the middle of the train. Where catering and other services are not accessible to disabled passengers, they must be provided by alternative means, such as a trolley service or a special service, upon request.

Steps and stairs are an obstacle for disabled passengers. There should be no steps inside the coach between the doorway and any area designated for the use of disabled passengers.

3.3.2. General design criteria

- All public areas should be evenly lit to enable passengers to safely manoeuvre through the train. High lighting levels alone will not necessarily result in good visibility. To ensure good visibility, harmony between the following factors is required:

  the lighting level.

  the light reflectance (or luminance).

  the colours of objects and surrounding area.

  the contrast between the object and surrounding area.

Further information is given in tables 3.1 and 3.2.

- Contrasting colour and tone should be used for easy identification of the doors, steps and grab handles.
- Shiny surfaces should not be used for interior vertical partitions.

  Where transparent panels such as glass are used, other than for coach windows, they should be clearly identified by a band of colour or other highly visible means.
- All floor surfaces should be skid resistant in all weather conditions.
- The entrance vestibule should contrast in colour and tone with other passenger areas by any means of differentiation (e.g. the floor surface).

- A strip of floor surface, of contrasting colour and tone, should be provided within 100 mm of the edge of the door sill. The strip should extend the full width of the external doorway to a depth of at least 80 mm.
- In order to enable people with mobility impairments to circulate safely, regularly spaced handrails and handholds should be provided throughout the train including passenger saloons, corridors, vestibules and inter-coach gangways.
- All handrails and handholds must be in a contrasting colour with the background.
- Sharp corners, edges and overhanging features should be avoided or must be very clearly identified.

3.3.3. Interior doors

- Interior doors should open automatically or semi-automatically and must remain open long enough to enable disabled people and passengers with heavy luggage to pass through safely.
- Door opening, if not automatic, should be by means of a simple control device (push-button, lever etc.) in contrasting colour and tone to the background (red should not be used as this is associated with stop or danger). The control device should be operable with the palm of the hand and must not require a force greater than 10N to operate. The highest point of the control device must be at a maximum of 1300 mm above the floor, although 1200 mm is preferred.
- Interior doors providing access to the priority seats and to luggage storage should have a minimum clear throughway of 800 mm. For interior doors providing access for wheelchairs, the preferred minimum clear throughway is 850 mm.
- Doors incorporating glass or any other transparent material should be highlighted with clearly visible

features (such as coloured strips) at eye level (about 1500 mm) and preferably at lower eye level (about 900 mm) for children, small passengers and wheelchair users.

3.3.4. Corridors and vestibules

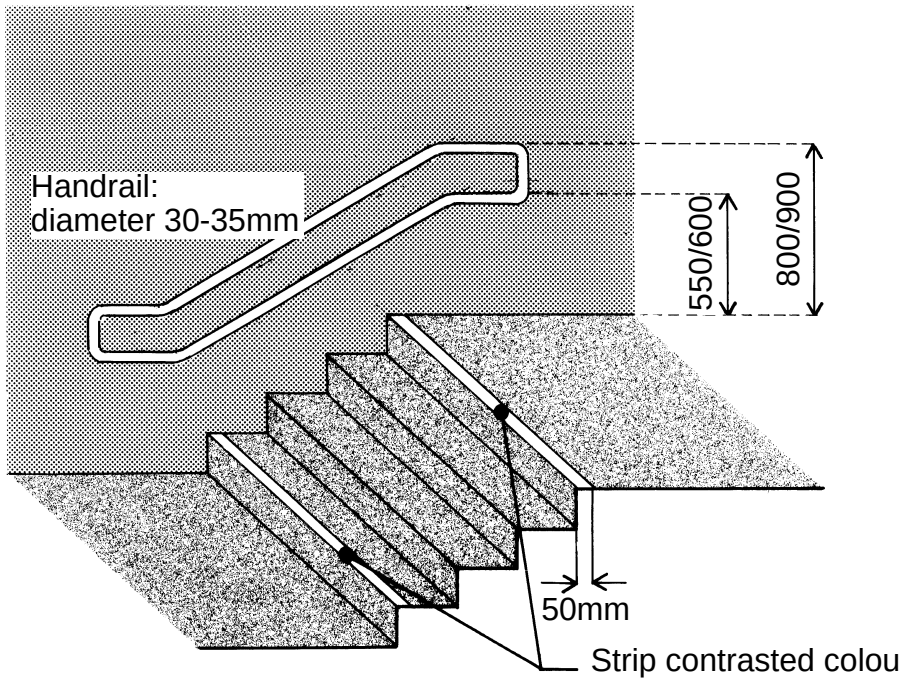
- Aisles and corridors for the use of disabled people should be at least 800 mm wide. *Where access for wheelchairs is required, the preferred width is 900 mm.*

- Sufficient space should be provided to enable a wheelchair to turn through 180. Space to enable a three-point turn is acceptable, although *a turning circle of 1500 mm diameter is preferred*.

3.3.5. Steps and stairs

- Where steps are unavoidable, each step should have a maximum height of 200 mm and a minimum depth of 280 mm. *The preferred depth is 330 mm*. Overhanging step nosing should be avoided.
- Staircases (2 or more steps) must be provided with two parallel non-slip handrails on both sides, installed at heights of 550-600 mm and 800-900 mm relative to the bottom step and must be parallel with the line of the step nosing. The handrails should extend beyond the first and last steps (figure 3.10). If a handrail is curved, the radius to the inside face of the curve should be a minimum of 50 mm.
- As a minimum, the edges of the first and last steps must be indicated by a strip of contrasting colour and tone of at least 50 mm breadth extending the full width of the steps on both the front and the top surfaces of the step nosing.

Figure 3.10. Stairs and handrails



3.3.6. Handrails and Handholds

- All handrails must be round in section with a diameter of between 30 and 35 mm and must have a clearance of at least 45 mm to any adjacent surface for easy grasping. Also, they must be in a contrasting colour to the background surface for easy identification.
- Handrails curved along their usable length must have a minimum inside radius of 50 mm.
- Handholds or vertical handrails and/or oblique handholds on the backs of aisle-side seats should be provided at regular intervals to aid safe circulation through the coach.
- Handholds must be positioned at between 800 and 1000 mm above the floor.
- All handrails and handholds must be structurally sound.

3.3.7. Interior Ramps

Where ramps are unavoidable, the following gradients are considered acceptable because of the limited space inside railway coaches.

ramp length	ramp slope
>1000mm	max. 8%
600-1000mm	max. 13%

A steeper slope up to 18% for a maximum length of 600 mm is acceptable only *for existing or refurbished coaches*.

Handrails shall be provided in accordance with the specifications above (paragraph 3.3.6).

3.4. Accommodation during the journey

3.4.1. General remarks

This section considers the accommodation requirements for disabled passengers so as to ensure that their journey can be made as easily and as comfortably as possible.

Some seating must be identified as Priority Seating. These seats provide easy and unhindered access for disabled passengers who want or need to use them. Identification of these seats makes it easier for disabled passengers to claim them.

This section also concentrates on the requirements for wheelchair accomodation within the designated coaches. It is important that access between the wheelchair accessible doorway and the saloon can be achieved easily and in a forward direction.

Although not specifically referred to in this section, any other features requiring passenger interface that may be provided within the priority seat area and the wheelchair

designated space, such as lighting controls, should be within easy reach from the seated position.

As operators are not all starting from the same point, the number of priority seats and wheelchair spaces provided per train set has to be a matter of local determination. The following principles are recommended:

- A minimum of 10% of seats or a minimum of 8 seats on each coach should be designed and designated as priority seats for use by disabled people.
- Every train set, new or refurbished, must have a wheelchair space.
- It is a matter of equality of opportunity to travel that wheelchair spaces be provided in every separate class of accommodation which is available to able bodied passengers.
- It is much better to provide at least two wheelchair spaces together; because wheelchair users may be travelling together.
- It is not necessary to equip every coach in a train set. However, long train sets should have more than the minimum number of wheelchair spaces and priority seats.

3.4.2. Priority seats

General specifications for all priority seats:

- Each priority seat shall be clearly identified by a notice with a strict obligation to give up the seat to a person who needs it. The notice shall be positioned on or adjacent to the relevant seats. The universal wheelchair symbol is not appropriate to be included in this notice, nor is any symbol that conveys illness.
- A minimum of 10% of seats on each coach should be designated as priority seats for use by disabled people.

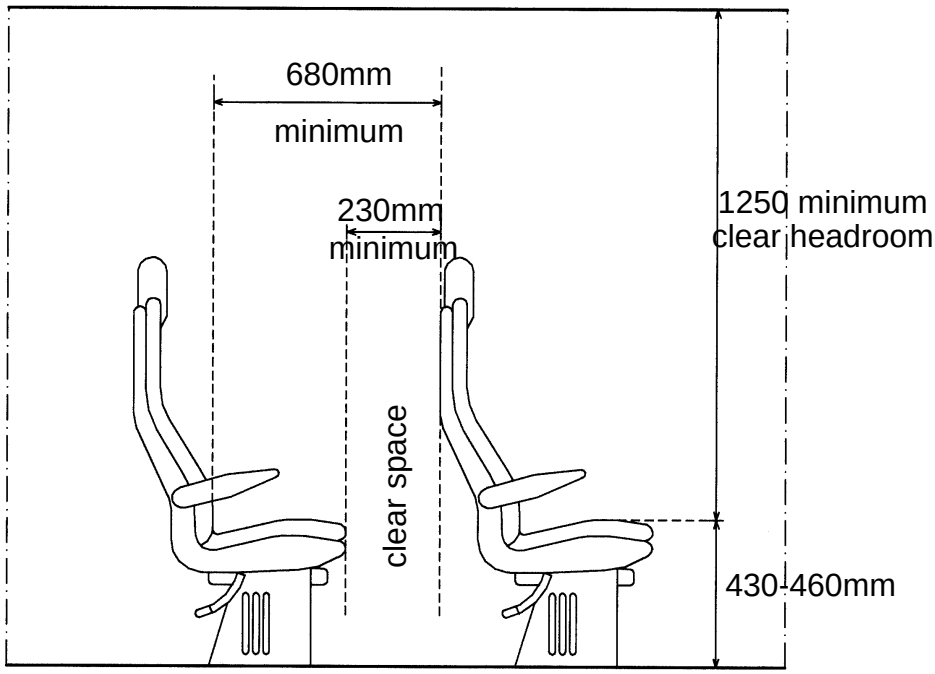
- The priority seats should be located immediately adjacent to the entrance vestibule and, in the case of double-deck coaches, some of the priority seats must be on the entrance level.
- The seat cushion for each priority seat must be at least 450 mm wide.
- To improve the ease of standing from the seated position, the top of each seat cushion must be between 430 mm and 460 mm above floor level at the front edge of the seat. The clear headroom above each seat must be at least 1250 mm from the top of the seat cushion.
- Seating that is provided specifically for wheelchair users to transfer into should have the seat cushion at 450 mm above floor level at the front edge of the seat.
- Priority seats must be equipped with movable armrests that should move to the extent required to enable unrestricted access to the seat or to any adjacent priority seat.
- Priority seats must not be capable of being tipped-up to create space for a wheelchair or for luggage storage.
- Where practicable, all priority seats should have a clear space underneath for an assistance dog. A minimum of two priority seats per coach must have a clear space beneath.
- Priority seats should be provided, wherever possible, in a mix of uni-directional seats and facing seats so there is a choice for individuals or for groups of people travelling together. The provision of facing seats is particularly important to speech impaired and to hearing impaired persons.

3.4.3 Uni-directional seats

- Where uni-directional seats are provided, there must be adequate clearance in front of each seat so as to ensure ease of access. As shown on figure 3.11, there must be

a minimum distance between the front surface of the seat back and the vertical plane through the rearmost part of the seat in front of at least 680 mm. There must also be a minimum clear distance between the front edge of the seat cushion and the same vertical plane for the seat in front of at least 230 mm.

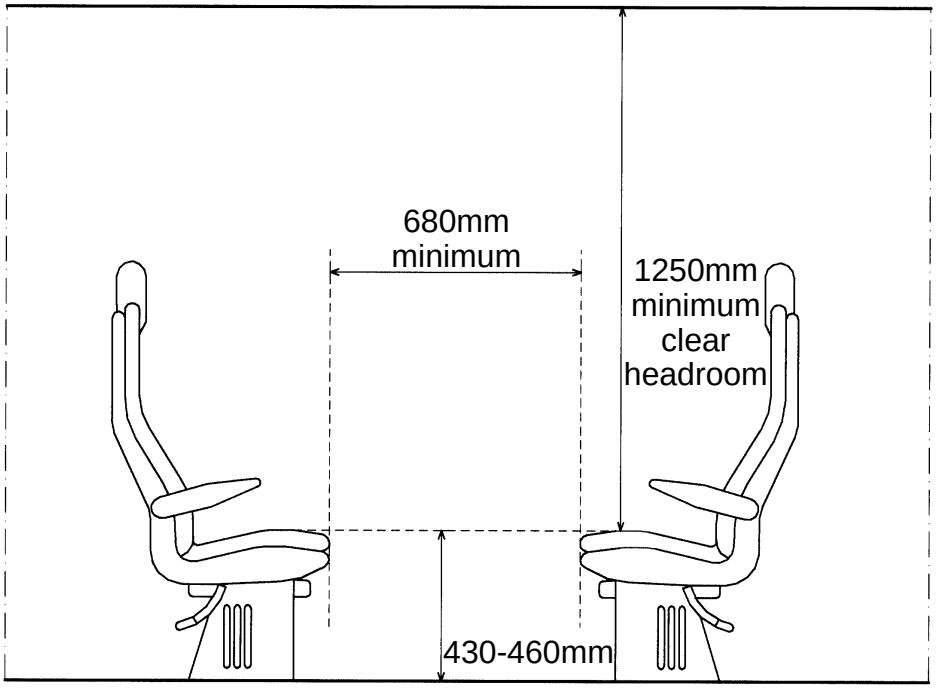
Figure 3.11. Uni-directional seats



3.4.4 Facing seats

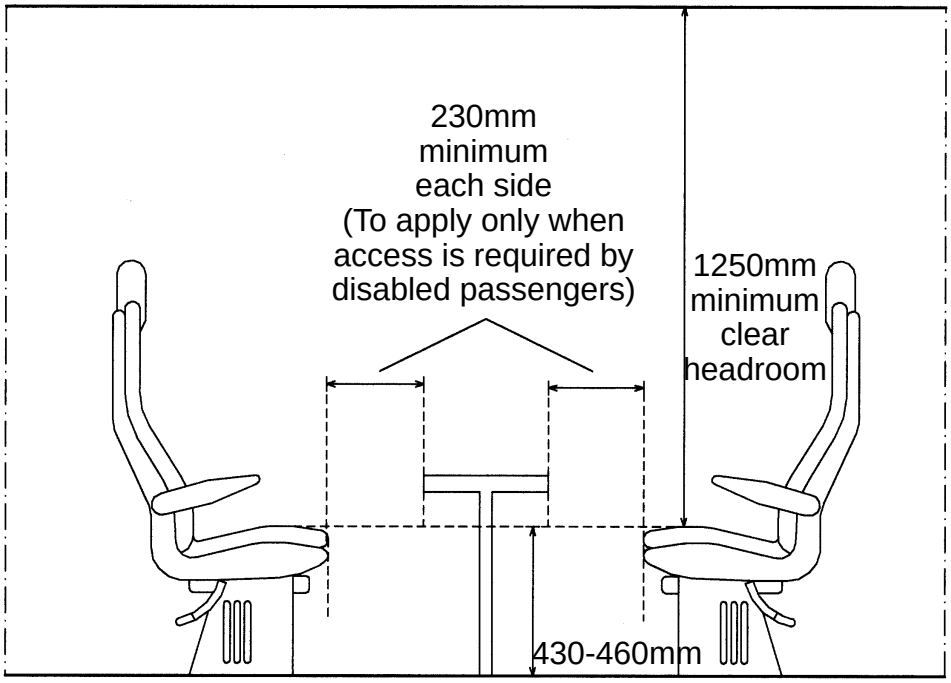
- Where facing seats are provided the distance between the front edges of the seat cushions must be a minimum of 600 mm (figure 3.12).

Figure 3.12. Facing seats



- Where facing seats are equipped with a table, there must be adequate clearance between the front of each seat and the edge of the table so as to ensure ease of access. There must be a minimum clear horizontal distance between the front edge of the seat cushion and the leading edge of the table horizontal of at least 230 mm (Fig. 3.13).

Figure 3.13. Facing seats with table



3.4.5. Reserved space for wheelchair users

Specifications for the Designated Space

- A clear space for a wheelchair, called here the designated space, must be provided in a passenger area immediately adjacent to a wheelchair accessible doorway.
- The space or spaces must be clearly identified by the International Symbol of Access (the wheelchair symbol).
- Sufficient space must be provided to enable a person in a wheelchair to manoeuvre between the accessible doorway and the designated space including space to enable a 180° turn.
- The minimum clear area for a designated space must be 1300 mm in the longitudinal plane of the coach by 750 mm in the transverse plane. *The preferred dimension is 1400 x 800 mm.*

- To maximise seating capacity within the coach it is permissible to provide tip-up or fold-up seats in the designated space provided that the above clear space is maintained.
- There must be no obstruction of the designated space between the floor and the ceiling of the coach other than an overhead luggage rack, a horizontal handrail attached to the wall or ceiling of the coach or a table in accordance with recommendations below.
- No features or fittings for the use of other passengers (magazine racks etc.) must be provided within the designated space.
- To ensure stability of the wheelchair under all operational conditions the designated space must be designed for the wheelchair to be positioned either facing or back to the direction of travel.
- There must be a structure or other acceptable fitting at one end of the space at least, that must have a minimum width of 700 mm, measured at floor level, and have a height capable of preventing a wheelchair which has been positioned with its back against the structure or fitting, from tipping over backwards.
- Wheelchair restraint systems are not generally required. However, where a restraint system is provided it should be easily operated by a wheelchair occupant, it should not cause an obstruction to access and egress and it should not represent a hazard to other passengers.
- A horizontal handrail should be provided on the side wall of the coach in the designated area. The handrail shall have a slip-resistant surface and must colour contrast with the side wall of the coach. The handrail should be at a height of between 700 and 800 mm above the floor, should be round in section with a diameter of between 30 and 35 mm and have a minimum clearance of 45 mm to the adjacent surface.

- Associated seating should be provided adjacent to the designated space for the use of accompanying passengers.
- Where tables are provided in the passenger area, the designated space must be provided with a table giving an unobstructed clearance of 720 mm between the underside of the table and the floor. The table may be fixed or designed to be hinged or folded away, but it must not obstruct wheelchair access into and out off the designated space. Any table designed to be hinged or folded away must be capable of being easily operated by a person in a wheelchair.
- For those passengers who prefer to transfer out of their wheelchairs, a stowage space, which can accommodate a folded wheelchair, should be provided adjacent to the designated priority seat.

3.4.6 Emergency Alarm

- An emergency alarm must be fitted in the designated space within easy reach of a passenger in a wheelchair. The alarm control must be operable by palm or any part of the hand press and must not require a force exceeding 10N to be operated.

- The alarm must sound a warning that will be heard by a member of the train staff who can take the necessary action. An intercom system is acceptable but other voice systems should not be used. A visual and audible indication that the alarm system is working should be provided adjacent to the designated space.

- The alarm device may be designed to be activated only when a person in a wheelchair is in the designated space.

3.5 Service Facilities

3.5.1. General remarks

On board facilities and services should be accessible to all passengers.

Where this is not possible, alternative means must be provided to ensure that disabled passengers get equivalent amenities as all other passengers.

3.5.2. Toilet specifications

General specifications for all toilets

- The centre of any door handle, lock or door control device on the exterior or interior of the toilet compartment must be located at a minimum of 800 mm and a maximum of 1200 mm above the floor.
  They must be of a suitable size and form to enable easy operation.
- Any door control device, and other equipment inside the toilet compartment must require a force of not greater than 10N to operate.
- Any control device, including flushing system, should be provided in a contrasting colour and/or tone to the background surface, and should be identifiable by touch. Clear, precise information for the operation of any control device must also be provided, making use of pictograms.
- Fixed vertical and/or horizontal handrails should be provided adjacent to the toilet pan and the wash basin. Handrails must be round in section with an outside diameter of 30 mm to 35 mm, and must have a minimum clear distance of 45 mm to any adjacent surface. If a handrail is curved, the radius to the inside face of the curve should be a minimum of 50 mm.
- The toilet seat and lid, and any handrails should be in a contrasting colour and/or tone to the surroundings.

- The flooring in the toilet compartment and in the adjacent vestibule area should have a smooth, skid resistant surface, even when wet.
- The locking mechanism must be clear and unambiguous.

Wheelchair Accessible Toilet

In addition to the general requirements above, a wheelchair accessible toilet must incorporate the following requirements:

- The toilet access door must provide a minimum clear throughway of 800 mm. *A power operated sliding door is preferred*. The exterior of the door must be marked with the International Symbol of Access.
- There must be sufficient space inside the toilet compartment to enable a wheelchair to be manoeuvred to a position adjacent to the toilet seat and, where practicable, to the front of the toilet seat. This will ensure access to the toilet for a large majority of wheelchair users.
- A horizontal handrail that complies with the dimensional requirements in the clause above must be provided at each side of the toilet seat. The handrail on the wheelchair accessible side must be hinged in such a way so as to enable an unobstructed transfer for the wheelchair user to and from the toilet seat.
- The front of the toilet seat should be at a minimum distance of 700 mm in front of the back bulkhead to enable a wheelchair to be suitably positioned for lateral transfer.
- The surface of the toilet seat, when lowered should be at a height of 475 mm to 485 mm above the floor level.
- All amenities (wash basin, soap dispenser, toilet paper etc.) should be readily accessible to a wheelchair user.
- The toilet compartment must be fitted with a minimum of two emergency alarm devices. One must be positioned

at not more than 400 mm above the floor and the other at between 800 mm and 1200 mm above the floor. The alarm devices must be operable by the palm of a person's hand and must not require a force exceeding 10N to operate.

- The alarm must sound a warning that will be heard by a member of the train staff who can take the necessary action. An intercom system is acceptable but other voice systems should not be used. A visual and audible indication that the alarm system is working should be provided within the toilet.

Figure 3.14. Example of Wheelchair Accessible Toilet

3.5.3. Catering facilities

- Access to all catering facilities should be provided for wheelchair users and mobility impaired people. Where this is not possible because of gangway restrictions in existing or refurbished coaches, location on the upper deck of a double-deck coach etc., an at-seat service or trolley service must be offered.

- Where a restaurant coach is accessible to wheelchairs, it should have a minimum of two suitable table places, one in the non-smoking and one in the smoking zone (where applicable). There should be an unobstructed clearance of at least 680 mm between the underside of the table and the floor. *720 mm is preferred.* There should also be at least one seat at these tables for an accompanying person.
- Where practicable, there should be a clear space underneath some of the seats in the restaurant coach for an assistance dog.
- Where provided, the menu and price list shall be clearly displayed and easily legible (large characters, contrasting colours etc.). One menu should be available in Braille on request from the catering staff.
- Automatic vending machines should have controls not higher than 1300 mm from the floor. *1200 mm is preferred.*

Figure 3.15. Wheelchair in a dining car

3.5.4. Communication facilities

Where a train provides facilities for communication such as telephone, facsimile machines etc., the following requirements are recommended:

- At least one of each type of device must be accessible to wheelchair users.
- The top of any part of a device that has to be reached by the user should be at a minimum of 800 mm and a maximum of 1200 mm above the floor level.
- At least one telephone should include an induction loop system. It must be identified with the appropriate international symbol.

An alternative solution for wheelchair users and people with walking difficulties would be to provide mobile facilities available on request from the train staff.

3.5.5. Sleeping facilities

Where a train provides sleeping facilities, the following requirements should be included:

- A minimum service of one compartment on each coach should be designed especially for people with walking difficulties that can be booked in advance.
- A minimum of one sleeping compartment should be accessible to wheelchair users and must be suitably equiped to enable transfer between the wheelchair and the berth. This compartment must provide for access to a toilet (figure 3.15). It must be identified with the International Symbol of Access.
- Access requirements to special compartments must be in accordance with section 3.3, Circulation within the train.
- Each special compartment must be fitted with a minimum of two emergency alarm devices. One must be

positioned at not more than 400 mm above the floor and the other must be accessible from the berth. The alarm devices must be operable by the palm of a person's hand and must not require a force exceeding 10N to operate. The alarm must sound a warning that will be heard by a member of the train staff who can take the necessary action. An intercom system is acceptable but other voice systems should not be used. A visual and audible indication that the alarm system is working should be provided.

Figure 3.16. Example of a sleeping compartment for disabled passengers

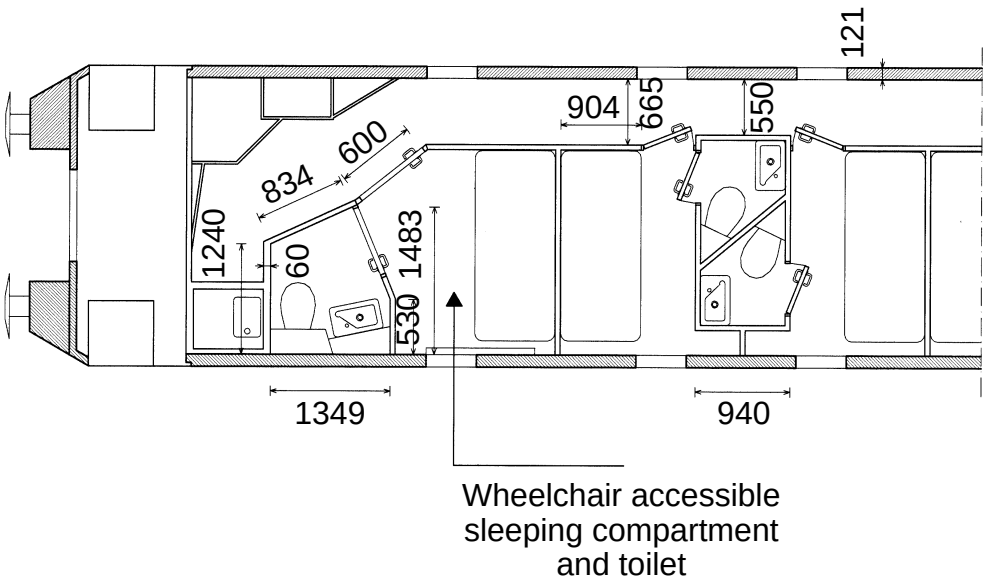


Figure 3.16.2. Example of a sleeping compartment for disabled passengers

3.6 Information

3.6.1. General statement

Good information on the exterior and interior of the train provides a comfort to all passengers with respect to their journey and helps avoid any anxiety they may have about their final destination.

Receiving audible information may be difficult or even impossible for hearing-impaired people and similarly, visual information to sight-impaired people. Therefore, it is important that information is provided through both audio and visual messages as far as possible.

Visual information is commonly displayed by means of new technologies (LED or LCD displays and video screens). The displays should be located so as to be clearly readable by all passengers under all lighting conditions, by day and by night (see table 3.1). Dynamic signs provide variable (real time) messages. Their speed of change should not be too fast; a line of text should be displayed for at least ten seconds.

To improve legibility, a mixture of upper and lower case lettering (initial capital followed by lower case) should be used. The use of serif typefaces should be avoided. Helvetica, Rail Alphabet, Frutiger and Airport typefaces, or equivalent, are recommended (see table 3.2).

For audio displays, attention should be paid to the quality of loudspeakers and recording systems (when used).

3.6.2. Information on the exterior

- The International Symbol of Access must identify the coach(es) fully accessible for all. Where special facilities are provided on any other coach, they must be identified

by appropriate pictograms, so they can be easily located from the station platform.

- The train destination must be displayed very legibly on the sides of the coaches and/or on the front of the train.
- When located on the front of the train, characters should be in letters at least 125 mm high for upper case and have a high contrast and tone with their background. At present this is best met by the use of bright yellow numerals and letters on a black background.

3.6.3. On board information

- Announcement of station stops should be made through both visual and audio means. The information must be given well in advance to enable passengers to prepare for alighting.
- A map of the nation wide network, showing distances and borders, should be displayed inside the coaches of main line trains. A map of the network of the region concerned should be displayed inside regional trains.
- Passenger information notices should be suitably located and easily readable. Text and/or pictograms should be in a contrasting colour and tone to the background.
- If on board information is provided on paper stickers the text should be in black lettering on a white or yellow background and should be easily readable.
- Where toilets are provided, their location should be indicated in the passenger saloons by means of sufficiently large pictograms. A luminous “toilet occupied” indicator should be provided that is visible to most seated passengers.
- The electro-acoustic chain should ensure a frequency range between 100Hz to 4000/6000Hz. The dynamics should prevent the signal from reaching saturation levels.

3.7. Case studies

Railway operators and train manufacturers have recently committed themselves to develop new designs for passenger coaches which facilitate access to disabled people or even provide full accessibility to all (including access for wheelchair users). Owing to the differences between platform heights of each country or region, examples of level access (with an automatic bridging plate) or step free access (with an access ramp) are described in the following case study sheets as well as examples of interior fittings.

3.7.1. Long distance trains

The first case study is the double deck coach ordered by VR in Finland. It is inserted in IC train sets to provide one accessible coach.

The second case study is the feasibility study of medium height (‘midfloor’) coaches for IC trains.

These examples show, together with the one of the TGV Duplex train operated by SNCF in France, that it is technically easier to make accessible double-deck coaches rather than standard coaches. This is due to bogie height constraints. The Talgo train design showed the way towards lower floor levels for long distance trains.

Case study 1: Intercity service coach, type Eds, for VR

Step-free entrance of the double-deck coach.

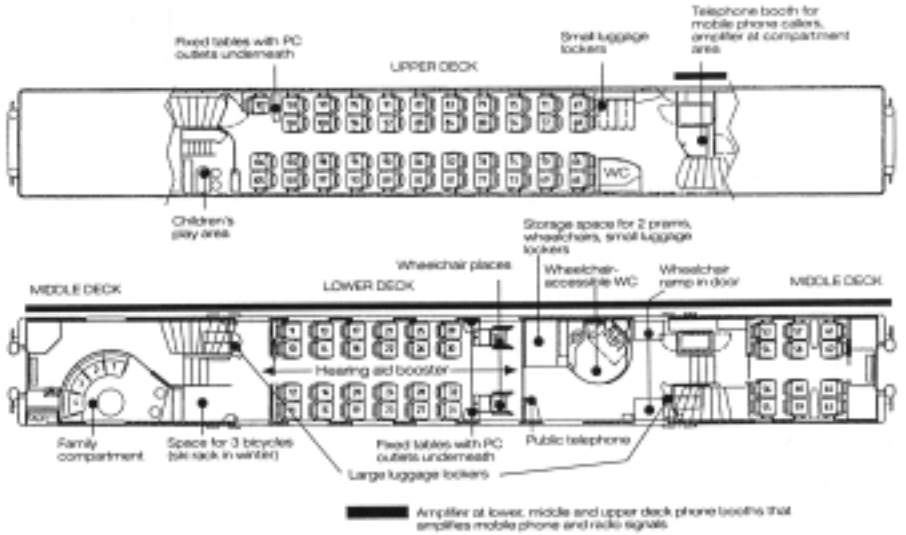
Features: New 2nd class coach with wide range of services for IC-trains. Total seating capacity, 85 passengers.

Entrance:

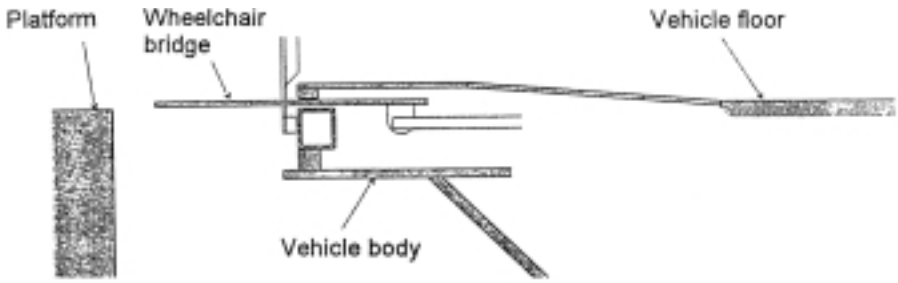
- Height of platform, entrance and lower deck, 550 mm from top of rail
- Passenger operated bridging ramp at entrance doors.
- Removable folding wheelchair ramp, operated by train crew, for earlier platform height of 265 mm.

Lower deck:

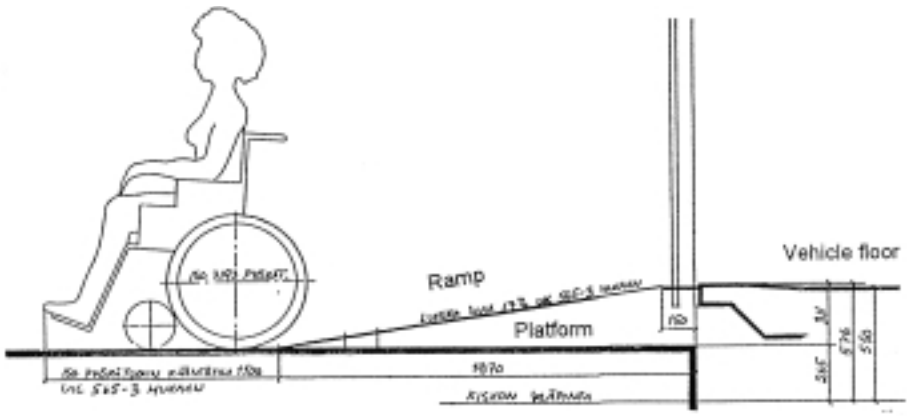
- Space for two wheelchairs in compartment.
- Wheelchair accessible toilet.
- Large luggage lockers near doors, small luggage lockers on both decks.
- Storage space for two prams or wheelchairs.
- Space for 3 bicycles / ski rack in winter.
- Hearing aid booster in passenger compartment.
- Public telephone, accessible for wheelchair passengers.



Layout of double-deck Eds coach



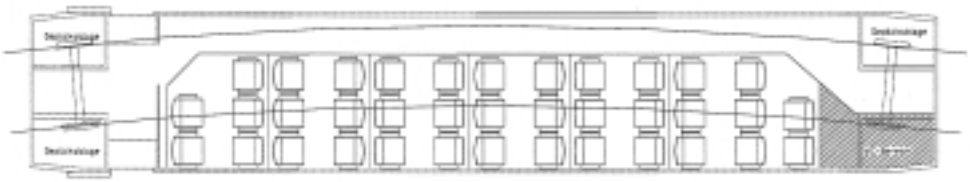
Wheelchair bridge structure. Maximum gap between bridge and platform, 50mm. Platform height, 550mm.



Operating principle of removable ramp for 265mm high platforms, which will be built to a 550mm height by year 2006.

Case study 2: New Generation of Main-line Passenger Trains

Item: Feasibility Study of the construction of new Middle-Floor passenger trains (by order of the UIC Sub-Commission Passenger Vehicles)



Articulated set of coaches, proposal of interior decoration (1st class)

Study by: Prof. Dr. M. Hecht, TU Berlin, Institut für Strassen und Schienenverkehr and Dipl. Ing. J. Wichser ETH Zürich, Intitut für Verkehrsplanung und Transporttechnik studied the feasibility of construction and operation of Midfloor-InterCity-coaches by order of the UIC, co-financed by the Swiss ministry of education and science.

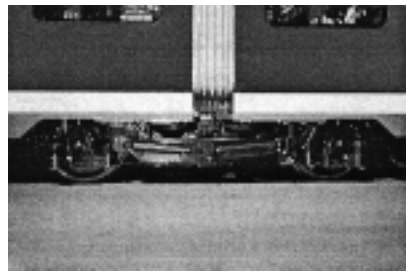
Results: It is possible to build coaches with an entrance level of 600/800mm and a floor level of 660/800mm. Therefore the entrance of the level from platform heights of 550/760mm can be offered to passengers.

Coaches can be constructed for a maximum speed of 200 km/h. Articulated trains featuring Jacobs-Bogies with special brake constructions and configurations (additional electromagnetic rail brakes and eddy-current brakes) could circulate with speeds over 200 km/h for scheduled train operations as well.

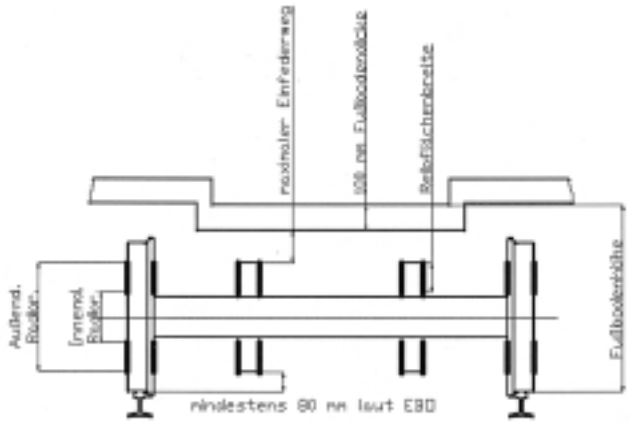
It should be possible to built tilting trains with reduced floor level.

Problems: The condition of the special floor level doesn't allow to couple those coaches with standard rolling-stock. So there is a need to compose complete trains or wagon-groups, coupled with standard rolling stock via special constructed and equipped so called transition-coaches at the end of the train or waggon group.

Generally the use of wheels with an diameter smaller than 920mm is necessary. A wheel-diameter of 760mm for articulated train is also needed.
Smaller brake-discs have a sufficient braking power to stop a train at the same way than ordinary trains do.



Bougie Jacobs Key Element of the articulated set of coaches (new Class 424, DB AG)



Wheel and floor level at Jacobs-bougie

3.7.2. Regional trains

New commuter or regional trains are designed with either standard or double- deck coaches. The case studies illustrate the provision of:

- Access ramp that fits one platform height (on the double deck coach for DB AG in Bremen-Germany).
- Access ramp that can fit three different platform heights (one the new DAB 764 double-deck coach operated by DB AG in Germany.
- Retractable step to be used in case of low platform height, wheelchair space and accessible toilet (on the ‘midfloor’ coach TER 72500 operated by SNCF in France.
- On board lifts for ‘midfloor’ coaches that can fit various platform heights (Region shuttle and ET-425-426 EMU commuter operated by DB AG in Germany.

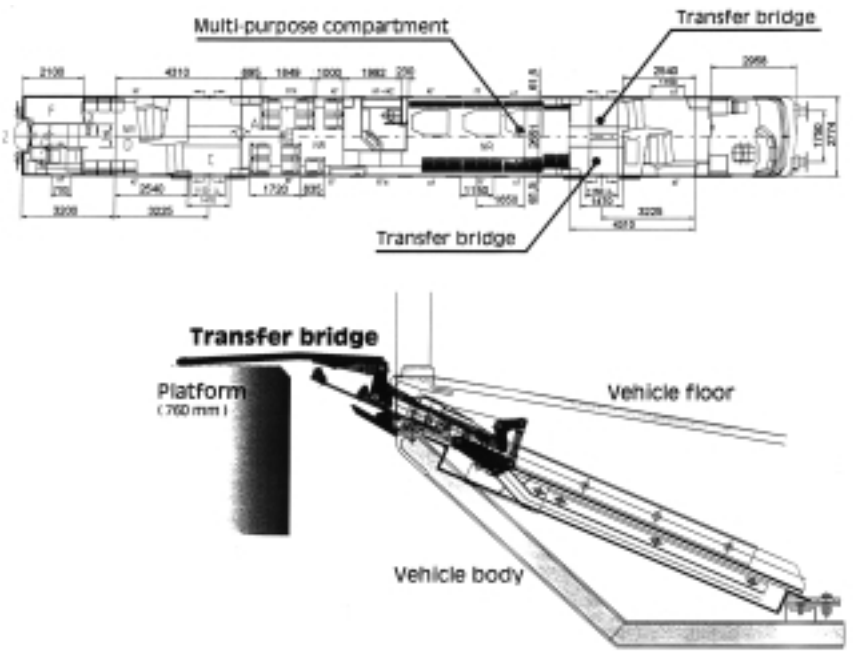
Two other case studies are at a prototype stage and illustrate:

- Interior lifting platform in the Crusaris Regina from Adtranz.
- Access ramp which would be automatically deployed and would fit platform heights from 250 mm to 700 mm and floor heights upto 1150 mm, to be operated by NSB in Norway.

Case study 3: Double-deck driving trailer DBbzf 761 (Bremen) for DB AG

Double-deck driving trailer, type DBbzf 761 (Bremen)

Features:
- Train set serving suburban and regional railway lines
- Height of platform/entrance 760 mm above rail surface
- Transfer bridge
  operating time approx. 5 sec.
  operated by staff, operation by passenger possible if required
  width 970 mm
  length 366 mm
  max. wheelchair weight 300 kg
  max. wheelchair length 1420 mm
- Multi-purpose compartment fully accessible to wheelchair space for 3 wheelchairs
  toilet accessible to wheelchairs
  31 foldable seats



Transfer bridge and multi-purpose compartment

Costs:
- Double-deck driving trailer: approx. DM2.6m
- Train set of 5 coaches (without locomotive): approx. DM9.6m
- Extra cost of DM0.3m per driving trailer for redesign and installation of equipment for wheelchairs
  = approx. 10% of vehicle price
  = approx. 3% of train set price.

Remarks:
- Transfer bridge requires same height of platform and coach entrance
- The next generation of the driving trailer will have two different entrance heights of 600 mm and 760 mm to serve both 760 mm and 550 mm high platforms. To reach the suitable entrance, the wheelchair user will be able to circulate inside the vehicle between the two entrance areas
- Manufacturer of vehicle: Bombardier Transportation, DWA Görlitz

Case study 4: Double-deck driving trailer accessible to wheelchair users, type DABpbzf 764, for DB AG manufactured by Bombardier Transportation, DWA Görlitz

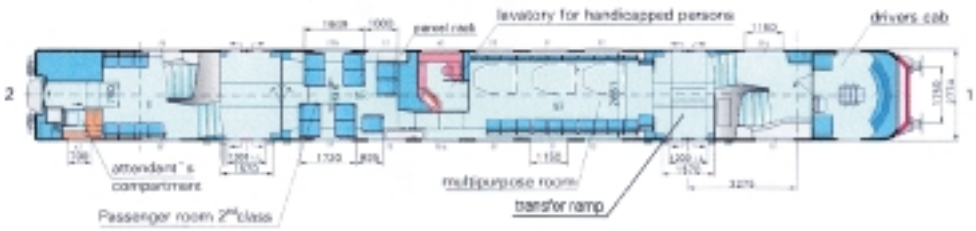
Double-deck driving trailer, type DABpbzf 764

Features:
- 1st an 2nd class-trainset serving suburban and regional railway lines
- The seating capacity of the driving trailer is 79 passengers (38 passengers 1st class)

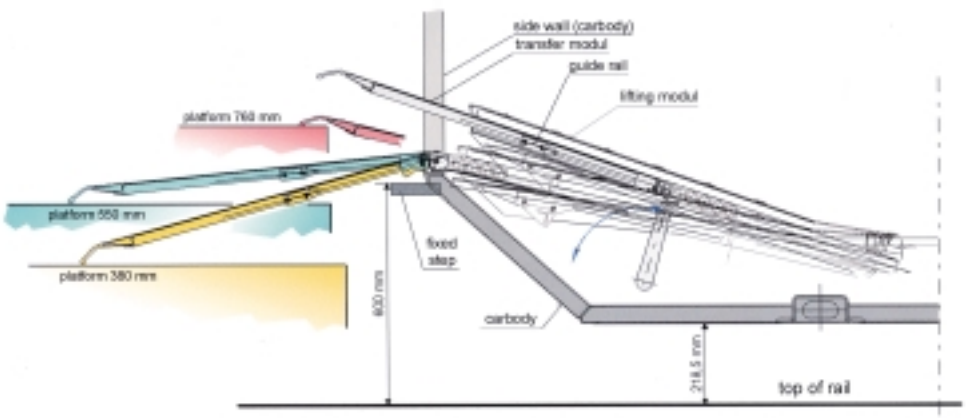
Entrance:
- Entry height: 600 mm from top of rail,
- Transfer ramp for wheelchairs operated by train crew for platform heights from 380 mm to 760 mm above rail surface
- Usable for wheelchairs with UIC dimensions, max. wheelchair weight: 350 kg

Lower deck:
- Multi purpose compartment fully accessible to wheelchairs

- Space for at least 3 wheelchairs
- Toilet accessible to wheelchairs
- Space for 6 bicycles or other large pieces of luggage
- Call-button for disabled people inside and outside
- 23 foldable seats



Lower deck of the double-deck driving trailer



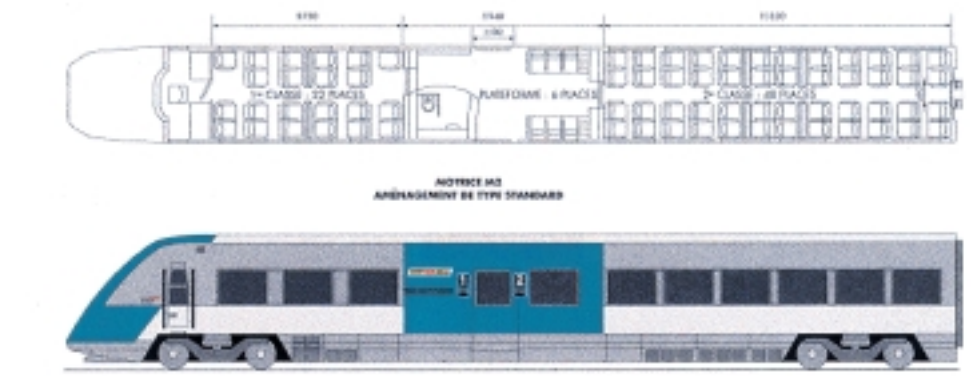
Operating principle of transfer ramp for different platform heights

Case study 5: XTER 72500 - Diesel Multiple Unit (DMU)

Two or three cars train set serving SNCF suburban and regional railway lines

Ease of Access

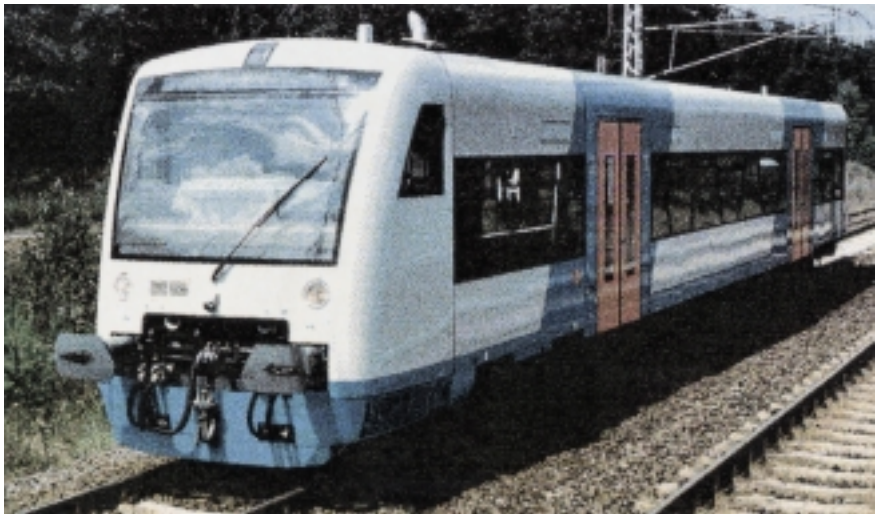
- Accessibility for mobility impaired passengers and prams.
- Through a wide single leaf door located in the middle of the coach: free width 1100mm
- Semi automatic opening by push buttons from inside and outside
- Access door fitted with a moveable step device
- Vestibule with low floor level: 860mm above rail surface
- From platform height of 550mm:
  - horizontal gap with step device: 50mm in straight line
  - vertical gap with step device: 85mm



Vestibule Equipped with

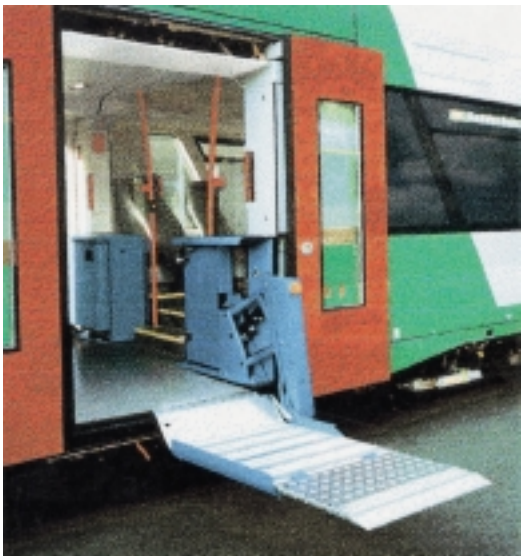
- Locations with tip-up seats foreseen to accommodate wheelchair users
- Toilet module accessible for wheelchair users

Case study 6: Regio Shuttle



Features: Regio-Shuttle has attracted many customers around Germany since its introduction in 1996. More than 100 vehicles have been ordered by some ten different customers.
Regio-Shuttle has the highest low floor portion among the diesel railcars for 70-80 seated passengers which fulfils the UIC buffer load requirements of 1500 kN. The location of the diesel engines and the drive unit below the driver's cab outside the bogies offers the opportunity to use all the space between the bogies for a 600 mm low floor area, with 760 mm optional.
The passenger area above the bogies have a floor height of 1000 mm.

Lift for Disabled Passengers



- For adaptation to different platform heights
- load capacity 300 kg
- platform dimensions: 1200 x 740 mm
- Time for loading/unloading about 2 min each time
- not usable without outside help (handling by railway staff only)
- design according to DIN 32 983

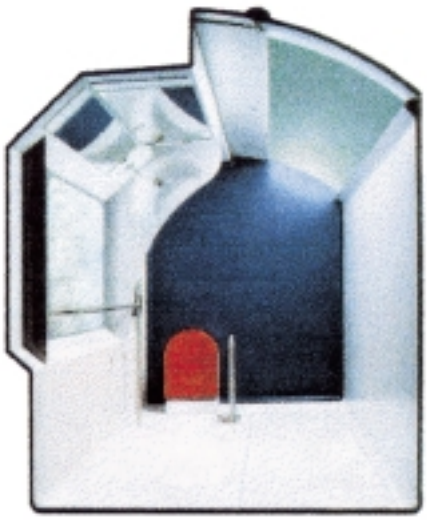
Layout of vehicle

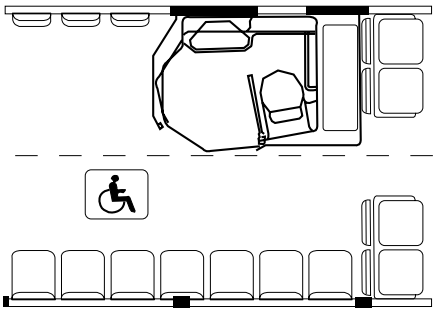
Seating capacity:	Seats	72
	Tip-up seats	4
	Area for e.g. bicycles	4
	Fastening Belts	3

Multi Purpose Compartment (MPC)

- Wayfinding sign to MPC on outside of coach (see that entrance/lift and MPC are close together)
- sufficient space for wheelchair turning
- fastening belts for wheel-chair (between folding seats)
- push button for wheelchair user “Stop at next station”

Lavatory for disabled passengers

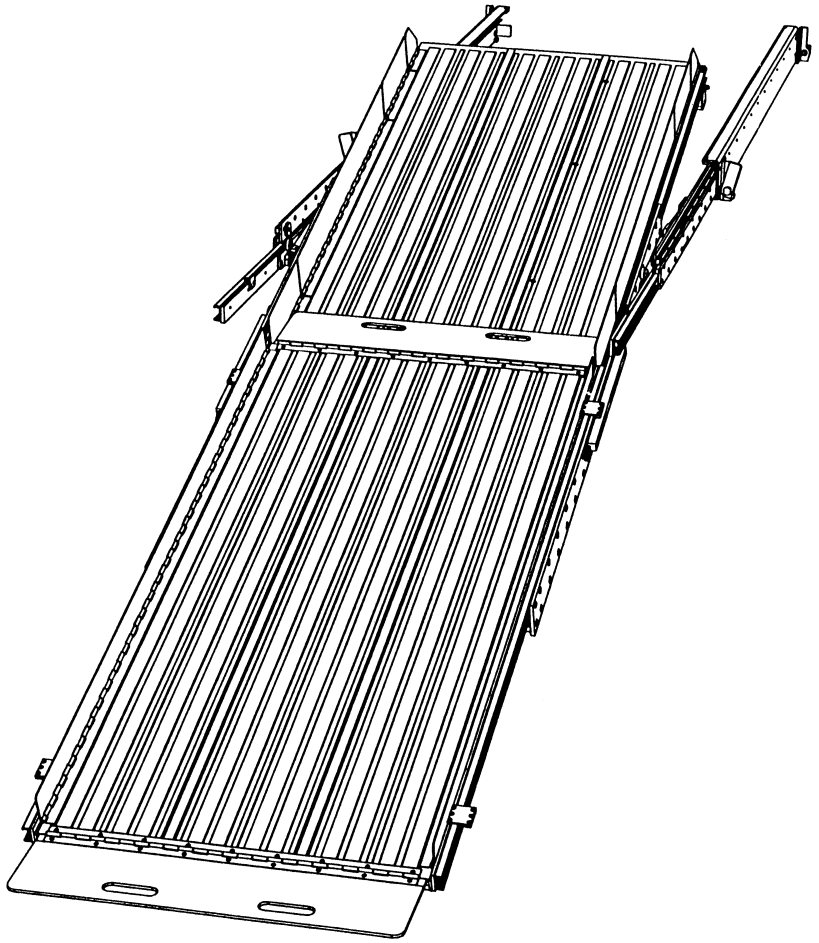




- usable without outside help
- electrically-driven sliding door
- place for wheelchair turning
- design in accordance with UIC 565-3, DIN 18022, DIN 18025

Case study 7: Access Ramp for Type 73 (new Express Trains) NSB / The Norwegian State Railways

Specifications: Tilting train sets of 4 coaches (without locomotive), manufactured by ADTranz Norway. First 3 sets in operation from November 1999.
One coach modified for wheelchair users, with access ramp to board and alight the train. Ramp is delivered as a compact cassette, integrated in the floor of the entrance area, containing frame, telescopic arms and the ramp.



Operational area: From platform 250 - 700mm ToR to floor 1150 mm

Operation time: Max. 45 seconds

Capacity: 450 kg

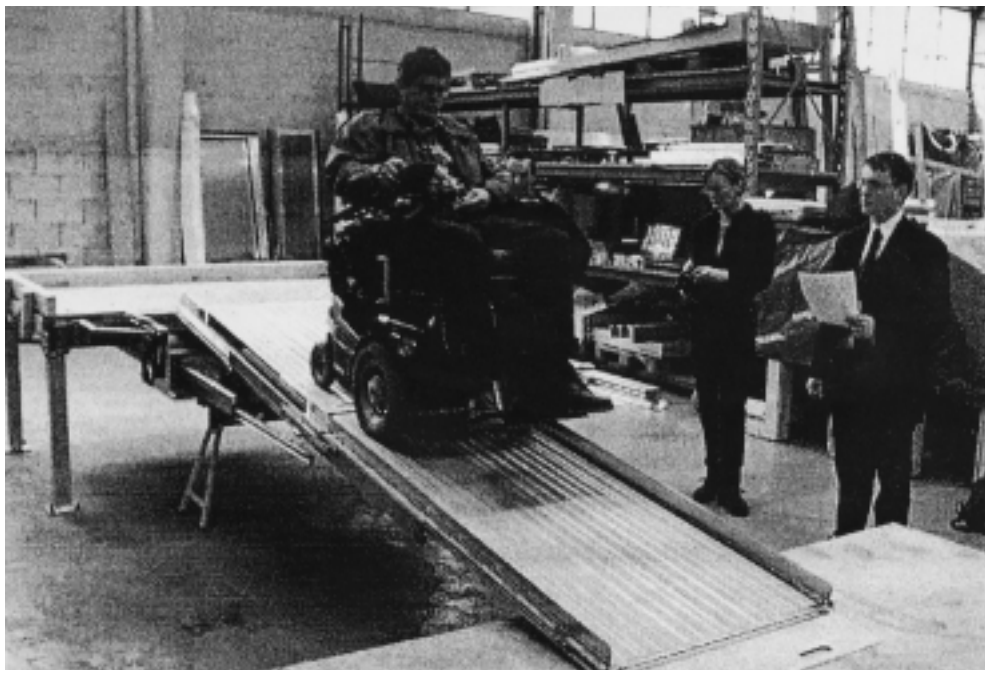
Operation: Preparations/parking: By staff only, 1 person, max. operating load 450 kg, Self-supporting access by low angle, otherwise need for assistance.

Dimensions: Ramp: 800 x 3336mm, cassette: 1000 x 1750 x 112 mm

Security: Electronic device activated in driver's cabin while in use

Work conditions: Snow, ice, water, sand.

Propotype testing



Case study 8: CRUSARIS Regina

Wheelchair user prepared - wheelchair lift is standard

Spacious wheelchair accessible toilet

The train is equipped with a spacious wheelchair accessible toilet near the wheelchair lift and a flexible area especially designed for passengers with wheelchairs or prams

Internal wheelchair lift

Entrance at platform height and a internal wheelchair lift that can be used from the wheelchair make Regina easily accessible for wheelchair users. The wheelchair lift can be found in all the train sets

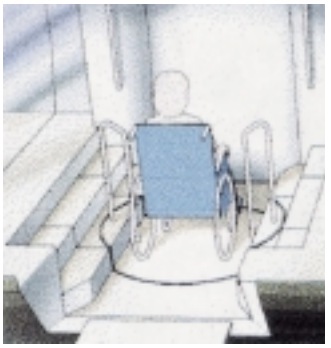


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Table 3.1: Recommendations for the use of contrast, brightness, colour and shape for information matters

(source: Verbesserung von visuellen Information im öffentlichen Raum. Bundesministerium für Gesundheit)

Priority	Value for contrasts	Colour combinations (light on dark)	Value of light density
1 – Warning	0.83 < K ≤ 0.99 optimum contrast	Blue on green ° Yellow on lilac Green on blue Black on white White on red	300 cd/m^2 up to 500 cd/m^2 on signs and markings surfaces Emergency lighting: >500 cd/m
2 – Decision	0.5 < K ≤ 0.83	Yellow on green Black on neutral*° White on blue White on green	30 cd/m^2 up to 299 cd/m^2 in weak room lighting up to well lit shop rooms
3 – Guiding	0.28 <K ≤ 0.50	Blue on neutral° Yellow on grey Green on neutral Red on neutral Black on green°	3 cd/m^2 up to 29 cd/m^2 as in dim street lighting

° exception: black on light

* neutral = black or white or grey

Table 3.2: Recommendations for height of characters for information matters

(source: Verbesserung von visuellen Information im öffentlichen Raum, Bundesministerium für Gesundheit)

	Reading distance			
Priority	**30 m**	**10 m**	**1 m**	**0.25 m**
1 – Warning	1040 mm	350 mm	35 mm	9 mm
2 – Decision	520 mm	170 mm	18 mm	4 mm
3 – Guiding	420 mm	140 mm	14 mm	3 mm

4. Bridging the gap from platform to train

4.1. Preamble

Boarding and alighting a train usually means that passengers have to get through the door and negotiate a few steps, as only in recent years some new trains began to offer level access between the platform and the train floor at the entrance door.

Steps and gaps are a real barrier to people in wheelchairs and even to people with severe walking difficulties. The functional capabilities for passing over the gap between the platform (or pavement) and the vehicle floor have been investigated. Laboratory tests were performed in France, Germany and Great Britain by mobility impaired people and wheelchair users who were used to moving around in the city and reaching the train station.

The requirements were determined as follows:

- The horizontal and vertical gaps shall be not greater than 100 mm (*50 mm is preferred*) and 50 mm respectively for people in wheelchairs (see Chapter 3).

- The horizontal gap shall be not greater than 300 mm for people with severe walking difficulties.

Where level access cannot be achieved, technical and operational solutions for boarding/alighting are being used in order to overcome the steps and gaps.

It is quite clear that the use of such boarding aid devices is a burden both for the passenger and for the railway (and station) operator. Therefore, it is important that the right choice is made after considering all the factors that may affect the safe and effective operation of the system.

4.2 Factors for boarding aid choice

The ideal system does not exist. In fact, the choice of the best solutions depends on the kind of train traffic (from the commuter train with short dwell times at the station to the long-distance train), operational, technical and economic factors.

4.2.1. Technical aspects

Space available on the platform: the platform width as well as the presence of obstacles on the platform (staircase, furniture, poles, kiosks etc.) may prevent the boarding aid from being deployed or from being positioned where required. Another factor which has to be considered is the crowd on the platform which may be an obstacle to deploying a boarding aid or for a platform based device which has to be transported from the storage area to the coach door.

Reliability of the boarding aid must be ensured. This means that any mechanical and electrical components must be designed taking into account the environmental conditions likely to be encountered in service, dust and objects which may cause damage to the device. Vandalism is a concern of operating companies, more and more of whom are installing securement systems in the stowage area. The UIC-report (Mobility for All - The missing millions, 1996) indicated that on-board devices then in use were more complex and therefore were more prone to problems that were likely to cause train delays.

Safety of operation is a crucial issue both for the passenger and for the operating staff where present. Currently the deployment of a boarding aid, whether on the platform or on board, requires staff supervision. In case of an on-board lift, it may also be necessary to install visual

and audible warning signals especially if the staff member deploying the device does not have a full view of the operation.

The design of the boarding aid must take into account the possibility of a wheelchair, and in particular a high-powered electric wheelchair, accidently overriding the raised edges of a ramp or lift platform.

A powered boarding aid must incorporate an emergency method of deployment and operation with a wheelchair occupant in case of power failure.

Availability of the boarding aid when and where it is needed will help reduce the stress level of the passenger and improve working conditions for the staff. An on-board boarding aid can be considered as always available, provided that the train staff are about when passengers require assistance. With regard to a platform based boarding aid, the staff must be aware of its location and must return it after use. A secure stowage area would ensure greater efficiency as staff would know where to find it and it would also avoid the risk of damage (possibly from dust and dirt) and vandalism.

Flexibility in traffic management : train operators should consider the allocation of station platforms for their devices. Generally it has been considered too difficult to restrict boarding aids to a few platforms as trains are frequently routed into any available platform. Another problem is the common use of tracks for freight as well as for passenger trains. The gauging constraints of freight trains often mean that the gap between the platform and the rolling stock has to be wider than would normally be required. Giving consideration to the separation of passenger trains and freight trains through stations would help overcome this problem.

4.2.2. Human factors

Dignity of the passenger must be guaranteed. Examples that clearly not acceptable are the use of a luggage carts and the manual transfer of a person. In any case this is prohibited under EC legislation (Manual Handling of Loads Directive 90/269/EEC of 29 May 1990). Moreover, representatives of disabled people prefer on-board devices as their use is more discreet.

Ergonomics, comfort and safety: Good ergonomic design of a boarding aid will reduce the risk of harm or injury to the staff member operating the device. It is also more likely to reduce the temptation of some staff not to use the device and to transfer the passenger by hand, a practice that puts the passenger at considerable risk. The smooth operation of a powered lift is essential and the slope of a ramp should not be too steep.

Availability of staff has to be guaranteed to assist with passengers who have booked in advance. Passengers in some countries are experiencing problems with the non-availability of staff.

Staff training will ensure an efficient use of the boarding aid and guarantee a safe quality service.

Independent boarding for disabled people should be the aim wherever possible. Initially it should be aimed at suburban and regional trains for which passengers do not usually reserve their seat in advance.

4.2.3. Economic aspects

Investment cost depends on the number of train coaches and/or the number of station platforms to be equipped. On board devices must be provided on each side of the accessible coach as the platform may be on either side.

Operational cost includes:

- -maintenance of boarding aid devices(increased time for trains out of service and staff cost);
- -staff time to deploy the devices;
- -increased dwell time at stations for the deployment of boarding aid devices;

Operational cost for the last two parameters is considered to be lower for on board devices even though deployment time is directly linked to the height of the vertical gap. However, on board devices are more complex and at present may be more prone to failures and require more frequent maintenance.

4.3. Analysis of pros and cons of boarding aids

A survey of European railway operators involved in the COST335 action has been carried out to provide information on station and train parameters, the types of boarding aids used, numbers in use, frequency of use, the opinion of disabled passengers and their future strategies. Fourteen countries responded, the results of which are summarised in table 4.1.

It should be noted that in each country the questionnaire was answered by the railway network operator except for the United Kingdom, which was answered by Railtrack, the company responsible for the stations and track infrastructure since privatisation of the railway network. Also, the contact at Railtrack is a disabled person in a wheelchair and therefore in a better position to express the views of the people directly concerned.

Table 4.1

Boarding Aids in European Countries (1)

Country	Austria	Switzerland	France	Germany	Finland
Boarding Aids used	Platform lift	Platform lift	Platform lift Platform ramp Lift on TGV duplex	Platform lift On board lift Bridging ramp	On board lift On board bridge
Platform height-mm	550, 380 and less	550, 350	550, 350 900 (IdF region)	380, 550, 760, 900	265, 550
Floor height-mm	n/a	1160	900, ~950, 1190	600, 800, 1100	~550, 1200
N° stations equipped	n/a	150	200 (platform lifts)	385	0
N° Boarding Aids	100	250	220 platform lifts	580 lifts 30 ramps	100% Pendolino trains 10% main line fast trains 100% main line IC trains (1999)
Reasons for choice	n/a	Simplicity Low cost Only one staff	Easy to handle Fit various gaps	Easy to handle Low cost	Staff onboard
Boarding Aid price-Euro	4 400	4 900	4 100 manual lift 5 400 electrical lift	4 100 ~20.000 (lift/door)	4 400 (autom. bridge) 17.000-25.600 (lift / door)

Country	Austria	Switzerland	France	Germany	Finland
N° staff	1	1	1 or 2	1	1 for lift 0 for bridge (IC train)
Staff training	Yes	Yes	Yes	Yes	Yes, mostly
Manoeuvre time	A few minutes	Preparation not needed	~3 min	1 min	1,5 - 2 min (lift) 10-15 s (bridge)
N° use/day	n/a	15- 20 (main station) 2-5 (small stat.)	n/a	10/day to 1/ fortnight	n/a
Passenger opinion	Satisfied	Satisfied	Satisfied	Satisfied, mostly	Satisfied
Criticisms	n/a	None	Dirt/ Damage	n/a	n/a
Long term strategy	None	No change	Level access	Level-access + bridge plate for S train	level access

Table 4.1 (cont'd)

Boarding Aids in European Countries (2)

Country	Netherlands	Luxembourg	Denmark	Great-Britain	Sweden
Boarding Aid used	Platform ramp	Portable ramp	Platform lift Platform ramp	Platform ramp Onboard ramp	On-board lift Platform lifts (few)
Platform height-mm	760, 840 (new)	n/a	550	915	580 (all new stations) 730 (few suburban syst.)
Floor height-mm	1160, 1320	n/a	900-950	n/a	1150
N° stations equipped	150	1	30	n/a	few
N° Boarding Aids	327	1 (prototype)	50	n/a	160 (80 trains) 60 platform lifts
Reasons for choice	Small gaps, low cost, fits 2 platform heights	Easy to handle, fits various gaps, transportable in train	Best solution	Low cost, low maintenance	Few or no staff in small stations
Boarding Aid price-Euro	2 300	-	8 100	500	6 450 (12 900/train)
N° staff	n/a	Onboard staff	1	1	On-board staff
Staff training	Yes	-	Yes	n/a	Yes
Manoeuvre time	3-5 mins	3-5 min	2-3 min	n/a	1- 2 min
N° use/day	200/day	4-5 /week	n/a	Frequent	50/day

Country	Netherlands	Luxembourg	Denmark	Great-Britain	Sweden
Passenger opinion	n/a	Satisfied, easy, quick	Satisfied, would prefer self-sufficiency	Satisfied, but ramp too steep, not always available	Satisfied, would like self-sufficiency,
Criticisms	Staff required	n/a	n/a	Ramp weight (lighter new design), lack of safety	Platform lifts require extra work
Long term strategy	Minimise the height difference	More ramps (6)	Self operated ramp Level access for S-train	Level access	Level entrance for new train system

table 1 (cont'd)

Boarding Aids in European Countries (3)

Country	Hungary	Italy	Norway	Spain
Boarding Aids used	Platform lift	Platform lift	Platform lift Onboard lift (regional) Onboard ramp (manual)	Platform lift, Onboard lift (commuter)
Platform height-mm	300	250 to 550	700-570-350 and less	550 (main), 280, 700, 900 650 (high speed train) 680 (commuter)

Country	Hungary	Italy	Norway	Spain
Floor height-mm	1 100	500 to 1100	1320-1150-920-750	650 (Talgo), 850, 950 (high speed)
N° stations equipped	30	75	5 (1 lift/station)	60 (main)
N° Boarding Aids	33	110	16+22 onboard lifts 36x2 onboard ramps	120 platform lifts
Reasons for choice	**Safe, cheap, simple use**	Agreement with some disabled representatives	Operation safety Few crew in stations	Easy, cheap
Boarding Aid price-Euro	2 600	12 000	n/a	7 180
N° staff	1	2	1 (lift or ramp)	1
Staff training	Yes	Yes	Yes	Yes
Manoeuvre time	25- 30 s	2-3 min	2-3 min (lift) < 1 min (ramp)	1-2 min
N° use/day		~500/week	n/a	60 (high speed st.) 30 (main st.)
Passenger opinion	Satisfied	Yes, would prefer self-sufficiency	Satisfied, would prefer self-suffiency	Very satisfied
Criticisms	all coaches not adequate	Battery charging of electr. Model	Lifts too narrow, Long to operate	n/a
Long term strategy	No change	Test onboard lift, +continue use of platform lift	Platform height 570, 700 for commuter, Level access	continuation

Examples of Boarding Aids in use in Europe are shown on:

Figure 4.1. Platform ramp - Intercity train – UK

Figure 4.2. Platform ramp – NS railways – NL

Figure 4.3. Onboard lift – SJ X2000 train – SE

Figure 4.4. Platform lift – SNCF railways – FR

Figure 4.5. Bridging ramp – DB railways - DE

Figure 4.6. Access ramp – Double deck coach DB railways – DE

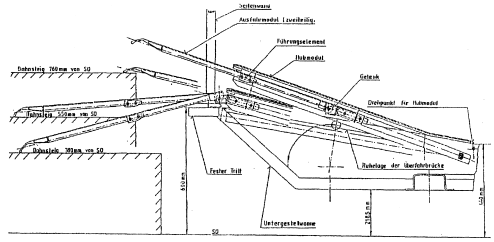

Figure 4.7. Partially raised platform – RBS railways, Bern – CH

Raised platform (32 cm)

Bridging plate

Entrance with one step at low platform (18 cm)

The results of the survey clearly show the difference in platform heights between countries and even within a country. It is interesting to note that several operators have decided to harmonise their platform heights and to provide level access with their new rolling stock, at least for commuter or regional trains.

The variation in cost for boarding aids of a similar type can be explained by the level of automation and the height span to which they are required to operate.

From the above analysis completed by a literature review, an evaluation of lifting devices against access ramps has been made highlighting the differences between platform based and on board devices. The evaluation is summarised in table 2 and table 3. The summaries are only general statements and do not reflect the differences between boarding aid and operating conditions for each country.

table 4.2

EVALUATION SHEET / LIFTING DEVICES

PARAMETERS	PLATFORM LIFT	ON-BOARD LIFT
TECHNICAL		
Area on platform	quite large for operation, storage, movement	smaller, predictable
Reliability	good provided steady maintenance and adequate storage	higher level needed to avoid disturbance of train operation
Safety	staff involvement	staff involvement + visual and audible signal during operation
Storage	on platform, sheltered, protected from vandalism	integrated in the train
Availability	depending on storage location	always, provided communication between on-board staff and PRM
HUMAN FACTORS		
Staff availability	1 or 2 persons from station staff	1 person from onboard staff
Staff training	needed	needed
Comfort – safety	work load in case of manual device ; possible jerks during lift operation	lower work load (powered device), smaller area for the wheelchair
Passenger dignity	lack of discretion	more discreet
Self sufficiency, prebooking	not self-sufficient, prebooking required 1/2h to 48 h in advance	prebooking required but shorter times allowed (communication with on-board staff)

PARAMETERS	PLATFORM LIFT	ON-BOARD LIFT
ECONOMICAL		
Investment	connected with number of station platforms from 1/station to 1/platform	connected with number of trains 2 devices/train (1 on each side)
Working time	longer operation (movement on platform, within station)	shorter - staff on-board.
Manoeuvre time	longer, 2 to 5 minutes, depends on platform clutter and staff skill	shorter : 1 _ to 2 minutes
Maintenance	depends on storage conditions	more limited

Table 4.3

EVALUATION SHEET / RAMPS

PARAMETERS	PLATFORM RAMP	ON-BOARD RAMP
TECHNICAL PARAMETER		
Area on platform	quite large for storage, movement and operation	smaller and predictable
Reliability	good with steady maintenance and adequate storage	good
Safety	staff involvement	staff involvement or visual and audible signals during operations (powered ramp)
Storage	on platform, sheltered, protected from vandalism	on board
Availability	depending on storage location	always, provided communication between on-board staff and PRM (manual ramp)
HUMAN FACTORS		
Staff availability	1 or 2 persons from station staff	1 person (on-board staff)
Staff training	needed	needed
Comfort – safety	work load and risks on steep slopes	less steep slopes but risks due to smaller width
Passenger dignity	lack of discretion	more discreet
Self sufficiency, prebooking	not self-sufficient, prebooking required 1/2h to 48 h before travel	prebooking required if manual ramp shorter times admitted (staff on-board)

PARAMETERS	PLATFORM RAMP	ON-BOARD RAMP
ECONOMICAL FACTORS		
Investment	connected with number of station platforms from 1/station to 1/platform	connected with number of trains 2 ramps per train (1 on each side)
Working time	longer operation (movement on platform, within station)	shorter - staff on-board.
Manoeuvre time	longer, 2 to 5 minutes, depends on platform clutter and staff skill	shorter : 1 _ to 2 minutes
Maintenance	limited, depending on storage condition	much limited

4.4. Recommendations

Boarding aids must be considered as a temporary measure to overcome gaps and steps between station platforms and trains.

A real improvement of accessibility to trains for all passengers can only be made when station platforms and coach-floor heights are at the same level and the horizontal gap (if greater than 50 mm) is filled by a bridging plate.

In the long term, the aim for total accessibility can only be achieved by means of level/step-free access to all facilities within the train.

The technical means to achieve this within a totally self-contained railway system is a matter for local decision, however,

where interoperability is a factor (including international services), a common European standard on station platform height is necessary.

Based on known rolling stock technology, it must be acknowledged that the coach floor cannot be lowered to any great extent as future developments tend towards higher running speeds. On the other hand, it is more feasible to raise a station platform rather than lower it. Therefore,

the recommendation is that platform heights should not be less than 760 mm above rail level.

For cross border operations, bilateral agreements should include consideration of the aim for level access across the service.

An intermediate step towards full accessibility should be to provide at least one coach with step free access in each train set.

During the transition period when boarding aids are necessary, the analysis in the above sections has highlighted the following:

- Operating companies must be careful when choosing their boarding aids in order to be consistent with their long-term strategy concerning availability of staff at stations.
- An important aim for the near future should be to get boarding aids safely automated so that wheelchair users and persons with walking difficulties can be independent when travelling by train.
- When a member of staff is needed to operate a boarding aid, a programme of training and refresher courses must be put in place, to include disability awareness, so that quality of service and passenger dignity be maintained at a high level.
- An access ramp is a simpler and less expensive solution than a lift if boarding and alighting can be achieved perpendicular to the doorway. However, vertical gaps should not be higher than 130 mm for independent access (ramp slope manageable by the passenger), or 180 to 250 mm for assisted access (ramp slope being manageable by the assistant).
- Partially raised platforms would be a less expensive solution, but allow less flexibility for train operation. It may be more difficult to implement such a solution in stations where trains with different gauges pass along the platform. It is certainly worth considering this solution for commuter trains operating with short stopping times.
- Platforms along curved tracks set a problem for bridging plates. An access ramp may be a more reliable solution

because it is folded out over the platform and can fill horizontal gaps of varied dimensions.

- Liability issues must be carefully investigated if a fully automatic boarding aid is to be implemented.
- Responsibility for the service and its safety must be clearly identified between the railway operator and the station operator where they are different companies.

4.5. Technical specifications

4.5.1. General specifications

- The boarding aid must accommodate the wheelchair whose dimensions are as specified in the ISO 7167 Standard with an occupant and withstand a weight of at least 300 kg.
- When staff manually operate the device, it must be ergonomically designed for safety and must require minimum effort.
- When the device is operated remotely by train staff, by the passenger or fully automatic, in conjunction with door opening/closing, it must incorporate safety features that provide visual and audible warning and prevent feet being caught between the platform and its moving parts.
- If powered, the boarding aid must incorporate an emergency method of deployment and operation with an occupant, in case of power failure.

  Such a method must be capable of being operated in a non-hazardous manner for the occupant or the operator.
- The international symbol for access should identify the location of entrance doors appropriate for access with the boarding aid and be readily visible.

4.5.2. Access ramp

An access or bridging ramp may be:

- Positioned manually by staff whether stored on the platform or on board (fig. 4.1).
- Or be deployed by mechanical means, operated by staff or by the passenger - see general specifications above (fig 4.6).
- The slope should be not more than 8% for a ramp longer than 1000 mm, 13% for a length between 600 mm and 1000 mm. If the length is less than 600 mm, a maximum slope of 18% may require assistance to the passenger.
- The effective width must be at least 760 mm. If the plate is less than 900 mm wide, it must have raised edges on both sides.
- The surface must be slip-resistant.
- The upstands at both ends must be bevelled, must not be higher than 20 mm and must have contrasting hazard warnings.
- The access ramp, if manual, must be securely fixed to the train coach when in use.

4.5.3. Integrated bridging plate

The bridging plate is a device integrated into the coach floor, fully automatic and activated in conjunction with the door opening/closing (see general specifications above). It should extend only a sufficiently *short* distance to fill the gap between the platform edge and the floor sill to ensure step free access (fig. 4.5).

- The effective width must be at least 900 mm or be as large as the doorway width (if smaller than 900 mm).
- The slope may be as steep as 18% because its length is less than 600 mm.
- The upstands at both ends must be bevelled, must not be higher than 20 mm and must have horizontal hazard warnings.
- It if remains horizontal (without support on the station platform), the horizontal and vertical gaps between the

plate and platform edges must not be greater than 50 mm (fig. 4.7).

4.5.4. Platform lift, on board lift

The platform lift is a device which can be moved, stored on the platform and must be operated by the station staff (fig 4.4).

The on-board lift is a device integrated into the doorway of the coach that must be deployed by the train staff. (fig. 4.3)

- The system must be able to overcome the maximum height difference between the coach floor and the platform where operated.
- The lift platform's effective width must be at least 760 mm.
- The lift platform must be unobstructed and must be slip resistant.
- The lift platform must have raised edges and two strong barriers, 100 mm hight above the surface of the plate to prevent an electric powered wheelchair from overriding the edge.
- The lift platform must be equipped with a handrail on one side, 750 to 900 mm high, for use by the person standing or in a wheelchair. If ramped at one end, a slope steeper than 13% may require help from the staff for a manual wheelchair.
- The upstands at both ends must be bevelled. If they are higher than 20 mm, help from the staff may be required.

4.5.5. Partially raised platform

This solution is a means for achieving level or step free access but is only feasible for railway systems and networks which can ensure that the accessible door of every train set stops adjacent to the raised section. The

design must be compatible with the gauge of the trains likely to pass through the platform (fig 4.7).

- Its width (perpendicular to the platform) shall be at least 2200 mm and be consistent with the length of the train's access ramp or bridging plate, if any). *The full width of the platform is preferred.*
- If the raised platform is shorter than the platform width, its extremity opposite to the track must either join the existing platform with a gentle slope or be marked with a painted edge of contrasting colour and tone. If such a step (opposite to the track) is higher than 210 mm, it must be equipped with two handrails located at 700 and 900 mm (+/- 50 mm) above the ground, structurally sound enough to prevent a person falling (fig. 4.7).
- The slopes leading to the raised part must be consistent with the recommendations for stations (see chapter 5). *5% is the preferred slope.*
- The international symbol for access should identify the location of the raised area.

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5. Railway Stations – design for all

5.1. Preamble

In many ways access to rail travel for many people depends on the layout and facilities at railway stations and how well these are maintained. The report sets out to demonstrate this to planners and transport professionals. Many barriers to rail travel occur at transport interchanges. All rail journeys start and end at rail stations. Therefore it is clear that measures taken to improve access at rail stations are extremely important to the overall journey.

The work in this chapter overlaps with chapter 4 in relation to access between the platform and the train. Easy access from platform to train is essential to the train journey. Without it, all other access improvements become redundant.

It also overlaps with chapters 6 and 7. If people are to travel by train, they must have information. Information is of utmost importance before and during the journey, and much of this information must be provided at the station. Thus signage and other means of providing information at stations must be located in the right places.

Making rail travel accessible to disabled people will increase the overall quality of railway travel. Inclusive design - design for all passengers - will both improve the station facilities, and be more cost-effective. Increased quality will increase the number of passengers using rail transport, just because they find railways easier to use. The distinction between the needs of disabled passengers, and those of non-disabled passengers is difficult to determine. Many people will find it more comfortable to go by train, once the rail system is made accessible. This increase in

the overall number of passengers makes investment in improved facilities financially worthwhile.

5.2. The Stations Handbook

A design handbook for accessible stations has been produced in parallel.[1]

The intention was to create a user-friendly handbook with examples of existing best practice for those responsible for planning and developing both existing and new stations. These recommendations are not intended to be prescriptive, or to limit innovation. And the drawings provided in the handbook are examples only and are not intended to illustrate the perfect solution.

For the Stations Handbook, certain general features of station design such as visibility, design of steps and ramps are identified, and the design principles to apply to these features are outlined. Then the journey of a passenger through the station is followed, outlining the principles for each specific station feature encountered on the journey.

In this report the thinking behind the good practice recommend is described, and some of the specific design recommendations are highlighted.

5.3. Railway stations as part of the travel chain

The railway station is an important part of the travel chain. The station, as a link in that chain, must fit with the other links (i.e. means of arrival and departure, and access to suitable rolling stock). This requires good intermodal

[1] You can find out where to get the Stations Handbook on the Internet at www.cordis.lu/cost-transport/home.html. An extract of the Handbook is included in subchapter 5.8 (Dahl charts).

connections that are integral to the overall station design, accessible, and clearly signed.

Good intermodal links will require proactive and co-operative relationships between local transport planners and operators. A good example of transport links is the train-taxi, already available some European countries. The taxi will be booked, at a set rate, for the passenger's ongoing journey. Pedestrians, cyclists and private car owners must not be forgotten in the development of intermodal connections, and safe walking and cycling routes and good parking facilities - with plenty of designated parking for disabled drivers and passengers close to the station entrance - are essential.

Photo 5.1 Hässleholm Station (Sweden)

Individual companies in the rail industry do not always have full control over the station and its environment. Parts of the environment may be under the control of local government authorities, local businesses or other rail companies. It is important, if we are to achieve full access for disabled people to the rail network in Europe, for the whole industry to work in partnership, inside and outside the industry, in

order that no link in the travel chain is broken. If, for instance, the local government authority owns the station forecourt, and retains a steep flight of steps up to the station entrance, many disabled people will face an impossible barrier to overcome. The station owner must exert influence over local government to ensure that this barrier is removed.

5.4. Some broad design principles

Good, accessible station design always has the function of the station as its primary consideration. Stations are places where passengers board and alight from trains. Travel operations, such as finding information about train arrivals and departures, buying tickets, and waiting for trains in reasonable comfort, should be the first priority. Of secondary importance are the commercial facilities, such as advertising, retail outlets and so on. These can enhance the experience of rail travel for passengers, but only if they do not create additional stress on the journey by getting in the passengers' way.

Other broad considerations include:

- Ease of passage from one part of the station to another:
  - Doors should open automatically so that passengers do not need strength or luggage free hands to open doors while keeping the station environment weather-proof.
  - Ticket control barriers should be avoided where possible, as they create a psychological and a physical barrier to the free flow of passengers.
  - Passageways should be wide.

- Distances between station facilities should be short:
  - Signs including distance measurements where distances are longer can help people with walking difficulties to plan and manage their station visit.

- Lifts are to be preferred to long ramps as these shorten the distance to cover, and the time needed.
- Plenty of seating should be provided to enable people to rest frequently.

• Assistance should be available for those who need it
- Assistance provided should be discreet, but readily available.
- All assistance staff should be trained in effective customer care, including disability awareness.

- If staff is not available, then assistance should be provided in another way. In some countries, local authority staff, taxi drivers and others are contracted to supply assistance at stations when it is needed.

Photo 5.2 Graz Station (Austria)

For more about information and staff training see chapters 6 and 7 in this report.

5.5. General elements of design

These elements are general, because they occur throughout the whole station experience, and form part of many other station features. For instance, the floor surface is part of the ticket office, but also of the station concourse, the toilet, the platforms etc. The later descriptions, here and in the Stations Handbook, of good design for specific station features, such as ticket offices, assume an understanding of appropriate floor surfaces, as well as the other general elements.

5.5.1. Circulation

Circulation is about the free movement of passengers through the station area. Some of the issues considered here are:

- **The layout of the station**
  Good use of space is important in designing a station – providing enough room for passengers to gather at specific points (such as in front of the departure boards) whilst ensuring that disabled passengers, those with prams and heavy luggage, can manoeuvre without endangering themselves or others.

  Station layout should be logical as this will assist all passengers, but especially people with visual and cognitive impairments. Main facilities should be located in step-by-step progression, with each facility visible from the previous one. For example, the ticket office should be visible from the station entrance. Secondary facilities (such as shops) should not intrude into the main circulation space.

  Information signs need to be logically positioned - at the point at which passengers will need the information. Information and advertising should be kept well apart.

Information desks should be positioned in the middle of the main hall, whereas travel centres and information giving more detailed assistance may be positioned around the main hall, easily visible from the information desk (i.e. easy to point out). Lifts and ramps to other levels should also be visible from the centre of the main hall, preferably in the same direction as the facilities they are leading to. Doors should without exception be glazed to enable people to see what is beyond them.

- **Floor surfaces, distances and turning circles**

  Floor surfaces must be slip resistant in all the local weather conditions.

  Turning circles for wheelchair users need to be a minimum of 1500 mm diameter, with a recommended diameter of 1600 mm.

  Walking distances should be taken into account, and station facilities – particularly those essential to travel such as the ticket office – must not be placed too far apart. Where greater walking distances cannot be avoided, as in large stations, an electric buggy may be provided for the carriage of passengers. If buggies are provided, staff needs to be aware of this and offer the facility to those who need it.

- **Accessing other levels**

  Stair design needs to take the needs of people with walking difficulties and people with visual impairments into account. The tread must be wide enough to support the foot, and the stair nosings should be contrasted, at the very least on each first step, to be easily seen by those with visual impairments. Open treads are not recommended as they cause a trip hazard.

The underneath of the stairs should always be closed so that people withvisual impairments, especially, are not in danger of colliding with the underside of the steps.

Photo 5.3 Leiden Station (Netherlands)

A rolling conveyor belt up the side of a flight of stairs can assist people carrying luggage, but the speed should be appropriate for people with walking difficulties. It should be installed so that it does not impede those using the handrails or cause a hazard for people with visual impairments.

A handrail is essential, and although stainless steel is good for vandal resistance and ease of maintenance, it is almost or totally invisible to people with visual impairments, and colour contrast is essential. Coloured coatings for stainless steel are available and can be used if stainless steel is the preferred material.

Photo 5.4 Ljubljana Station (Slovenia) - luggage conveyor belt

Some form of step free access (ramped travelators or lifts) must be available for wheelchair users and assistance dog users. Escalators are useful for people who have difficulty with steps or walking, but are of little use to those with wheelchairs or dogs.

A choice of means of changing floor level should be provided, but is especially necessary for people who, for example, experience claustrophobia in lifts but have difficulty climbing stairs.

Photo 5.5 Utrecht Overvecht (Netherlands) - ramp

Long ramps should be avoided, or the additional option of a lift provided. Many people with walking difficulties find ramps difficult to negotiate. The longer the ramp, the gentler the gradient should be, and the more resting places should be provided. Ramps should never be longer than 132m, best length not longer than 50m, with a gradient of 6% maximum.

Platform stair lifts are not recommended for use in a station, as they are more suited to domestic use. Vertical open platform lifts can be used for short rises (about a metre), and should include a folding seat for ambulant disabled and elderly people.

Photo 5.6 Leon Station (Spain) - open lift

Closed lifts are best made from glass, as this reduces the risk of claustrophobia, increases security for the passengers in the lift and reduces the likelihood that people will use the lift as a toilet. However, the glass should be well marked so that it does not present an additional hazard to visually impaired people.

It is important that choice is available to passengers for as much of the time as possible, therefore it is recommended

that routine maintenance is carried out frequently, and at night when the station is less busy.

Some form of communication aid should be provided in lifts and on escalators, especially at small unstaffed stations, so that people can call for assistance in an emergency. And at unstaffed stations, a maintenance contract needs to be in place so that passengers are not left stranded for more than an hour at most. Madrid Chamartin station, for example, has a contract with the escalator supplier which requires an engineer to arrive within 10 minutes of being called.

Photo 5.7 Chamartin Station (Spain)

5.5.2. Visibility

- **Lighting**
  It is essential to ensure long lines of sight in a station so that passengers can “see and be seen”. Good lighting is important for way finding, and reading information provided. It is also important for security – often of great

concern to disabled passengers who are unable to move as quickly as others can. The lighting level should be adapted to the surroundings. Lighting should be even throughout the station area, except at entrances and on stairs, where a slightly increased lighting level is needed. It is important to use lighting and materials in a way that avoids reflection, glare, or alternate patches of light and dark. It may be necessary to regulate the amount of natural sunlight that enters the station area in order to avoid glare and reflection.

- **Contrast**
  Colour and contrast can be used to direct passengers around the station (for example, the route to and from platforms marked on the floor in one colour). It is of great importance to people with low vision, to mark obstacles, and identify surroundings and facilities. For example, good contrast between walls, floor and ceiling enable visually impaired people to get the measure of their environment.

5.5.3. Environment

- **Clean air**
  People these days are becoming more environmentally aware, and more concerned about clean air in public places. This is not just a ‘green’ issue - increasing numbers of people have allergies, currently 4% of the population, and are unable to breathe in areas that are contaminated by smoke, dirt or animal hair. If the railways are to attract more passengers, the access needs of this group of people must be taken into account.

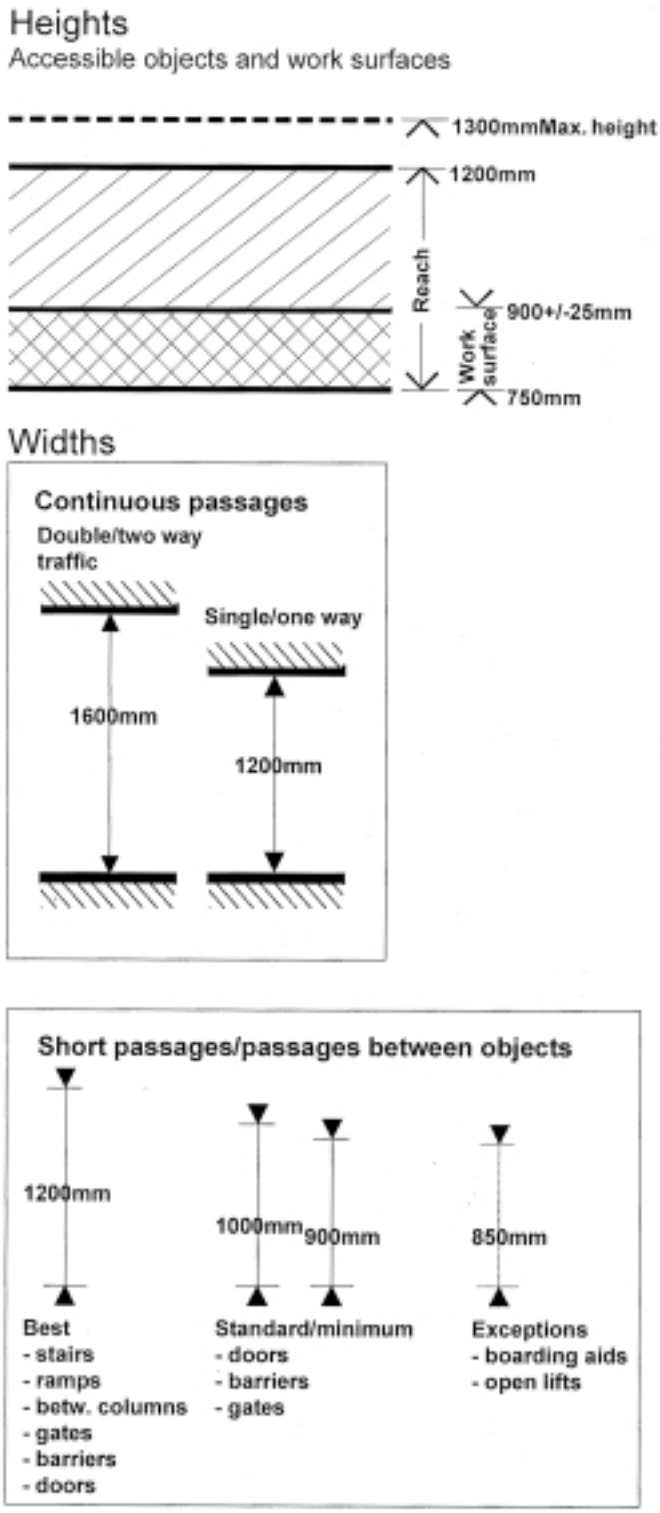
  The minimum requirement is for non-smoking areas - although it is better to have limited areas for smoking, with the main part of the station non-smoking. Animals,

such as dogs, should also be restricted, although the needs of assistance dog users should be balanced with the needs of those with allergies. Adequate provision needs to be made so that both groups of people can receive equal service in the station, without discrimination or discomfort.

Smoking is also a fire-hazard, and in some places it is safer to ban smoking altogether.

Disabled passengers may well be more affected by a dirty environment, for example, toilets, or on floors. People with walking difficulties may slip on wet or dirty floors more easily than non-disabled people. And disabled people using toilets have to touch their surroundings more than non-disabled people, and are therefore more inconvenienced by unhygienic toilets.

Figure 5.1. Dimensions



5.5.4. Arrival, Departure & Wayfinding

- **Arrival at and departure from the station**
  The railway station is inevitably only part of a whole journey. In order to get to, and from, the station, some alternative form of transport will have to be used, ranging from walking to air travel. Stations need to make the interchange as easy and safe as possible for passengers. This can be achieved by open station frontages, with safe routes for pedestrians, clear sign posting and shelters for those who have to wait for an alternative form of transport such as a taxi or a bus. These shelters must give passengers a clear view of the arrival of their alternative transport, so that they have confidence that they will not miss it.

- **Safe and easy entry into the station concourse**
  Passengers, including those with visual impairments, need to be able to find the station entrance with ease. Good signage and a clear line of sight from the arrival point will assist, as will marking the entrance clearly, for instance with a contrasting colour.

  The entrance should be level, and the doors should open automatically. Doors should open to at least 800 mm with a recommended width of 900 mm. Automatic doors require a reliable sensor so that they do not close on people who move slowly. A button to delay the door closing mechanism can be provided, to increase passengers' confidence. Revolving doors must be avoided – two sets of double sliding automatic doors with a short distance between can provide equal weather protection. All glass must be clearly manifested for people with visual impairments.

- **Way finding**
  If the station is laid out logically, way finding is immediately easier. No one wants to have to double back

on themselves because they have chosen the wrong route, and for disabled people this can be especially tiring and frustrating.

Photo 5.8 Nässjö Station (Sweden) - good way finding system

Signs should be positioned to be easily read by passengers, including those with visual impairments. Good contrast between the lettering and the background is required.

For people with visual impairments, a guide path (tactile path) on the ground can assist with way finding. It is important to choose the appropriate surface, and if you have a national standard for tactile surfaces you must adhere to it. Guide paths should be designed and laid in consultation with visually impaired organisations, as it is important to provide the right amount of information, and not confuse passengers with too many paths. Guide paths

work well when combined with technological way finding systems.

Technological systems like the system currently in test in Utrecht Central Station in the Netherlands, or the system at Leeds City Station in the United Kingdom, enable visually impaired people to navigate around a station complex on their own. These systems are triggered by smart cards and provide the visually impaired person with spoken information either to a headset, or aloud. They are most useful when combined with a guide path as in Utrecht.

Photo 5.9 Utrecht Overvecht Station (Netherlands) - BOS system

People with cognitive impairments need straightforward directions, clear signage, and a well laid out station. Colour

and guide paths can also be of use to them as they become more familiar with the station.

Way finding from train to station exit must not be overlooked when designing a station. Clear signage, easily visible from the full length of the train, guide paths, colour, and open station design all help to make the journey stress free.

5.5.5. Pre-travel

- **Ticket office design**

  Ticket offices must provide enough space for people queuing, and for disabled people (including wheelchair users and assistance dog users) to move around without feeling they are obstructing the other passengers.

  The queuing system is an important consideration. Some disabled and elderly people find it difficult to stand in line, and will need seating. However, they will want to retain their place in the queue. One solution is to provide a special desk for disabled passengers so that they can purchase their tickets straight away without having to queue. However, this can make some disabled people feel awkward. A better way is to use queue numbers – passengers take a number when they enter the ticket office, and when their number is called, it is their turn to buy a ticket. If such a system is provided, both the ticket issuing machine and the announcement of the number to be served next must be audible *and* visual, so that deaf and visually impaired passengers can use the system.

  The ticket issuing machine must be accessible to wheelchair users, and if it has controls they must be easily used by those with limited manual dexterity. It must always be kept clean for ease of use and, if possible, staff should be available near by.

Counters should be accessible for tall people, and for short people and wheelchair users. In order to achieve this, it is best to use an adjustable ticket counter. The station staff member can lower or raise the counter to suit the passenger purchasing the ticket.

Photo 5.10 Södertälje Station (Sweden) - adjustable ticket counter

It must be possible for disabled passengers to communicate effectively with the ticket sales staff. Induction loops for hearing aid users are a requirement. Open ‘face-to-face’ counters are best, but where this cannot be done (e.g. for security reasons), non-reflective glass for good visibility, and a sound system that enables people of all heights to speak and listen with understanding should be used.

- **Alternative ticket purchase**
  To assist passengers who find purchasing tickets in the ticket office difficult, or where the ticket office opening

hours are short, it should be possible to purchase tickets in alternative ways.

A useful way of purchasing tickets is the ability to order tickets in writing, by telephone or on the internet, and receive the tickets at home before travel. There are already examples of this system in some European countries. Tickets could also be available from newsagents or other shops, like lottery tickets are.

Ticket vending machines – another alternative to the ticket office – are often difficult for disabled passengers to use. The buttons may be set too high, be too small for those with limited manual dexterity, or be difficult for people with visual impairments to see. Ticket vending machines should be set at a height that enables all passengers to reach the highest and lowest buttons. The buttons must be large enough, and separated enough, for people with limited manual dexterity, and visible to those with visual impairments – e.g. colour contrasted from the machine background, and with large size text, or readily recognised symbols. The addition of speech output will help people with visual impairments and learning difficulties. Touch screens should never be used exclusively for any of the functions – i.e. there should always be an alternative way of selecting as well as touching the screen, so that people who cannot see the screen are not disadvantaged. Ticket vending machines should be positioned so that they can be easily found, but they do not get in the way of passengers. They must be well maintained, so that the features that have been included to provide better access – such as illumination, or sound – do not degenerate. Buying tickets should be a logical, straightforward process, not based on the organisation of the railway, but on the way that passengers think about travel. They should *always* give disabled passengers the ability to use discount cards,

where other discount cards (such as those for elderly passengers) can be used.

5.5.6. Station facilities

- **Waiting**
  Warm, dry, safe waiting facilities should be provided in the station concourse. Plenty of seating must be available, of different heights, and both with and without armrests. Some people find it easier to get up from a seat using the armrests. Access to the waiting facilities must be level, and where the area is enclosed, the doors should open automatically. This will assist all passengers.

  Passengers using the waiting facilities will need information about train departures and arrivals, so that they know when to make their next move. This information should be provided both visually and audibly.

- **Toilets**
  At least one toilet should be accessible to wheelchair users. Some countries, such as the UK, have a national key scheme for accessible toilets, so that they can be locked against vandals. If there is a problem of vandalism this is recommended, but a key must also be readily available on the station from staff situated close to the toilet. The wheelchair accessible toilet should be fitted with the same facilities as other toilets, such as sanitary supply dispensers and condom machines, at an accessible level, and with easy to use controls.

  Other toilets should be fitted with handgrips for people with walking difficulties – including men's urinals.

  Colour contrasting should be used in all toilet facilities to enable visually impaired people to identify facilities without having to use their sense of touch.

In all toilets, facilities such as hand driers, towels, soap and so on must be easy to reach, and easy for those with limited manual dexterity to use.

Toilets must be kept clean and well supplied. Wet floors, lack of soap, dirty toilet seats and surroundings and so on are more of a hazard to disabled people – and will make non-disabled people reluctant to use the facilities provided.

- **Telephones**
  Provision of public telephones is recommended. Wherever these are provided, they should be made accessible to disabled people. The highest feature of telephones that passengers need to reach should not be above 1300mm. Provision of induction couplers and volume controls, pay text telephones, and easy to distinguish and use controls are all important considerations. Where telephones have a canopy to protect users from ambient noise, the canopy should reach to the floor, so that white stick users can recognise it as an obstacle and not bump into it.

- **Trolleys**
  Luggage trolleys are a very important facility for passengers, especially in larger stations. Trolleys should be stable, and easy to manoeuvre with a good braking system. The locking mechanism (to connect a row of trolleys) must be easy to use for people with limited manual dexterity.

  Frequent trolley points are important so that people do not need to walk a distance to return their trolley.

- **Commercial outlets**
  Commercial outlets are usually rented to third parties. However, every effort should be made to ensure that they are accessible to disabled passengers, so that

disabled passengers are given equality of service on the station. Additional facilities are an important part of the station experience – they add value to the service railway companies provide to their customers. Service agreements and lease terms can be used to require access for disabled passengers.

Important things to remember are: identification of the facility – e.g. by inclusion in the wayfinding and guidance systems, counter heights, access to and identification of goods, communication with sales and service staff. In food and drink outlets, at least some loose seating should be provided, so that wheelchair users, assistance dog users, and ambulant disabled people are able to be seated at tables.

- **A 'safe haven'**
  When people get into difficulty on their journey, they need somewhere safe and comfortable to stay whilst they sort out the problems. These problems may arise because they have missed a train, or mistaken information they have been given.

Photo 5.11 Chamartin Station (Spain) - "safe haven"

The ‘safe haven’ should provide seating, and a means of communication with rail companies or station staff, so that new plans can be made. It can be the same area as the waiting room, if one is provided, or the restaurant or café.

Although these ‘safe havens’ may be used by all passengers, they are of especial benefit to disabled people because of the forward planning required for their journeys.

5.5.7. Platforms and tracks

- **Design of platforms including safety**

  Platforms must be wide enough to allow passengers to stay clear of high speed trains passing through the station (clearly marked by a line on the platform), whilst still providing plenty of circulation space in the safe area. Guidepaths for visually impaired people should always be located in the safe area of the platform. The edge of the platform must be clearly marked with colour contrast. Tactile edging is recommended for marking the platform edge, but only where its meaning is unambiguous - the tactile surfaces should warn passengers specifically that they are at the edge of an off-street platform. Where there are national standards, they should always be adhered to.

  Obstacles on the platform should be avoided, and where this is not possible (such as lighting columns and train driver information panels), they must be clearly contrasted with their background so that they do not provide a hazard to visually impaired people. Furthermore, obstacles must not stick out further towards the top than at the bottom, as a white stick user may not detect the obstacle until they hit it.

- **Getting from one platform to another**

  Except where a station is a small halt with only one platform, getting from one platform to another will be essential for travel. Footbridges enable passengers to orient themselves more easily than they are able to when going under the tracks via a tunnel. They are able to see the tracks, and to get a good view of the station environment, and are liable not to become confused about directions. Both footbridges and subways require glass lifts (ramped footbridges generally require too long a ramp), and safe well designed stairs. In larger stations, escalators can be provided as an additional choice for passengers.

Photo 5.12 Clontarf Road Station (Ireland) - foot bridge

Photo 5.13 Hässleholm Reissecenter (Sweden)

Photo 5.14 Katrineholm Station (Sweden) - tunnel

Photo 5.15 Angleholm Station (Sweden) - level crossing

Crossing the tracks themselves may be acceptable in some circumstances - e.g. where the trains are less frequent and do not travel at high speed. In this case, care must be taken to ensure that the gaps in the rails, for the train wheels, do not cause an obstacle for those in wheelchairs, or with sticks and crutches. If the crossing is not a controlled level crossing (for example, a barrow crossing not primarily intended for passenger use), disabled passengers must be accompanied when crossing.

- **Waiting on platforms**

  No matter how punctual the trains are, and how good the information provided in the station concourse, some passengers will inevitably have, or choose, to wait on the platform. Disabled people are likely to wait on the

platform longer than other passengers because they will be less confident of getting to the train on time.

It is important to provide plenty of seating, of different heights, and both with and without armrests. Some people find it easier to get up from a seat using the armrests.

Photo 5.16 Ermelo Station (Netherlands) - waiting shelter

Good shelters are also required, and where possible and necessary, these should be enclosed and heated. The shelters must have level entrance, and automatic doors, to enable easy access. Modern shelters are often constructed of stainless steel and glass, but this causes significant problems for people with visual impairments, and as a minimum, stainless steel should be coated with colour, and glass should be clearly manifested. A range of seating should be provided in the shelter as on the platform. Shelters must be large enough to provide a turning circle of at least 1500 mm for wheelchair users.

Disabled passengers using the waiting facilities will need information about train departures and arrivals, so that they know when to make their next move. This information should be provided both visually and audibly.

- **Access to trains**
  The interface between platform and train is covered in chapter 4.

5.6. Sound and acoustics

5.6.1. Environment

Where passengers need to be able to hear staff speaking to them – for example at ticket office counters, information booths and so on, it is important that the surrounding area is quiet. These facilities should not be located where the noise of trains or traffic or of station announcements makes a disturbance.

Photo 5.17 Kastrup Station (Denmark) - talking information sign

5.6.2. Operational practices

Audible messages are provided so that passengers can be given information about their train journey – whether regular information or information about exceptions such as delays or cancellations. Railways often forget the purpose of these messages, and they may not even be of use to non-disabled passengers if they are not properly provided.

Staff who make announcements must be trained in the correct use of the equipment, such as microphones. Incorrect use of equipment is the most common reason for failure to communicate adequately. They should be encouraged to speak clearly, and not to speak too fast – very slow speech can, however, be equally difficult to understand. Announcements must be correctly timed – it is pointless announcing the train at platform 3 if it has already left the station.

Staff need to understand that if an announcement is worth making at all, it is worth ensuring that all passengers can understand it. But of particular importance are those announcements about exceptions to the norm at the station, such as platform changes.

5.6.3. Technology

The loudspeaker system should transmit the spoken messages faithfully. Clarity of sound depends on the choice of loudspeaker system, the placing of the loudspeakers, and the loudness of the audio signals. For the system to function satisfactorily the loudspeaker system should give an even spread of sound; there should not be points or areas where the sound is uncomfortably loud, or too soft to be heard clearly. As the main function of the loudspeaker system is to transmit spoken messages, the reproduction of consonants is of particular importance. The complexity of

combining the problems of acoustic conditions with loudspeaker technology requires use of consultants if the result is to be effective.

5.7. Emergencies

Any plans for emergencies must consider the needs of disabled passengers. In emergencies, many disabled passengers will be less able to fend for themselves. If their evacuation has not been properly planned, they may become a danger to themselves and to other passengers. Good planning can avoid such a disaster.

People who are deaf, or hard of hearing, need to understand that there is an emergency, what the emergency is, and what they should do. Visual information and the use of flashing lights can assist.

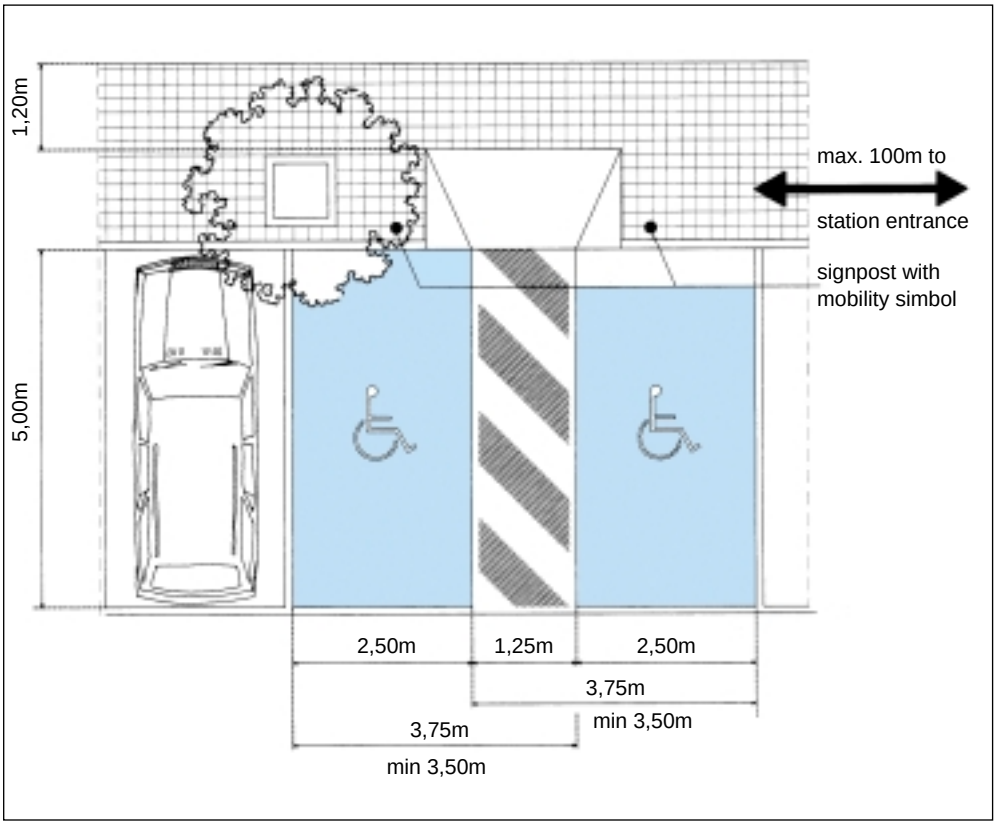
People who are visually impaired may be able to hear the warnings, but may not know where they should go, and may become disorientated. Emergency routes and exits should be well marked with colour and light, and assistance should be provided to those who are unable to use these cues.

People with mobility impairments will need time to evacuate and, in many cases, assistance. Refuges may be needed so that they can wait for assistance – these should be clearly identified, and have a communication system available so that the passengers can alert someone that they are there, and be reassured that help is coming. Lifts, escalators and travelators need to complete their journey, and will need a backup power source in case of power failure.

5.8. Dahl charts

Parking - location and type

Purpose
To ensure that passengers using private cars to access the station can leave their cars safely
To ensure that passengers with reduced mobility are able to park close to the station entrance



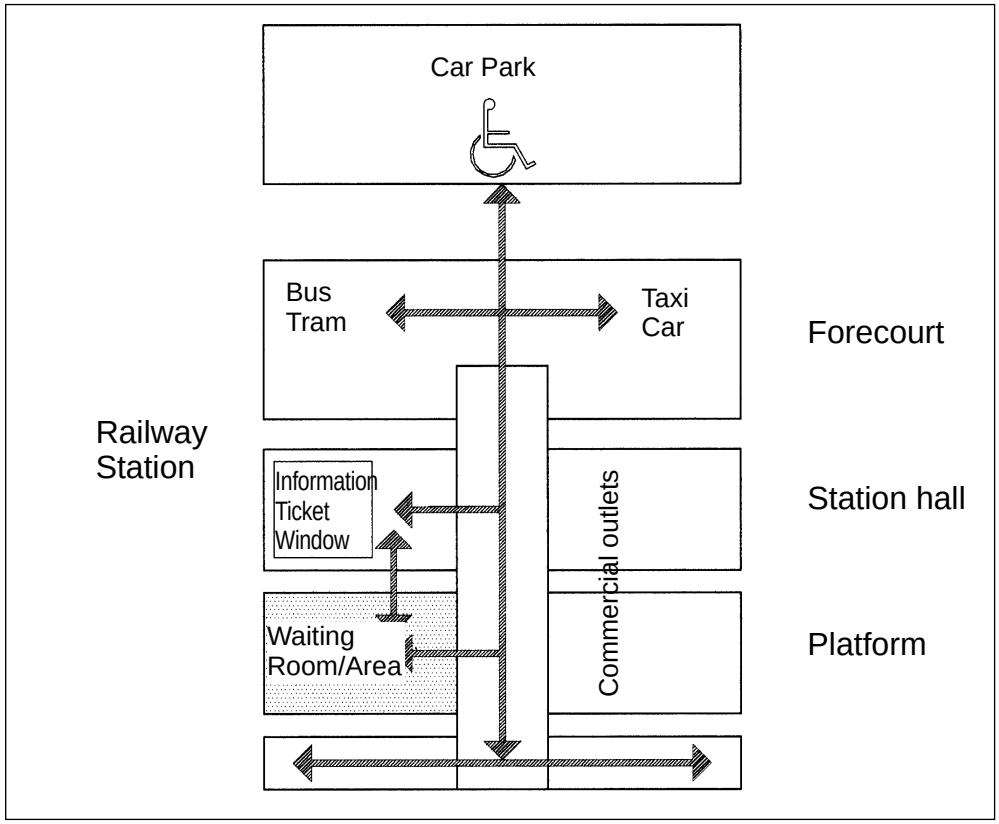
Best: Full range of parking options - short-stay, long-stay, drop-off, pick-up
All options available for people with reduced mobility within 50m of station entrance

	Parking space at least 3.75m wide Parking for people with reduced mobility clearly reserved (blue space) Fines for people parking illegally in reserved spaces Free parking for all options Security patrols in the car parks Well-lit parking areas Shelter to allow people to transfer in comfort
Recommended:	Full range of parking options - short / long-stay, drop-off, pick-up
standard:	Parking space at least 3.75m wide Parking for people with reduced mobility clearly reserved (blue space) Fines for people parking illegally in reserved spaces Reasonable parking costs for people with reduced mobility A working security system in the car parks that will monitor reserved spaces Well-lit parking areas
Minimum:	Full range of parking options - short / long-stay, drop-off, pick-up Parking space at least 3.75m wide Parking for people with reduced mobility clearly reserved Fines for people parking illegally in reserved spaces Well-lit parking area

Routeing systems

Purpose

To give guidance regarding the main layout of the station.



Logical layout

- Main functions located in a logical step-by-step progression
- Secondary functions clearly separated from but located adjacent to main functions
- Having goals in sight enables passengers to understand the route quickly and easily - main facilities clearly visible
  - from main entry
  - from platform end
  - at all stages through the building

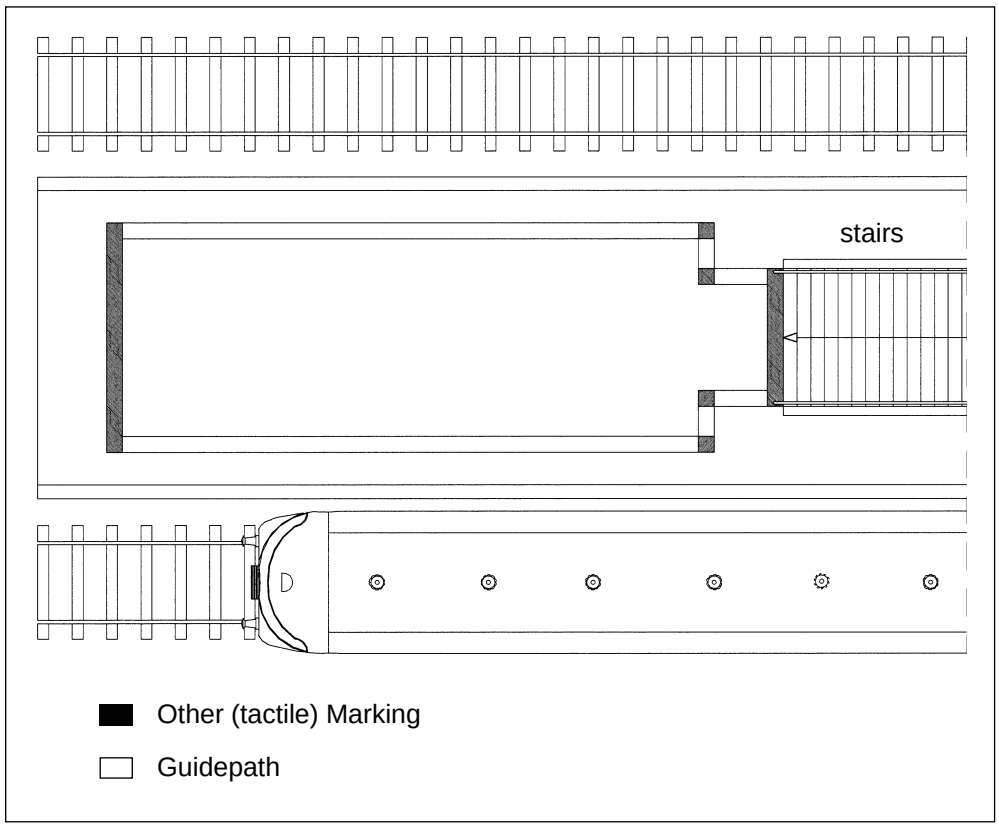
Circulation system

- All passengers should follow the same route, as a matter of principle
- Functions/facilities located adjacent to, not intruding into main circulation space
- For passengers to maintain a sense of direction, the route should follow a straight line through a clearly defined space.
- Changes of direction should be avoided wherever possible.
- A succession of bends, or bends at angles other than 90 degrees contribute to loss of direction and should be avoided.

Guidepaths on Platforms

Purpose

To direct visually impaired passengers along the platform to their boarding point, in the safe area



Best:

800 mm wide
On the safe side of the platform safety area (see Platform chart)
Rubber or concrete tiles (see Tactile Flooring chart for type)
Lighting 100 lux

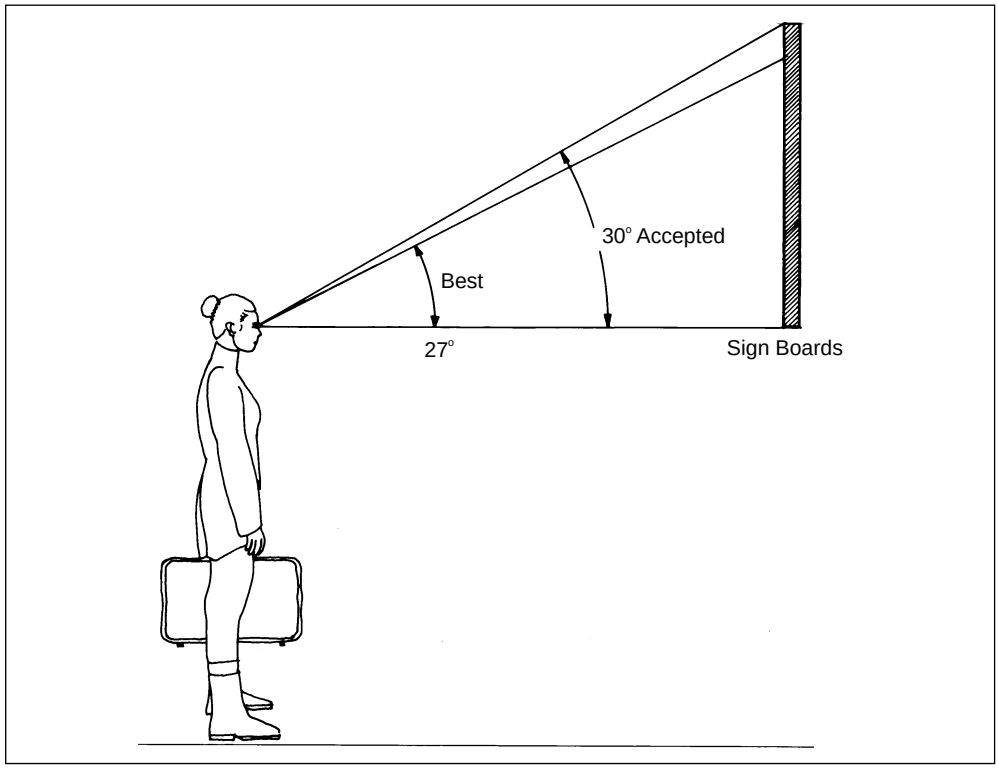
Recommended: 600-800 mm wide
standard: On the safe side of the platform safety area (see Platform chart)
Rubber or concrete tiles (see Tactile Flooring chart for type)
Lighting 50 lux

Minimum: 400 mm wide
On the safe side of the platform safety area (see Platform chart)
Rubber or concrete tiles (see Tactile Flooring chart for type)
Lighting 20 lux

Sign Boards

Purpose

To enable all passengers to read signs easily, to get information and to find their way



Best:

Sans serif font, mixed case, letters evenly spaced
Lighting indirect
Contrasting colours as indicated
Angle of elevation < 15º

$$\text{Height of lettering} = \frac{\text{reading distance}}{250\text{mm}}$$

Matt surface with maximum 15% gloss factor

Recommended standard:

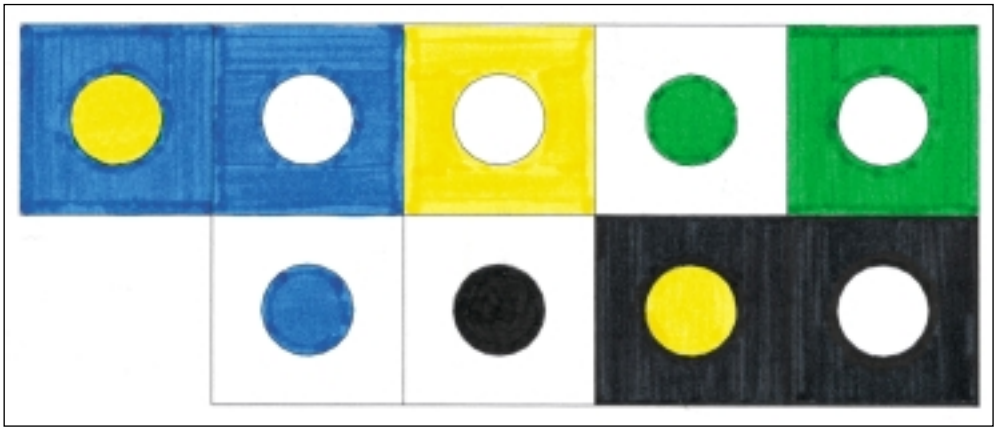
Sans serif font, mixed case, letters evenly spaced
Lighting from the back or side
Contrasting colours as indicated
Angle of elevation < 25º

$$\text{Height of lettering} = \frac{\text{reading distance}}{250\text{-}300\text{mm}}$$

Maximum 40% gloss factor

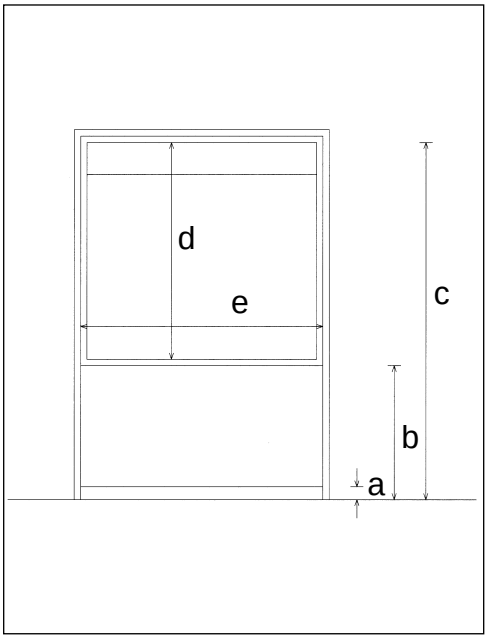
Reading distance (mm)	5000	4000	3000	2000	1000
Best letter height (mm)	200	160	120	80	40
Acceptable letter height (mm)	170	130	100	70	40

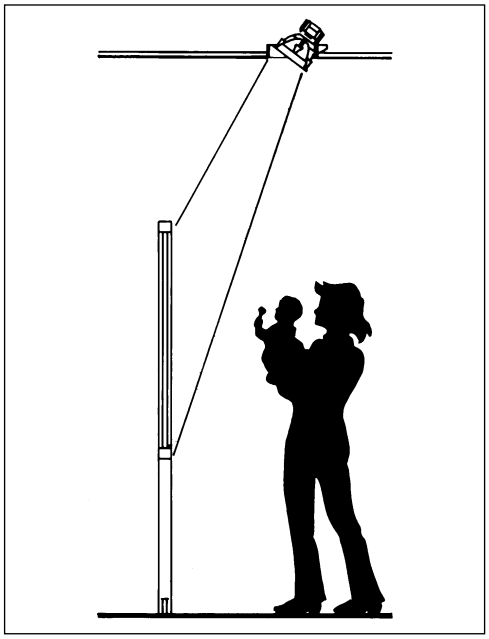
Tactile signs should be used where possible to support visual signs, but must always be within reach (800-1300 mm), and never disrupt passenger flow

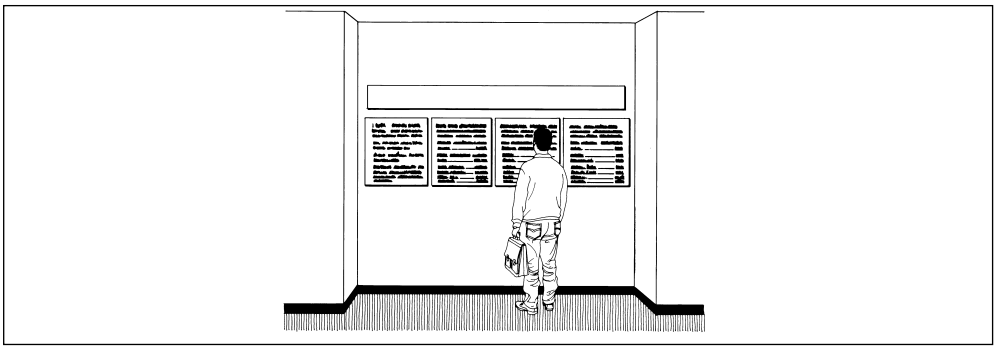


Timetable panels

Purpose
To provide easily legible and understandable information for passengers.
To provide information without blocking the main passenger flow (either the boards themselves, or those reading them)
To be clearly visible without causing an obstacle to disabled passengers, especially those with visual impairments.







Placing of panels

Panels should be positioned adjacent to the main flow of passenger circulation, and at right angles to the direction of the flow.

Placing should allow travellers to stand directly in front of the panel (reading distance less than 0.5 m) without impeding the main circulation flow.

Protection

Free standing panels should be clearly marked in accordance with the chart “Protection from obstacles”.

Panel frame

a. Skirting*:Minimum and best 300-400 mm

b. Underside of panel/free space underneath panel: Best 900 mm Minimum 700 mm

c. Top of panel: Best 2.1 m Maximum 2.6 m

Panel size, standards

d. Height 1.0 – 1.2 m
e. Width 800 mm – 1.1 m

Lettering

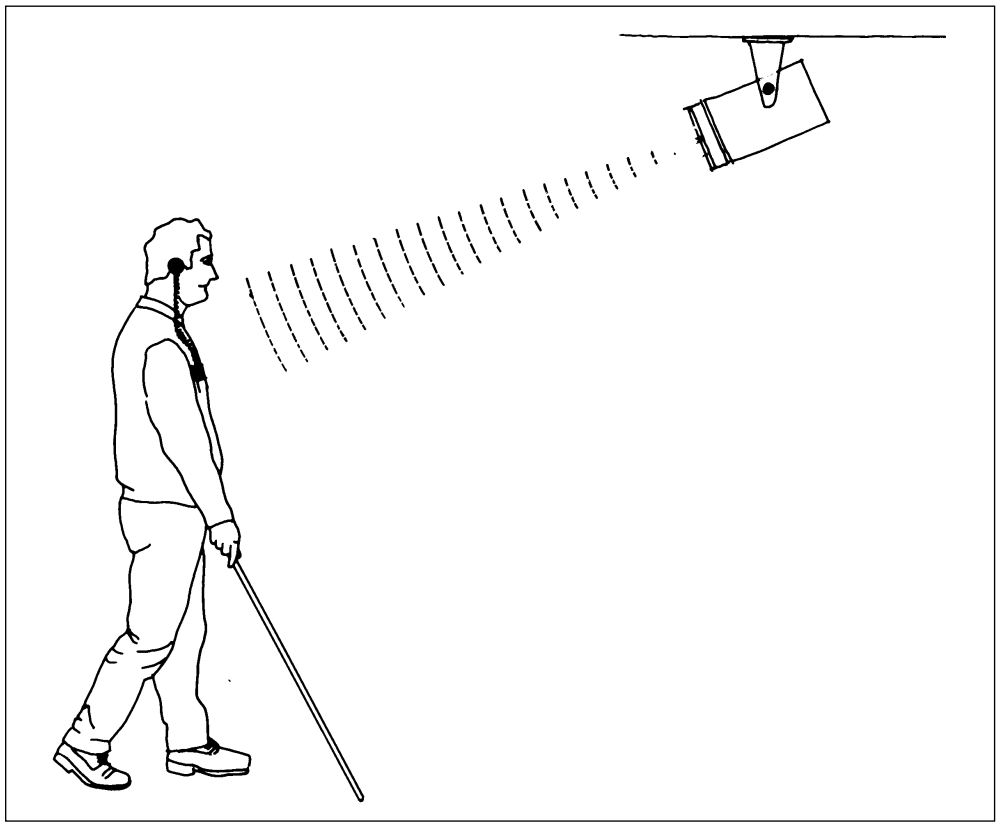
- Colour and contrast: see chart “Sign Boards”
- Text: Mixed case, Best 30 mm Minimum 25 mm
- Heading: Capital letters, Best 150 mm Minimum 50 mm

* Note. Free standing panels with an opening between the paving and the underside of the panel should have a skirting to guide visually disabled who use a touch stick around the panel.

Radio / Electronic Aids

Purpose

To assist visually impaired passengers to find their way around the station



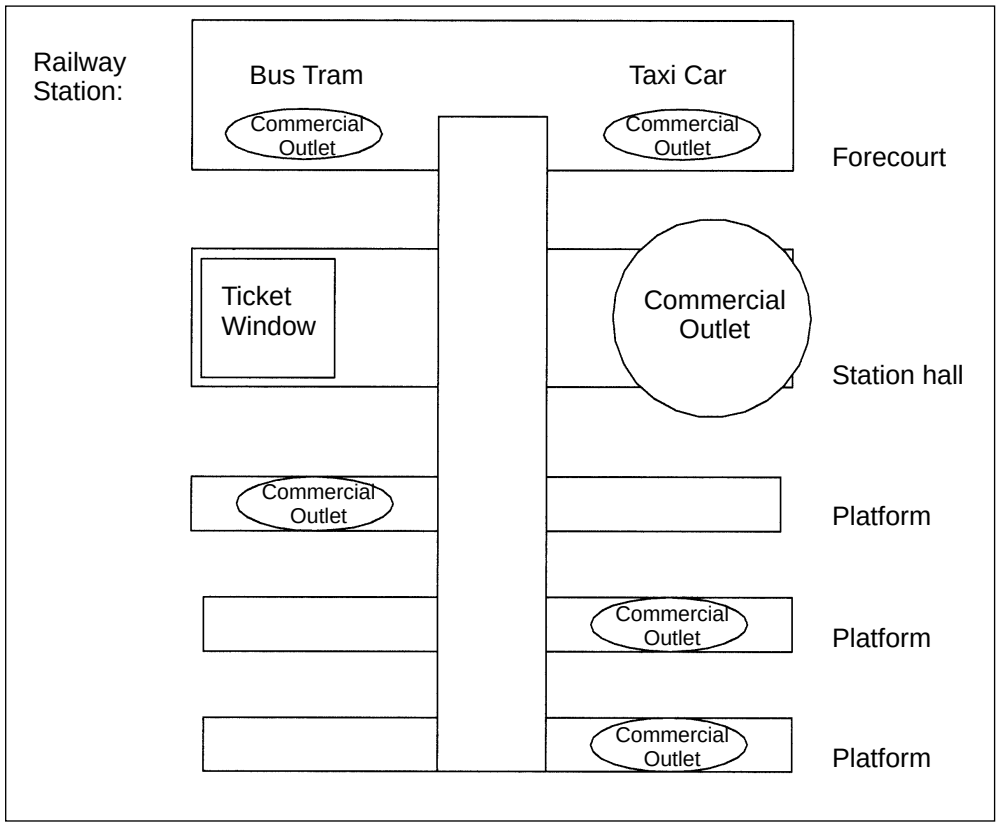
For passengers with a visual impairment, advanced guidance systems have been developed – sometimes known as ‘smart signs’. These systems are beacons that are controlled remotely by a receiver which the visually impaired person wears or holds, and provide information at critical points on the route.

There are two types of system – infra-red and radio frequency. Infra-red (BOS, Easywalker, Open, Infravoice and Talking signs) is line of sight only, and radio (RNIB React, Czech Blind United, pe, RIS) is non-directional.

Best:	Static information (about unchanging features of the environment) Route information in conjunction with a guidepath (see chart) Dynamic information (about train departures, platforms etc.)
Recommended standard:	Static information (about unchanging features of the environment) Route information in conjunction with a guidepath (see chart)
Minimum:	Static information (about unchanging features of the environment)

Commercial Outlets

Purpose
To ensure that the station gives better value to the community by providing services other than just transport whilst:
Enabling all passengers to find their way around the station more easily and
Providing better access for disabled people at commercial outlets on a station – such as catering, kiosks and retail outlets



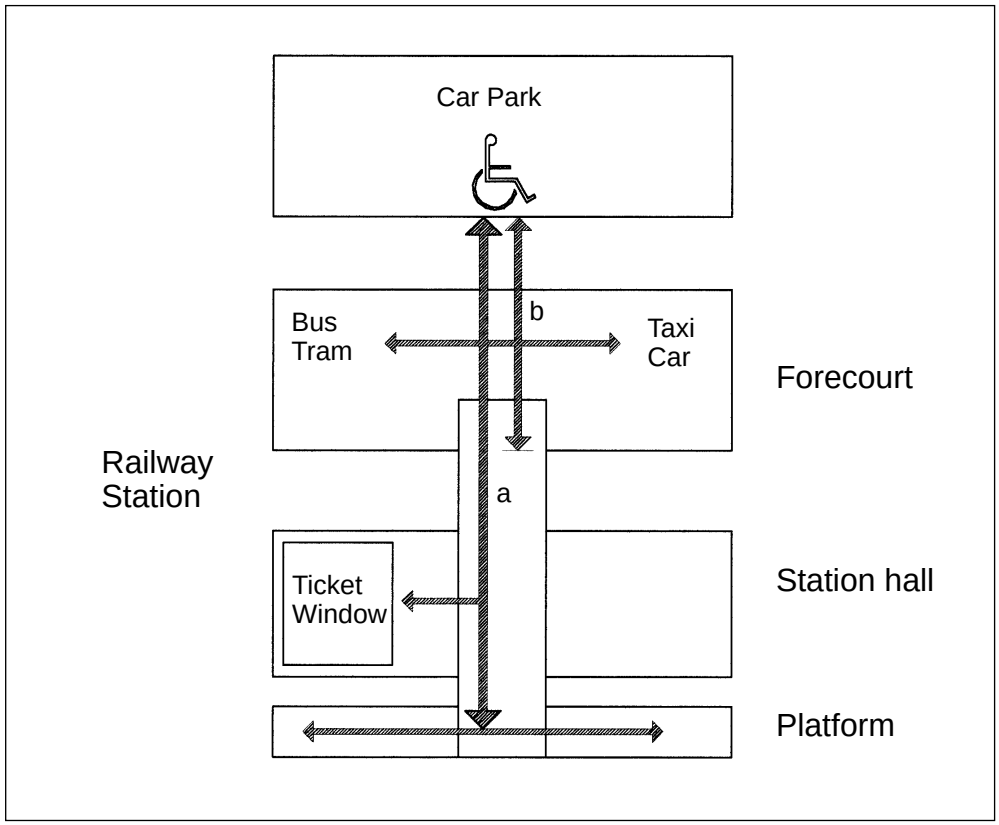
Best: Grouping of commercial facilities around a given theme – e.g. catering, pharmacies, bookstores

	Clear signage and text with directional arrows, pictograms, and colour-contrasted routes for visually impaired people and those with learning difficulties – with electronic orientation system Wide passageways and step-free access All interiors fitted with accessible furniture, tables, chairs etc. Adjustable counters with leg room under for wheelchair users Automatic glass doors, with markings for visually impaired people.
Recommended standard:	Clear signage and text with directional arrows, pictograms, and colour-contrasted routes for visually impaired people and those with learning difficulties – with electronic orientation system Wide passageways and step-free access All interiors fitted with accessible furniture, tables, chairs, adapted counters etc. Automatic glass doors, with markings for visually impaired people.
Minimum:	Clear signage and text with directional arrows, pictograms, and colour-contrasted routes for visually impaired people and those with learning difficulties – with electronic orientation system Wide passageways and step-free access Automatic glass doors, with markings for visually impaired people

Walking distances

Purpose

This chart outlines limits to the length of travel on foot; distance is one of the primary disabling features. (See also note 1 below)



a. Total distance from accessible car park to the start of the platform closest to the entrance
Best: 100 m. Maximum: 200 m.

b. Distance from accessible car park to station entrance or platform
Best: 50 m. Maximum: 100 m.

c. Ticket facility
   Should be situated on the main circulation route through the building

Notes:

1. Objectives

The figures should be understood as statement of aims and goals; the conditions in many existing structures may make it impossible to satisfy the requirements. The aim should always be to arrive at solutions that are as close to the maximum (or best) requirements as possible.

2. Supplementary dimensions

It is advisable to supplement the requirements with best/maximum distances to other facilities, such as toilet, left luggage etc.

3. Assistance/personal transport

Personal transport such as electric mini cars is an efficient way of minimising barriers between the entrance and the train for all passengers. The provision of personal transport is particularly advisable in large stations, where the size and layout make it impossible to achieve the recommendations in the table.

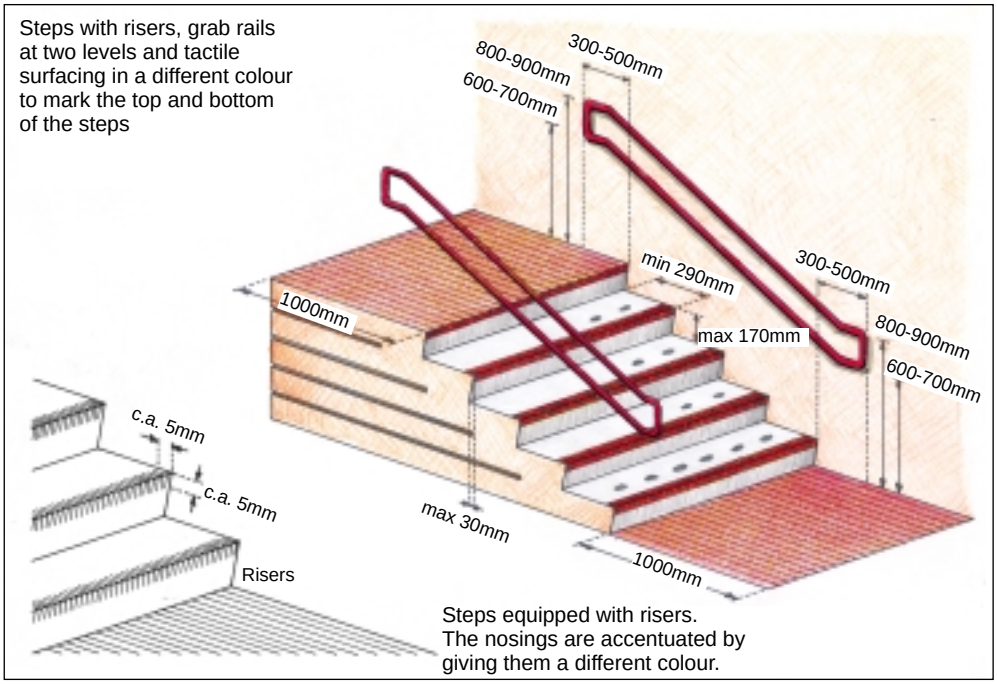
4. Route distance information

Where walking distances cannot be reduced, it is important to provide people with

a) information about the distance, number of steps if any, and suggestions for the 'shortest route'
b) seating and resting places close beside the route

Stairs

Purpose
To ensure that passengers who prefer to use stairs can do so safely and with ease



Best:

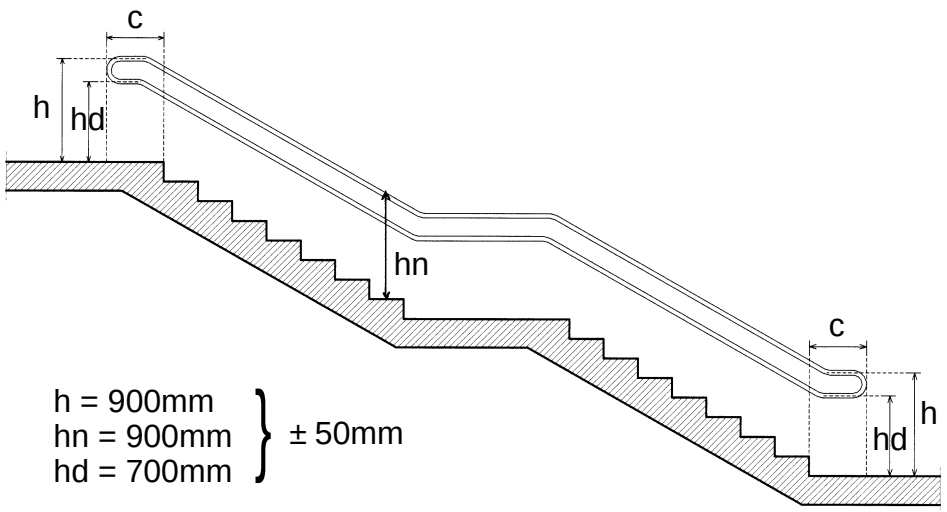
Straight flight(s); Each flight >3 and <12 steps with landings
Closed risers, height 100-120mm, 1 tread + 2 risers = 620mm
90º angle between tread and riser;
Width of stair 1.2m to 1.5m between handrails
Colour contrasted hazard warning at top/bottom of flights (>= 1m width)
Treads with contrasting nosings (on tread and riser) and non-slip surface
Good lighting on stairs (see lighting chart)
Closed underside of stairs
Handrails (see handrail chart)

Recommended standard:	Straight flight(s); Each flight >3 and <12 steps with landings Closed risers, height 100-120mm, 590mm<1 tread+2 risers>650mm 90º angle between tread and riser; Width of stair 1.2m to 1.5m between handrails Colour contrasted hazard warning at top/bottom of flights (>= 1m width) Treads with contrasting nosings (on tread and riser) and non-slip surface Good lighting on stairs (see lighting chart) Closed underside of stairs Handrails (see handrail chart)
Minimum:	Riser height not > 170mm; Landings at direction changes Closed risers unless a passenger operated lift is available 590mm < 1 tread + 2 risers > 650mm 90º angle between tread and riser; Width of stair >=1m between handrails Hazard warning at top and bottom of flights (>=1m width) Treads with contrasting nosings (on tread and riser) and non-slip surface Good lighting on stairs (see lighting chart) Open underside of stairs must be clearly marked Handrails (see handrail chart)

Handrails

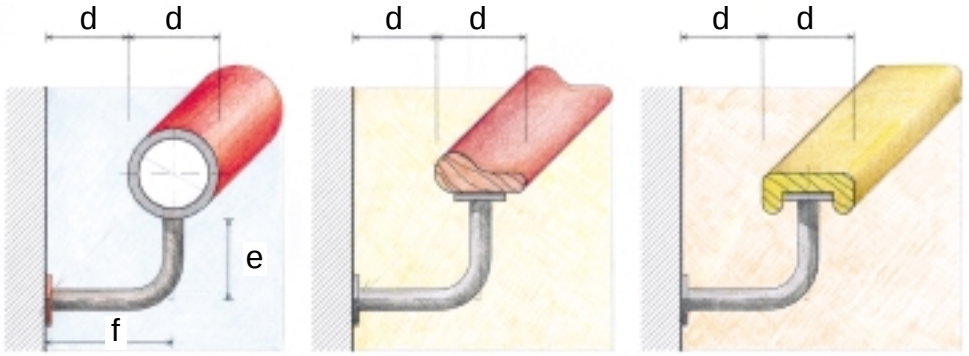
Purpose

To give passengers a safe, easy to hold, support when using stairs, ramps and other walkways



h = 900mm
hn = 900mm
hd = 700mm
} ± 50mm

300mm ≤ c ≤ 600mm Best 500mm



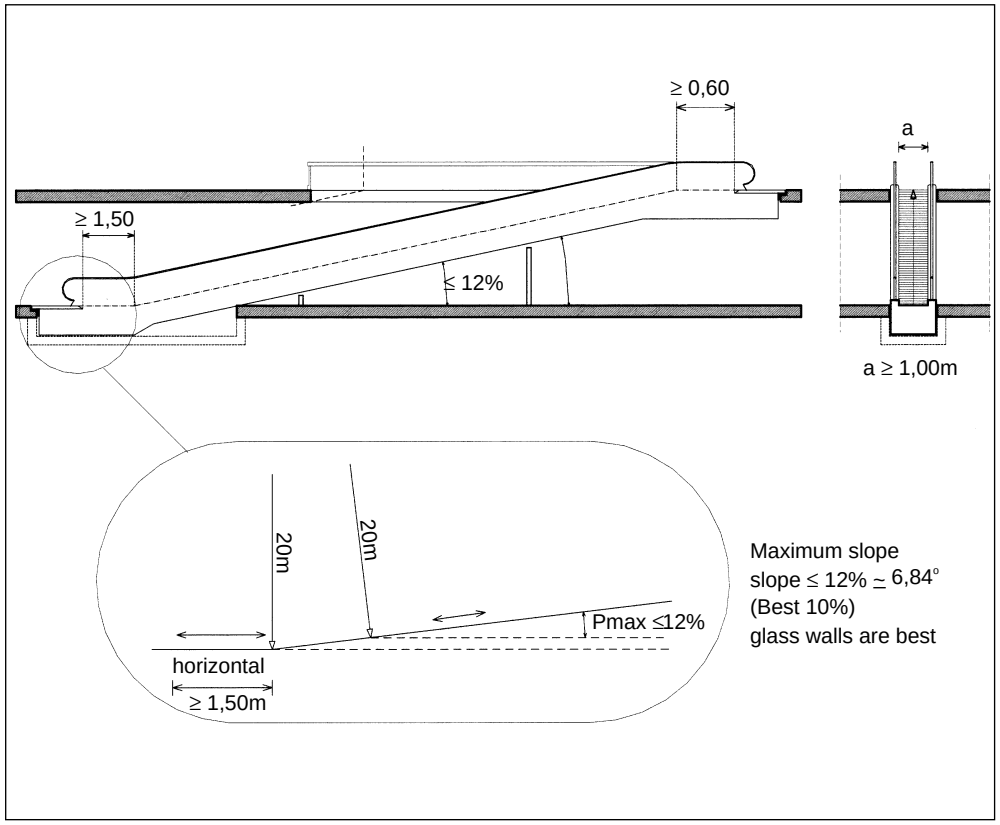
40mm ≤ d ≤ 50mm 40mm ≤ e (if necessary, f=75mm

Best:	Handrail at 900mm Lower handrail at 700mm for children and short people Handrail extends 500mm beyond top and bottom stair Material colour contrasted, rust-free, warm to touch, not containing nickel, rubber or chromium Handrail diameter between 40mm and 50mm Distance from wall between 40mm and 50mm
Recommended standard:	Handrail between 850mm and 950mm Lower handrail between 650mm and 750mm for children and short people Handrail extends between 300mm and 600mm beyond top and bottom stair Material colour contrasted, rust-free, warm or neutral to touch, not containing nickel, rubber or chromium Handrail diameter between 40mm and 50mm Distance from wall between 40mm and 50mm

Travelators

Purpose

To provide passengers with a route from one part of the station to another without having to walk far



Best:
Width >= 1.5m
Level travel
Speed <= 0.75 m/s
Handrail available (see handrail chart)
Handrail and travelator
Slip-resistant flooring
2.3m height clearance along the length

Recommended standard:
Width >= 1m
Gradient <= 10%
Speed <= 0.5 m/s

Handrail available
Handrail and travelator move at same speed
900mm slip resistant flooring at start and finish

If used outside, requires cover and other weather protection if applicable.

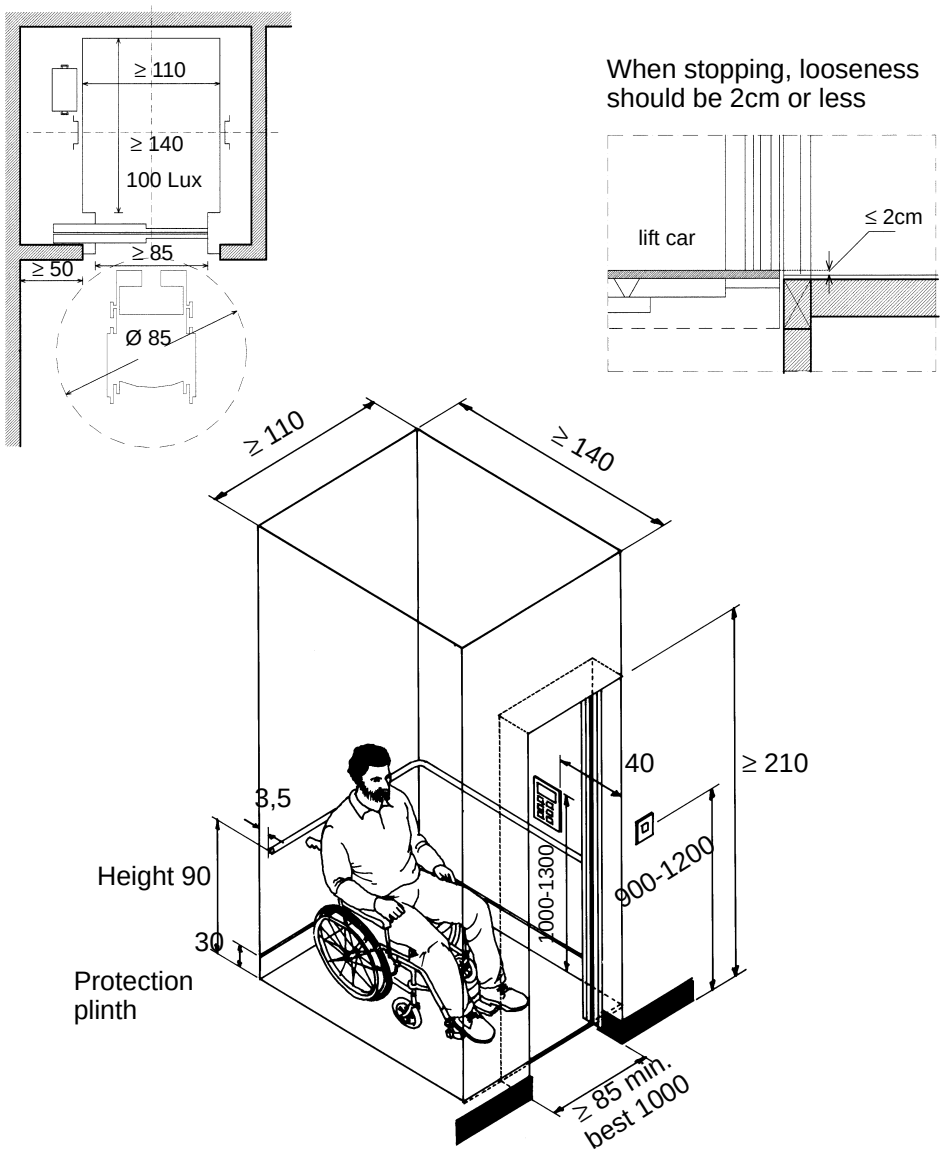
Steps must always be available in addition to a travelator.

Lifts

Purpose

To provide additional means of changing level for those unable to use stairs or escalators

Must always be available when there are different floor levels in the station



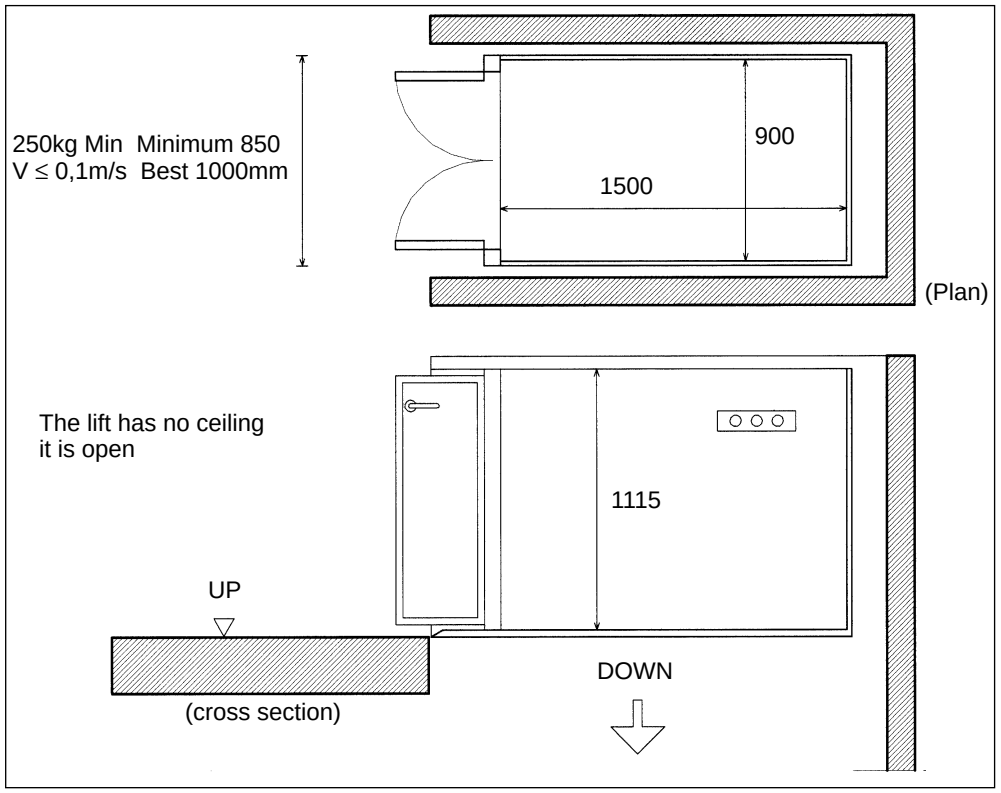
Perimeter round section handrail 3cm ≤ Ø ≤ 5cm

Best:	Located immediately next to the stairs Non-reflective glazed shaft and car for visibility in and out Automatic entry doors, with sensor preventing doors closing on passengers, baggage etc. – doors to remain open > 20 seconds for slowest passengers Doors block open when lift not in operation Slip resistant flooring Handrail around lift car (see handrail chart) Visual indicators of floor level and facility Acoustic information for floor level, doors closing and opening Visual information opposite lift door indicating floor level Weight capacity >650kg Emergency intercom system with induction loop Contrasting colour door For controls, see lift control chart
Recommended standard:	Clearly signed from and close to the stairs Non-reflective glazed panels Automatic entry doors, with sensor preventing doors closing on passengers, baggage etc. Slip resistant flooring Handrail around lift car (see handrail chart) Visual indicators of floor level and facility Emergency telephone Visual information opposite lift door indicating floor level Weight capacity >650kg Contrasting colour door For controls, see lift control chart

Open lifts

Purpose

To give a means of changing level to those unable to use steps that is cost-effective where the level change is <= 1m



Recommended standard:

User-operated
Automatic door(s)
Doors cannot be opened unless lift is on that level
At rest in the ‘down’ position for safety
Sensors to detect obstructions
Emergency stop button clearly visible
Handrails on both sides of the car (see handrail chart)
Sign recommending wheelchair users to apply brakes

Designers should **always** refer to national regulations (including safety) when considering use of open lifts.

LIGHTING

Purpose
To ensure that all passengers can find their way and travel safely

- **Platform:** Best – 100 lux, Standard – 50 lux, Minimum – 20 lux
  The minimum luminance on the platform edge relative to the average luminance on an open platform shall not exceed 1 : 2.5
  In a covered area: 1 : 5 for minor station; 1 : 7.5 for major stations
- **Stairs:** Standard 120 lux, with a clear accent placed on the start and end of the stairway

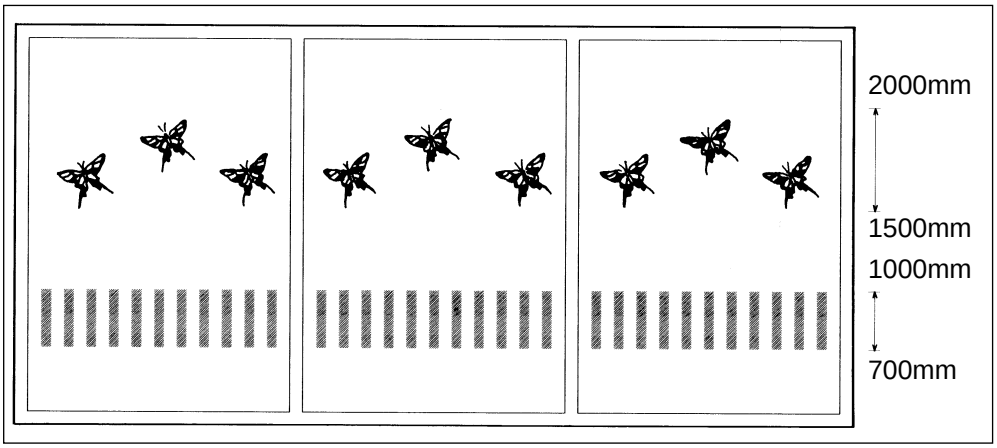
- **Ramp:** Standard 50 lux, with accents of max. 100 lux at the start, the end, and at any landings. If the ramp is located between two areas where the lighting level is considerably higher, the lighting level of the ramp should be adapted to the surroundings
- **Tunnel/Crossing:** Best 100 lux, Standard 50 lux. Good, clear lighting is required in (subway) passages.
- **Station forecourt:** Setting down and picking up points, crossing points, disabled parking spaces: Best 100 lux, Standard 50 lux, Min. 20 lux
- Additional, even downlighting should be provided at ticket counters and timetables
- Low pressure sodium should not be used due to poor quality light with poor colour rendering properties
- Lighting should never be used as flush mounted floor fittings so that they shine in people’s faces
- Lighting should not produce glare or dazzle

Glass Wall Marking

Purpose

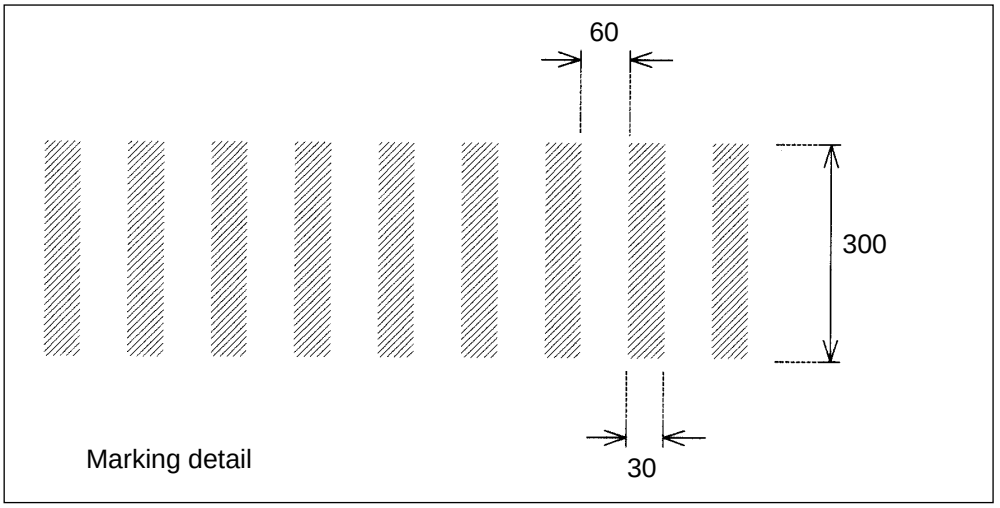
To ensure that passengers – especially those with visual impairments – do not mistake large expanses of glass as open space

Glass walls and doors must be marked with prominent signs, logos, emblems or decorative features at eye height (1.50-2.00 m), contrasting with the surrounding area, especially for visually impaired passengers. For people with a lower eye level, such as children and wheelchair users, markings should be repeated at a lower level (0.85-1.00m). Care should be taken that the markings chosen are clear – not confusing – for visually impaired passengers.



Minimum/Standard: Marking at 1.50-2.00 m,
Markings contrast with the surrounding area
Markings > 150 mm

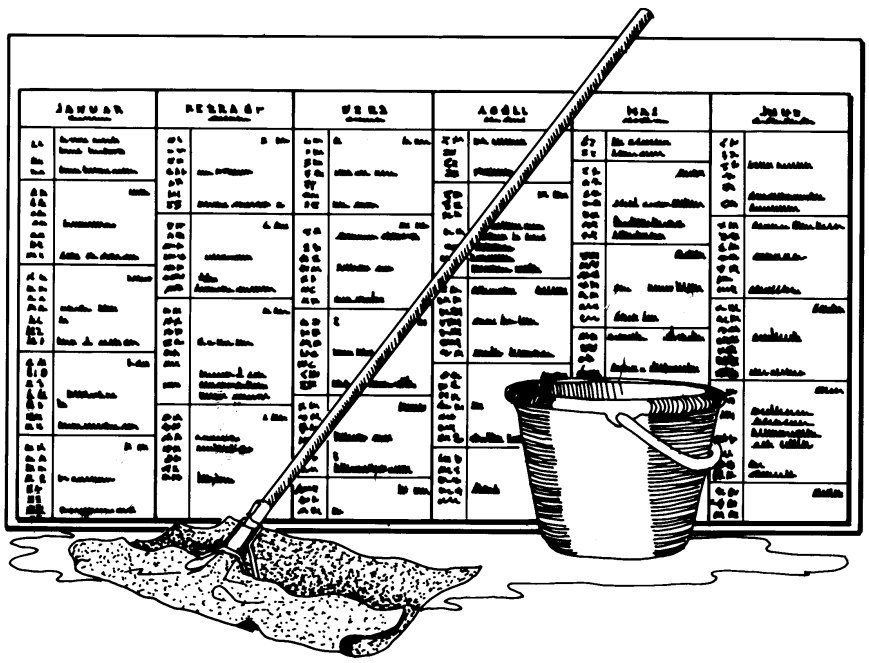
Best: Marking at 1.50-2.00 m and at 0.85-1.00m,
Markings contrast with the surrounding area
Markings > 150 mm



Marking detail

Clean, smoke-free stations

Purpose
To ensure that passengers with environmental impairments are not prevented from travelling
To ensure that passengers who do not like smoking can travel in comfort
To reduce the risk of fire
To provide passengers with reduced mobility with clean, safe toilet facilities to reduce the risk of slipping, and enable the clean, safe use of handrails etc.



Recommended standard:	No-smoking environment with enclosed smokers' area Plenty of ash-trays at entrances – out of line of travel Clearly signed no-smoking Staff request passengers not to smoke if necessary Some facilities with 'animal-free' zones, especially if enclosed[1] Cleaning materials to be stored out of the way in their own cupboards After regular cleaning according to overall plan for station Emergency cleaning teams available for spillages etc. Appropriate warning of slippery floor when cleaning is in progress
Minimum:	Clearly signed no-smoking areas available in all facilities Staff request passengers not to smoke if necessary Some facilities with 'animal-free' zones, especially if enclosed Cleaning materials to be stored out of the way in their own cupboards After regular cleaning according to overall plan for station Appropriate warning of slippery floor when cleaning is in progress

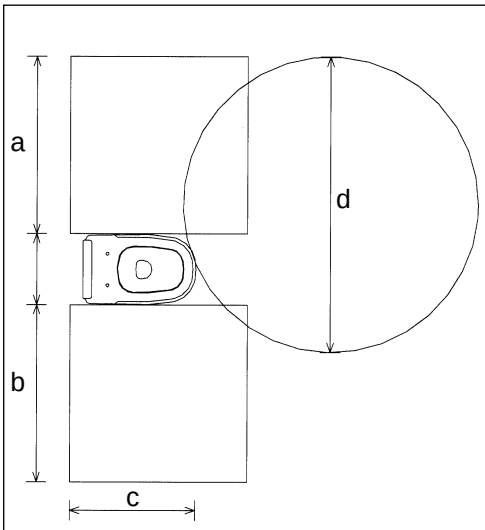
[1] Assistance dog owners must have access to all facilities – so within any facility an 'animal-free' zone will be appropriate. Even this may prevent difficulties, if assistance dog owners cannot see where they are, and staff should be sensitive to this.

Toilets

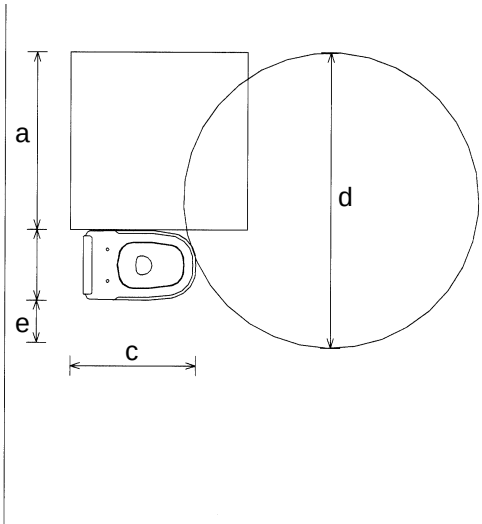
Purpose
To ensure that all passengers have easily accessible toilet facilities to use.

1. Space requirements

- The room should have sufficient unobstructed floor space to allow 360-degree turn for wheelchairs.
- For an optimum solution, the room should be large enough to allow a free floor space on both sides of the WC (a and b).
- For a minimum room, free floor space (e) on one side of the toilet may be reduced.
- Door widths see “Doors” chart



Best Wide free floor space on both sides of the wc

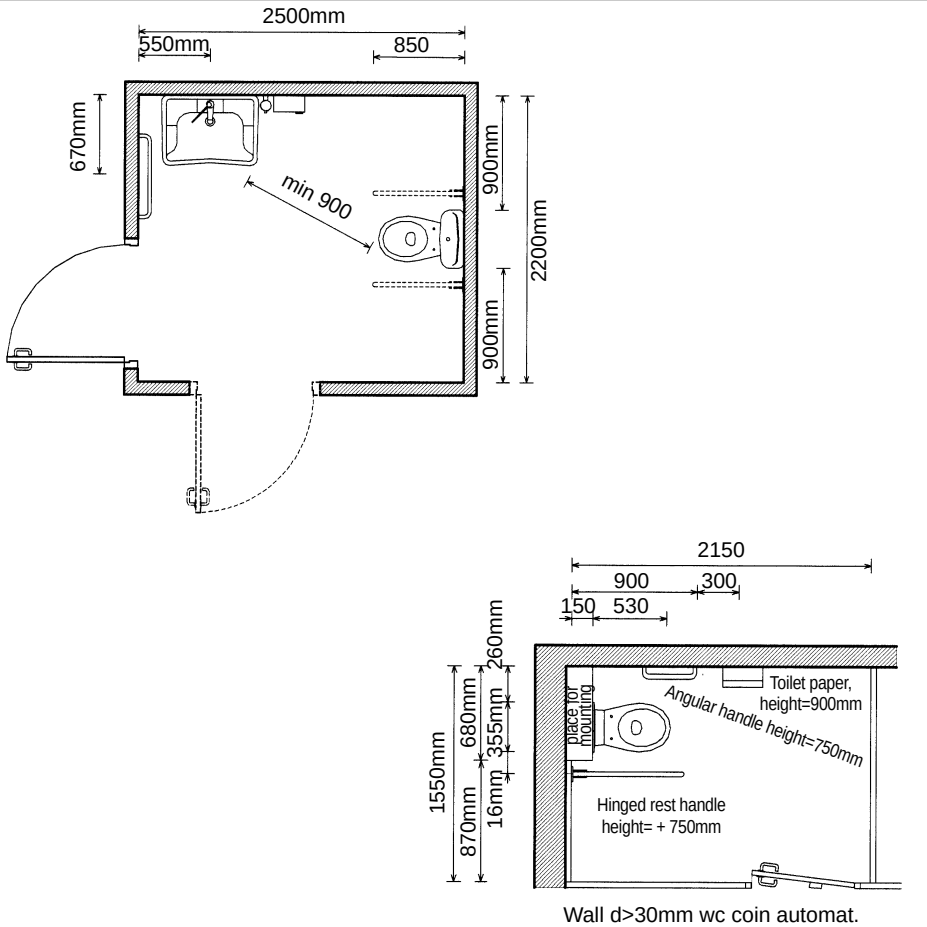


Minimum Wide free floor space on one side of the wc

a and b: Best 900mm. Minimum: 800mm
c: Best 850mm. Minimum: 750mm
d: see Passages and Space for Turning chart
e: Minimum: 250mm

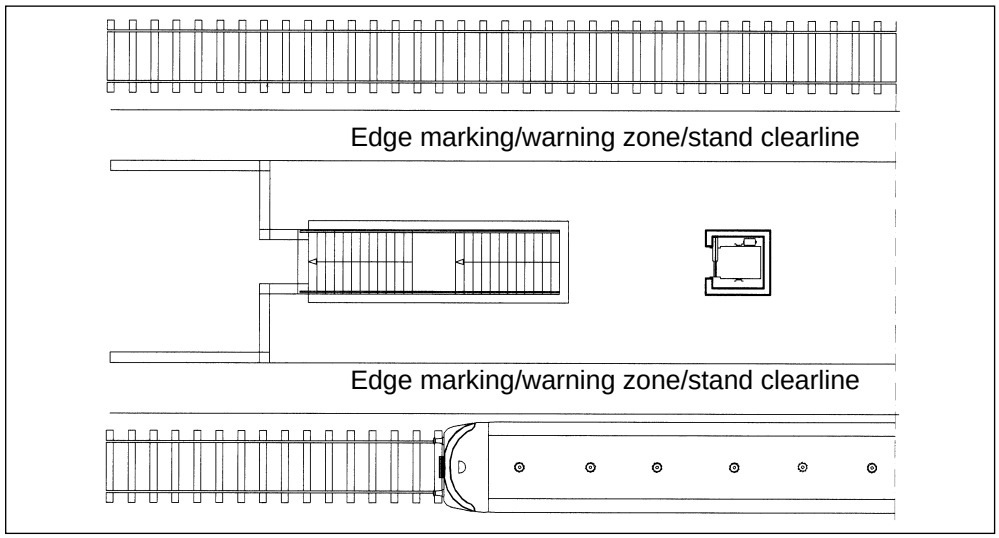
Provision, dimensions and layout

- It must be possible to access the WC in a straight line (no angles to be negotiated by wheelchair).
- Accessible toilets may be provided as a unisex facility.
- The lavatory bowl shall be located in such a way that is it easily accessible for the wheelchair user.
- Provision should be made where possible for person to wash whilst on the toilet
- Best solution will normally require room dimensions 2.5 x 2.2m. Minimum solution will normally require room dimensions 2.15 x 1.55m. When the minimum is used, an accessible wash hand basin must be provided in an adjoining, accessible room.



Platforms

Purpose
To ensure that passengers may walk safely along platforms
To ensure that passengers may wait safely on platforms for their train
To ensure that passengers may board safely and with ease



Recommended standard: Colour contrasted ‘stand-clear’ line[1] at appropriate distance from platform edge for local train speeds
Drainage system appropriate to local conditions to avoid standing water / ice
Gradients near platform edge must be away from the tracks

1 Paint may be more appropriate for the ‘stand-clear’ line than a permanent inlay into the platform, if train speeds are likely to change.

Guidepath for people with visual impairments on the safe side of the safety line (see Guidepaths on Platforms chart)
Platform edge tactile warning, colour contrasted (Tactile Flooring chart)

At least 2.5m clear platform before edge to enable wheelchair users to pass
Sheltered waiting areas with seating, audible and visual train announcements, train timetables
Good even lighting (see Lighting chart), lighting columns placed out of line of travel

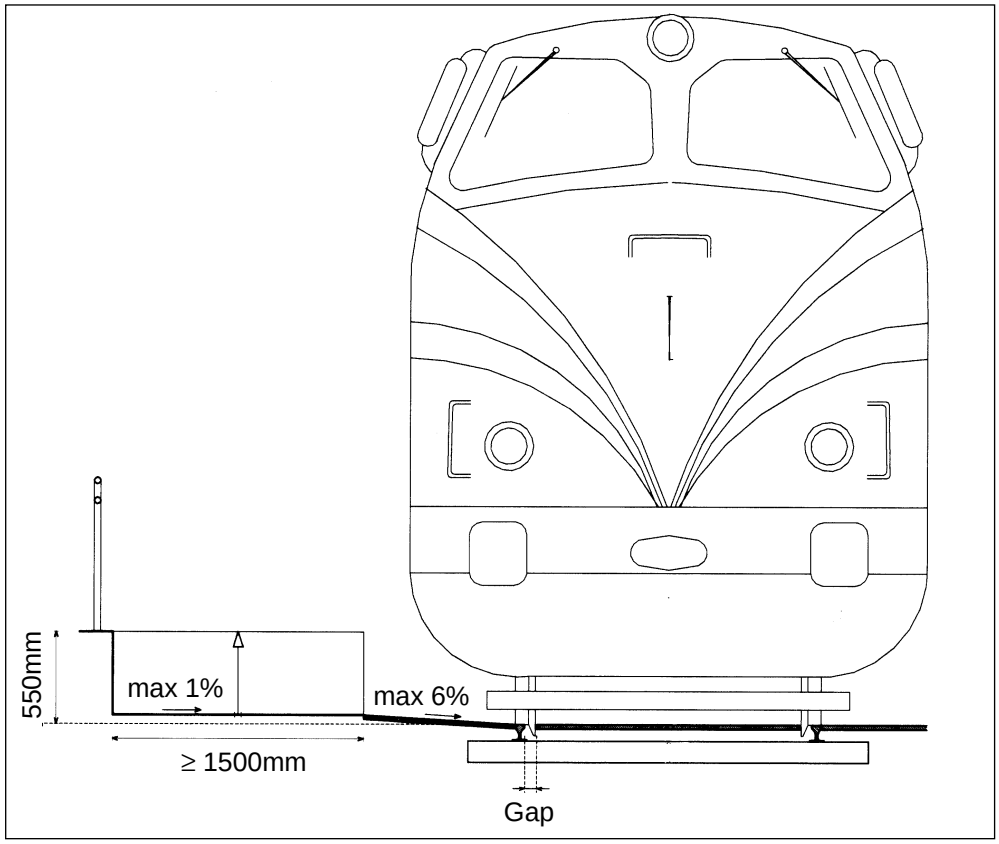
Minimum:

Colour contrasted ‘stand-clear’ line2 at appropriate distance from platform edge for local train speeds
Drainage system appropriate to local conditions to avoid standing water / ice
Gradients near platform edge must be away from the tracks
Guidepath for people with visual impairments on the safe side of the safety line (see Guidepaths on Platforms chart)
At least 2.5m clear platform between buildings / walls and platform edge to enable wheelchair users to pass
Sheltered waiting areas with seating, audible and visual train announcements, train timetables
Good even lighting (see Lighting chart), lighting columns placed out of line of travel

Crossing Tracks

Purpose

To ensure that, where passengers must cross the tracks, this can be done safely and smoothly



There will be national safety standards for the railway relating to track crossings and these should always be followed. The points below relate to access for disabled passengers – not to general level/track crossing design.

Best: For safety reasons track crossings should be avoided. For wheelchair users, and visually impaired people who use a touch cane, the standard gap of 70 mm can cause problems. However, this may be the only practical solution in an emergency

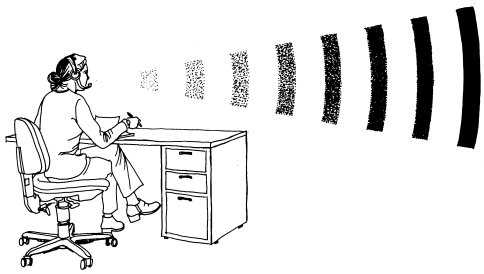
	and in small rural unstaffed stations with little traffic.
Recommended standard:	Gap < 20 mm (for white cane users) Gradient 5% (1:20)
Minimum:	Gap 70 mm Gradient 6% (1:16)

Where a voice communication system (e.g. phone) is provided with the nearest signal box, provision must be made for deaf and hard of hearing passengers.

Loudspeaker procedures, positioning and selection

Purpose

To provide and transmit easily understandable and useable spoken information.



Functional requirements	Format and content
The format and content of the messages should be easily recognisable	Clear enunciation Accurate, consistent and concise information; no superfluous wording. Localised information – to a specific platform.
The content should be appropriate	Minimum: Warnings of danger, evacuation etc Non routine information (changes of platform, delays etc) Best: Warnings, travel information, other messages for travellers
The sound should be transmitted and reproduced	Articulation losses, particularly loss of faithfully consonants should be kept to a minimum
The audio signals should have adequate loudness and clarity in all areas used by the public	Even spread of sound to all areas used by the public. Induction loops at appropriate places.

Planning and staff training

- Acoustics consultants should be brought into the design process at an early stage and for each application; building form, layout and the use of materials influence the acoustics.
- The staff should be trained in enunciation, use of equipment, purpose of the communication (to put anxious travellers at ease, to reduce staff harassment), and the needs of disabled travellers (hearing/visual impairments, learning difficulties etc.)

Timing of messages

Minimum	Best
Messages repeated twice	Messages repeated three times
Messages should never conflict with other loudspeaker announcements	As minimum +: Messages timed when background noise is low
Before arrival, never after the train has departed	

Calculations and technical requirements

Reverberation time (inflection/ absorption)	
Ambient noise level	
Sound Pressure Levels (SPL)	SPL at 1,2 – 1,7 m above floor level 80dB
Speech Transmission Index	Best 10-15 %ALcons Minimum15-3%ALcons
Articulation Loss	0,5-0,458 RASTI; equal coverage at 4kHz octave band
Frequency response	Minimum 400-5000 Hz
Total Harmonic Distortion	< 10

Emergency exits

Purpose
To ensure that disabled passengers can get out of the station in the event of an emergency

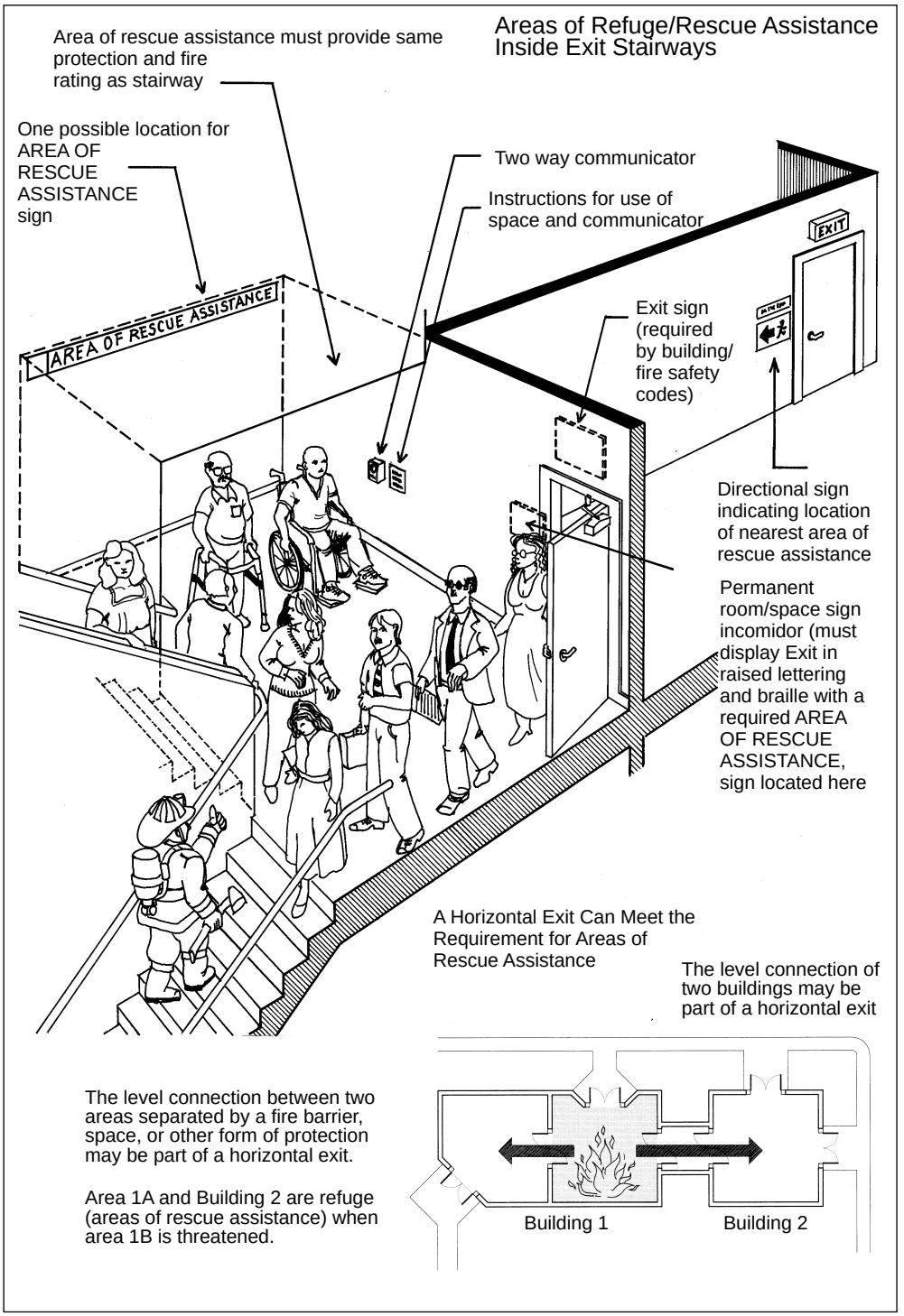
Disabled people in an crowd during evacuation may interrupt the pattern of flow, and slow down the rate at which people can be evacuated.

Where doors are positioned close to changes in direction, this can create almost insurmountable barriers for disabled people, and will cause considerably slower passenger flow.

Requirements

- sufficient passage widths, particularly through escape doors
- escape doors positioned in the direction of the escape route
- safe landings and resting places
- provision of personal assistance
- where emergency routes for disabled passengers are different, they should be clearly signed
- emergency lighting at floor level and around doors assists everyone in a smoky or dark environment
- provision should be made both for people with hearing impairment (visual information) and for people with visual impairment (audible information)

Example of a preferred solution

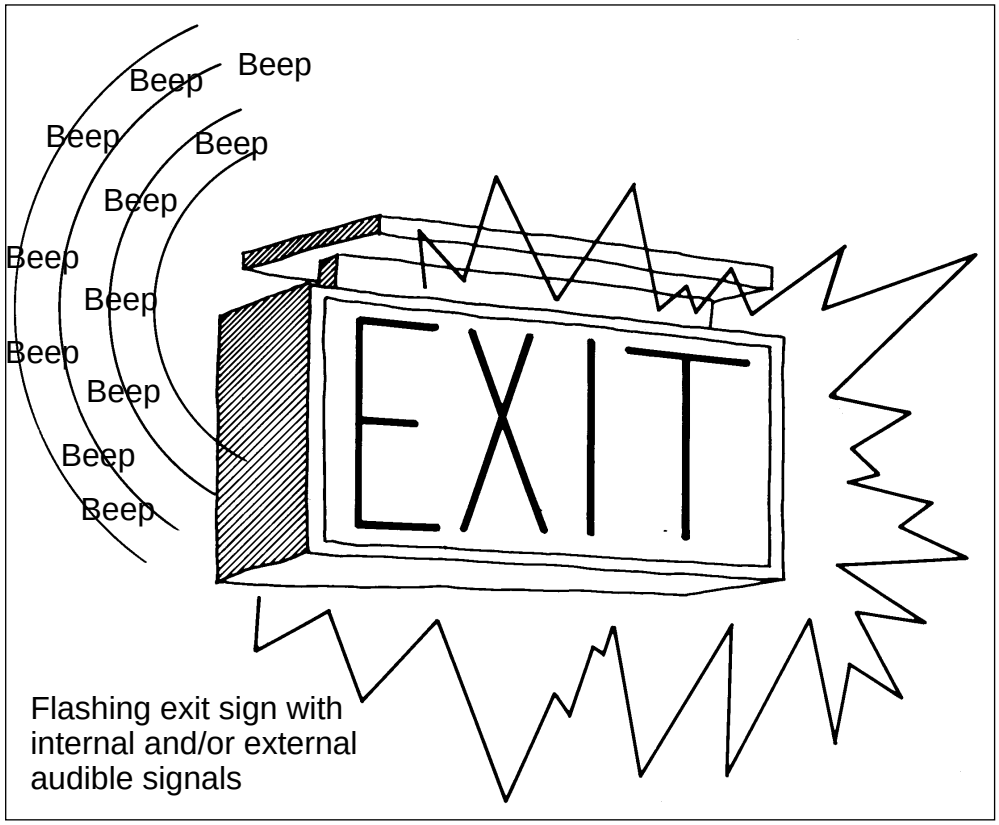


Alarms

Purpose
To ensure that all passengers are alerted by alarm systems for emergencies

Functional requirements

- Alarms should warn everyone present in the building.
- Alarms should be reliable and give adequate information
- Alarms should be distinct and different from other audible signals used on the station



Flashing exit sign with internal and/or external audible signals

All alarm systems should:

- alert responsible staff to put safety procedures into operation at the earliest possible moment
- ensure rapid evacuation of everyone to a safe place

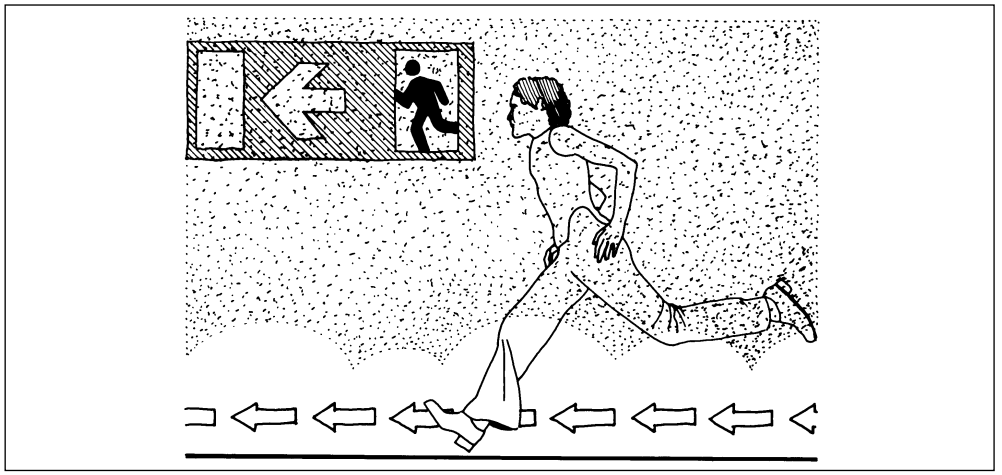
The warning system should use a combination of sound and light.

The best solution will provide information through loudspeakers (spoken message with brief, clear instruction), text displays/TV monitors and strips of leading lights.

Safety procedures must include rescue/escape assistance for disabled passengers.

Installations

Best	Warning:	Alarm loudspeakers and alarm lights
	Information:	Alarm loudspeakers, leading lights, displays, flashing exit signs
Minimum	Warning:	Alarm bells, sirens or horns, flashing exit signs
Notes: Large stations		Must have both visual and audible warning Must provide visual and audible information on escape
Small stations		May apply the minimum installation



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6 Information

6.1. What is information?

Information can be defined as: "*data organised in such a way that it can be used by people to serve their goals*" (Zwaga, 1999). This definition is rather general. More specific travel information can be defined as: "*data that contribute to the knowledge of the traveller, on which he can make or change his intentions before and/or during the trip*" (Zeilstra, 1995).

A journey is like a chain - it is only as good as its weakest link. When planning a journey we need information about each link in the chain, and this information must be clear and accurate. Lack of information reinforces the confidence barrier to travel.

6.2. Who needs information, and why?

Everyone travelling by rail needs information in order to travel in safety, in comfort and independently. They need to evaluate the possible choices and then make informed decisions about the journey.

Good information enables passengers to:

- Feel in control - e.g. knowing where they are; knowing where they are going; knowing what will happen next; knowing they are safe; knowing they can use the toilet; and knowing that if something does go wrong, there is someone to help out.
- Feel comfortable - e.g. knowing that they can get to and use station and train facilities; knowing that refreshments will be available; knowing that there will be comfortable seats and a comfortable, secure and hygienic environment.

Passengers get information in a wide variety of ways, and we all constantly check and double check the information that we have - although we are often not aware of doing this. Disabled passengers may need more information than others because they cannot make assumptions about access to the different stages of their journey. In addition, the traditional ways that the rail industry provides information may not suit a disabled passenger - who may have, for example, a sight or hearing impairment and needs the information presented in a format accessible to him.

6.3. What information do passengers need, and when?

Table 6.1 below shows the various stages of a journey from A to B and the sort of information people need at each stage.

Table 6.1

Journey stage	Information need
Planning	• What are the possible routes from A to B? • What time must I leave A to arrive at B when I need to? • Is it a direct route or are there connections to make? • Can I afford it? • How do I buy a ticket? • Can I make the journey independently – how much assistance will I need? • What facilities are available en-route, and can I use them? • How do I get to the station – and is the set-down/parking area convenient?
At the station – on the concourse	• How do I buy a ticket? • What time does the train leave?

Journey stage	Information need
	• Have I got enough time to catch it – if not when does the next train go? • What platform does it leave from? • Where is it – what is the shortest route? • Are there enough signs and landmarks for me to find my way – are there any obstacles en-route? • What might I need before or on the train journey? (e.g. book, toilet, refreshments) • Can I get them on the train – or should I get them now? Where from?
At the station – on the platform	• Is this the right platform? • Will the next train to arrive be mine? • Where do I need to wait for my train (to be at the right door)? • Is it a safe place to wait (with shelter)? • Is this my train? • Is this the right carriage? • Where is the door (and controls, etc.)? • Is there a step / handrail?
On the train	• Is this the right train? • Where do I sit? • Where do I put my luggage? • Where are my at seat facilities (light, etc.)? • Which direction and how far are the other facilities (buffet, toilet, etc.)? • How many stops before my stop? • How will I know it is my stop – will I find out in time? • How will I get out? • Are there any staff available on the train to help?
On the train – change from normal journey	• Why have we stopped? • Is there a route change? • Are we late? • How do I contact people / rearrange the rest of my journey?

Journey stage	Information need
Changing trains	• Have I got enough time? • What platform do I need? • Can I get there on my own / in time? • Are there any obstacles en-route?
At the destination station	• How do I get out? • Am I on time? • Where do I go for further journey information? • What are the choices of connection? • Where do I get them? • *Here similar information will be needed to that on the departure station concourse, about facilities etc.* • How do I complain about my journey?

This information has to be available from home, and at the station and in the train during the journey.

Figure 6.1. Example pre-journey information system Genvågen (SJ-Sweden)

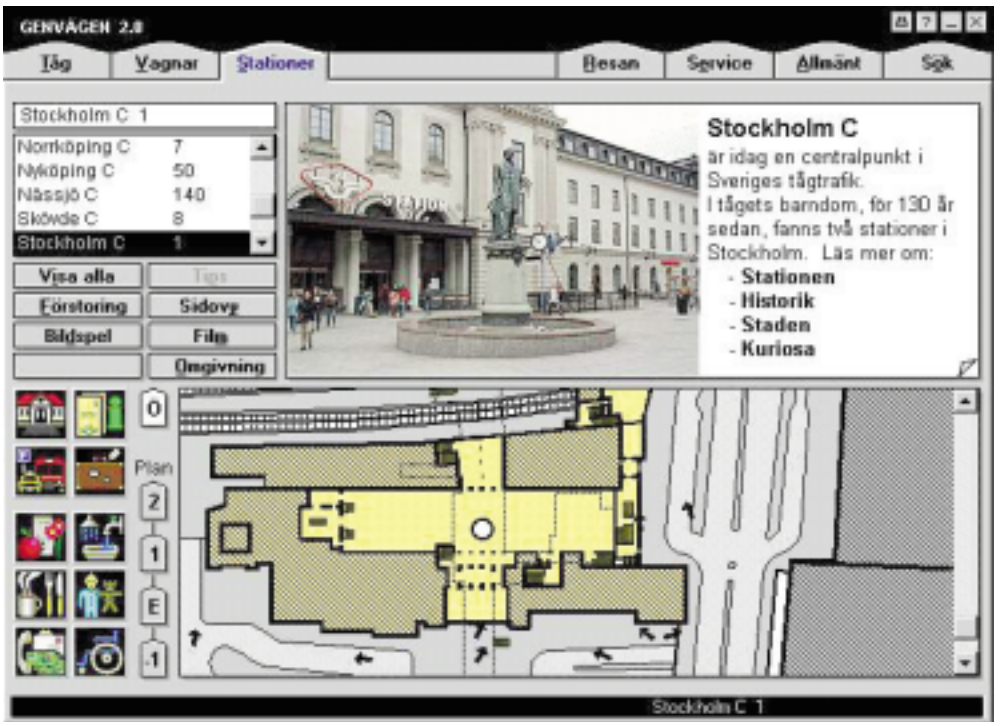
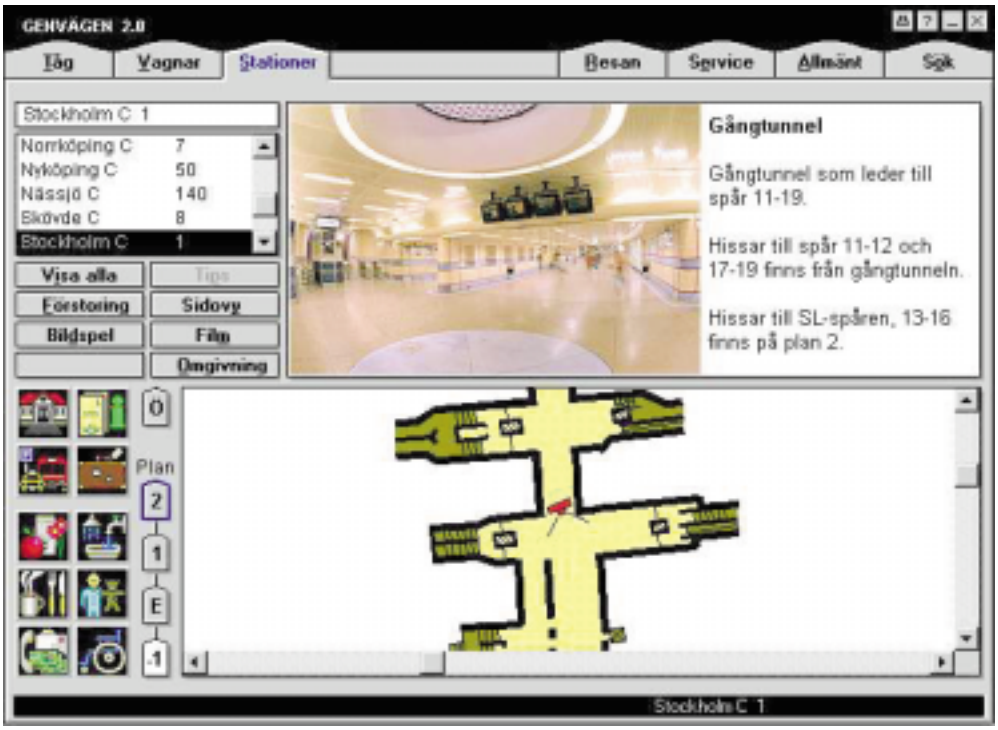


Figure 6.2. Example pre-journey information system Genvågen (SJ-Sweden)



6.4. How should the information be provided?

Information can be static or dynamic. Static information is information that is not updated continuously – for example the printed timetable. Dynamic or real-time information such as information about platform and time of departure is constantly refreshed.

The information can be provided in all sorts of ways. Looking at the questions in Table 6.1, some information is received through the design of the train – for example, where is the door / door control? Some is received visually (is this a safe place to wait?), some audibly (is this the right train?) and some both (what platform do I need?). Where information is not clearly provided, passengers may have to check with others, for example the destination of the train.

All information should be available to all passengers, including people with sensory and communication difficulties. This means providing information in alternative formats, such as large print, Braille, audiotape, disk and so on. Front-line staff of railway organisations must be aware that information is available in these formats, if they are to help passengers effectively. Consistent, simple and cheap access to information will break down the confidence barriers to travel. A ‘one-stop-shop’ – a seamless approach – that includes information provision, the ability to book tickets, and the ability to arrange assistance where necessary would achieve this goal.

People often give up looking for information if it is not easy to find or understand, or it does not provide all they need on their journey. Information for disabled passengers is often provided separately – as ‘special needs’ information. But lots of other passengers may need this information. For example, if you have a buggy or pushchair, you will want to know where the step-free routes are, or where you can put your buggy on the train. And many passengers, including older people, are put off by the word ‘disability’ and do not look for information that would be useful to them when it is identified as information for disabled people.

The European Conference of Ministers of Transport has identified four criteria for good information provision. Information should be:

- Clear;
- Concise;
- Accurate;
- Timely.

Whether the information is made available in a leaflet, on a sign, in response to a telephone call or in any other way, those four criteria must be satisfied if it is to meet the needs of passengers.

- **Clear** means two things: easily legible in the case of textual information whether printed or on a screen or a sign, and easily understood in all cases (including spoken information). Tactile information may also be needed – for example tactile maps, and tactile signs, but these must be displayed appropriately, at the right height, and in places where visually impaired people will find them. Deaf people whose first language is sign language, and people with learning difficulties including dyslexia, in particular need plain language, and pictograms, in order to understand easily. This also helps visitors from other countries who do not speak the language.
- Quite a lot of information is taken in while passengers are en route to their destination perhaps walking or maybe on a bus or a train. They have only a short time to see, read and fully understand the information. So information must be **concise**. International pictograms are particularly useful for taking information in quickly.
- Information in whatever form must be **accurate**. This means more than just making sure that it is correct at the time it is first presented – it must also be checked and updated to make sure that it remains accurate. A mistake in a timetable, or an announcement, can cause problems to any passenger. And to a disabled passengers the consequences can be very serious if poor information causes the journey chain to be broken.
- Information cannot be effectively absorbed and used unless it is **timely**. 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 and people with walking difficulties, but it needs to be made in sufficient time for the passenger to get ready to leave the train. An announcement as the train pulls into the station is too late for people who are less agile.

Three further criteria help passengers absorb and use information more effectively:

- Information must be **repeated** at crucial points on the journey. Passengers cannot take in all the information they need before their journey, and will need to be given some of it again as confirmation (for example, train departure times), and some of it only at the appropriate moment (for example, toilet location).
- All information provided must be **consistent**. Passengers will only trust consistent information. If on the concourse, a certain platform is showing, but when they reach the platform, their train is not leaving from that platform, they will begin to doubt all the information that is available. They will then begin to check with staff, and this takes up staff time unnecessarily. It also increases the confidence barrier to travel.
- Information should be **prioritised** into essential and non-essential. For example, passengers need to know where platform one is, and they may also need to know where the café is. But information about platform one is essential, whereas information about the café is not. Where information is not prioritised, passengers may feel overwhelmed, and not be able to absorb the information they really need.

6.5. Specific information for disabled passengers

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. Lack of knowledge about routes, times and how to use the system presents a barrier to people using it, and they may be unaware that a journey can actually be fulfilled by public transport.

For disabled people, lack of knowledge seems to be a bigger issue because the barriers to travel are greater

anyway. Also, if the passenger does not know what they must do to ensure a successful journey (e.g., arranging special assistance, or avoiding stations with impassable physical obstacles), they may have a bad experience which will put them off in the future.

Specific additional information that may be required by disabled people is identified in table 6.2. The long term goal must be for disabled passengers to be able to travel without needing this specific information. However, in the medium term, information about how to use train transport can be provided by leaflets, press stories, advertisements, local radio and other similar media. Transport training is also useful here (see chapter 7 – Training).

Table 6.2

Passenger group	Specific information need
People with mobility impairments	
walking problems	distances, steps/levels, sitting
wheelchair users	wheelchair accessibility, distances, safe positioning of wheelchair
People with visual impairments	
	wayfinding, interaction with outlets/machines
People with hearing impairments	
	announcements, communication
People with learning difficulties	
	wayfinding, interaction with outlets/machines, announcements, communication
People with other impairments (e.g. asthma)	
	specific provisions (e.g. animal-free carriages), emergency provision

Reliable pre-journey information on the physical accessibility of stations and trains will require an inventory checklist, like the Transport and Tourism For All (TTFA) checklist of access, for setting up a database. This database can be used to provide information on CD-ROM (such as the Swedish Genvågen, or Spanish RENFE systems), and to provide information via the internet and telephone services. Such services enable the rail industry to provide complex or rapidly changing information.

Figure 6.3. Example pre-journey information system Genvågen (SJ-Sweden)

Figure 6.4. Example pre-journey information system Genvågen (SJ-Sweden)

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7 Training

7.1. Why instruct rail staff how to serve disabled passengers?

Many disabled passengers resent having to plan and arrange their journeys in so much detail. At the moment, disabled people overcome the confidence barrier to rail travel by asking friends or family to help them – or get around the barrier by not travelling by rail. Until fully accessible facilities at stations and on trains are available some pre-planning will always be needed, but even now, sufficient well-trained staff can increase the possibility of train travel at short notice.

The common principles of good practice in training apply, but there are some additional issues that the rail industry needs to take into account.

The objective of staff training is to ensure that disabled passengers have equal access to rail travel and can travel freely and confidently by rail, on the same basis as non-disabled passengers. However, giving equal access is not the same as giving the same treatment. Good training ‘bridges the gap’ between the skills and qualities needed by rail staff to give disabled passengers a good, seamless service and the confidence to travel, and the skills and qualities that staff already have.

Well-trained staff will be able to interact with non-disabled passengers more effectively, and this will improve the quality of rail services.

7.2. Who should be trained?

All rail industry staff need training – from the Board to the train cleaning crew. This is not because there is anything

magic in serving disabled passengers. However, throughout Europe, disabled people have only recently begun to be included in everyday society. Many staff in the railway were not educated alongside disabled people, they have not worked with disabled people, and their view of disabled people, along with most people outside the rail industry, is that disabled people are different, and need special treatment.

The important thing is to train staff appropriately, according to their role in the organisation – the Board will not need the same training as the train cleaning crew!

7.3. What form should the training take?

Training does not have to mean off-job courses. It can take the form of:

- briefings, workshops, courses
- on-the-job training by external trainers, or by colleagues
- self-directed learning with books, videos etc.
- spending time with disabled passengers with a view to understanding the barriers they face and how to remove them
- specific supervised projects carried out in the workplace

7.4. What should the training cover?

7.4.1. Senior and middle management

Senior and middle managers need to be aware of the potential problems that face disabled passengers. Training, in whatever form, must enable them to recognise the *systemic* factors in the way their organisation operates – policies, practices, procedures – that serve to build and maintain barriers to travel. They need to understand how to go about dismantling these barriers – changing 'the way we do things around here'. Importantly, however, such training will have little impact unless managers understand and

accept that disabled people have a right to equal access to rail transport, and some equality training will therefore be needed.

A clear understanding of the changes that can be made without additional cost will encourage managers to implement them. In addition, understanding the importance of including changes that will involve cost into the future plans of the organisation will reduce the resistance to improving access.

Time constraints on management often means that regular briefings are the most effective way to deliver training.

7.4.2. Design and development staff

Designers and developers need to be aware of the physical barriers that disabled people encounter in the railway environment and how to avoid or remove them. They must be brought up-to-date on current legislation relating to design for disabled people, and on current best practice in inclusive design.

As with managers, understanding the importance of including changes that will involve cost into the future plans of the organisation will reduce the resistance to improving access.

Training for designers can often be effectively delivered using supervised projects in the working environment.

7.4.3. Front-line staff

There are two areas of training for front-line staff. First, such staff need to be trained in good customer service to disabled passengers. Secondly, staff who use special equipment such as text telephones or platform lifts need to be trained in the safe and effective use of this equipment.

Customer service

An effective way to train staff in the problems and barriers that disabled passengers encounter on their journey is to chart the journey a disabled passenger would make and to identify the barriers en route.

Staff will also need fully to understand the system that disabled passengers have to use to make a successful journey by rail, in order that they can explain any stage of the journey to a passenger. This will help to ensure that the disabled passenger experiences consistent treatment across the rail network, and that they themselves can more easily 'learn' the system. The system includes access at specific stations and to rolling stock, fare structures etc.

Understanding the journey, and the system, will enable staff to support disabled passengers more effectively when the journey goes wrong for whatever reason – delays, disruptions or human error by staff or passenger.

Staff will need to understand specific issues for people with different impairments and to practice the skills. These include communicating with people with hearing impairments, supporting people with learning difficulties, guiding people with visual impairments and pushing a wheelchair. Most important, however, is the need to pay attention to the way an individual disabled person wishes to be treated and to be flexible.

As with all passengers, staff need to be courteous at all times, and to recognise that an 'awkward' passenger may have had a difficult journey, and need appropriate support. Staff also need to be trained in disability etiquette – the appropriate way to behave towards disabled people and the language to use in relation to disability. Many disabled people are extremely sensitive about this. Extra time may

be needed for some disabled passengers, and they should not be made to feel as if they are a strain on rail staff.

Staff need to receive an aide-mémoire of useful information available both for them and for passengers, the formats it is available in (e.g. large print), and where it may be obtained.

In some countries, other transport providers (such as taxi companies) form part of the rail assistance network. For example, in Sweden, taxi drivers assist, by pre-arrangement, disabled passengers from the train at stations where rail staff are not available. Training in good customer service for disabled passengers must be available to these providers also, or the travel chain will break. There are some good examples of integrated services (Netherlands, Finland) in which disability awareness training is part of the training of taxi drivers.

Equipment

Staff need to be fully trained in health and safety issues relating to equipment used, and in the preferred way that disabled people wish to be assisted. On-the-job training by colleagues is not always the best way to achieve this, as bad habits and misunderstandings can too easily be passed on.

It is particularly important to ensure that this training is kept up-to-date, as some equipment may rarely be used, and therefore staff will not benefit from practice in its use. Additionally, staff should be trained in how to recognise malfunctions in equipment, and what to do about them.

7.5. Who should design and deliver the training?

Competent and professional trainers who have both training skills and experience of disability are vital. Trainers with personal experience of disability can often ‘kick-start’ the

process of raising awareness, because they themselves are role-models of disabled passengers – and can demonstrate that disabled passengers are just ‘normal’ passengers with specific needs.

There is always tension, as with other forms of training, between choosing trainers from inside the organisation who know the way the organisation works, and can relate to the staff involved, and choosing external trainers, who bring a fresh approach, and may question some of the deeply rooted practices that exist in the organisation and maintain the barriers to equal access.

The best solution may be to use external consultants, with dedicated support from Human Resource professionals inside the organisation. In any event, disabled people must *always* be involved in the design and/or delivery of the training if it is to have any credibility with disabled passengers. However, where disabled people are involved, their expertise should be recognised and appropriate payment made – otherwise their contribution is devalued, and the training with it.

7.6. Other issues

7.6.1. Keeping staff up-to-date

Sending staff on a training course, and then letting them loose on the public and hoping for the best, will not be enough. Staff will need regular refresher sessions to help them keep their skills, knowledge and attitudes up-to-date. This can be achieved by focus groups with disabled passengers, looking to improve the facilities and systems available to both staff and disabled passengers, as well as by additional training per se.

7.6.2. Recruitment

Just as the customer service qualities of job applicants are taken into account in staff recruitment, so attitudes towards disabled people should be considered. Recruiting the right staff to begin with will help ensure that any training provided is effective.

7.6.3. Modelling good practice

Training provided should always be fully accessible, delivered in an accessible environment and with materials provided in alternative formats. This models good practice for those receiving the training, and ensures that disabled staff are able to join in the training without elaborate pre-arrangements being made.

7.7. What about training passengers?

In reality the railways will not be accessible enough to allow totally independent travel for some time. Disabled passengers will need ‘specialist’ knowledge of how to use the system – which stations / trains are accessible, how to get information, how to arrange assistance and so on.

In addition, because public transport has only recently begun to be accessible for disabled people, in many European countries disabled people are reluctant to use it, and travel training will help to overcome the confidence barrier.

Travel training will usually involve accompanied journeys for disabled passengers on the train. This can also be a good way to train staff, as long as an experienced member of staff or trainer leads the expedition.

7.8. Examples of training materials available

Many of the examples listed are not specifically intended for the railway – indeed some are specifically for other industries, even outside transport. There is very little available for the rail industry itself, and much work needs to be done here.

It's a bloody nuisance
Access by Design – Implementing the Disability Discrimination Act 1995 Centre for Accessible Environments 1996 UK

Educating Peter
Hearing Concern 1996 UK

Serving Customers with Disabilities
Salenger Films 1994 USA

Stand up the real Glynn Vernon
Vanson Wardle 1996 UK

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8 Cost-benefit analysis

In the context of this study it has not been possible to do a comprehensive cost-benefit analysis. No single equation is possible because every railway in Europe has a different starting point. However, it is clear that an improvement in features for accessibility also results in an increase in the overall quality of the rail service; such a service will attract more passengers and therefore generate more income for the transport operator.

8.1. The cost

8.1.1. The cost of the rolling stock

The additonal cost of providing accessibility features in rolling stock will differ between designing and building new accessible rail vehicles and the cost of retro-fitting existing rolling stock to improve accessibility.

For new rolling stock, estimates from the industry indicate that the additional cost of building fully accessible trains is at maximum 5% for commuter trains and for Intercity/Eurocity trains. Regional trains would fall within this range.

The difference in additional cost will arise from the features required for each train service, such as accessible toilets, which may only be provided on trains for longer distances.

This on-cost is considered to be relatively minor, particularly when they are set against the life of the rolling stock, frequently 30 years or more.

Retro-fitting equipment to existing vehicles, which may occur at a time of refurbishment, will depend on the structure already available. It is therefore only possible to indicate a sample menu of equipment and indicative cost. On the whole, retro-fitting is a more expensive solution than

building in improvements at the design stage, but nevertheless will permit earlier progress towards accessibility for many railways.

Sample costs for individual items of equipment are shown in paragraph 8.1.3 below.

8.1.2. The cost of the stations

Changes in the operating structure of rail companies across Europe means that stations are often – or will become – the property of the state rather than the railway company. Stations and infrastructure are therefore usually financed out of public funds rather than a direct charge on the rail operators.

The responsibility for providing accessibility will also lie with those responsible for the stations.

Chapter 5 has described the features which will be required to consider stations as fully accessible. These would apply, in general, whether the station was a major city terminus, or a small local or regional station. But the total cost will clearly differ.

As was clear from chapter 5, the major cost element is to provide level access wherever possible for boarding trains and also level access within stations and to station facilities.

The cost of changing platform heights cannot be given within the context of this report. It depends too much on local circumstances. In one country or situation they might be negligible, whereas in other countries or situation they could be considerable. It is also clear that this is a topic which will have to be addressed between governments at the European level.

Whenever a station is being built as new, or is subject to a major refurbishment, level access can be achieved at

minimal cost. However, in most situations, ramps and lifts would need to be provided within the stations.

Over short distances ramps, whenever they can be realised, do usually not cause excessive additional cost. Lifts, however, tend to be rather expensive, not only in purchase price, but also in maintenance.The cost of lift access to a two platform footbridge would be in the order of approximately Euro 450,000.

Apart from these elements facilities such as induction loops, tactile edges and markings, which are common to both new and existing stations, construe a cost element, although a relatively minor one. A number of elements to be provided for and their cost are listed hereunder, all figures in Euros:

• ramps	200 p/m^2
• automatic doors	15,000 each
• accessible toilet at stations	15,000 each
• double handrails on stairs	100 p/m
• glass markings	20 per area of glass
• guideways	100 p/m
• warning markings	100 p/m
• obstacle markings	200 p/m^2
• indications in relief	400 each
• spoken information	150 per transmitter

It is recognised that not all such expenditure on stations could be undertaken within a short timetable. It may therefore not be necessary to make every railway station immediately accessible in the most comprehensive way. Depending on local circumstances and the availability of alternative services, *in the short term* it might be acceptable that only the key stations on reach route or fully accessible, without doing so at the intermediate stations. If this approach is adopted, it would be crucial to ensure that alternative provision, such as “train-taxis” or feeder bus

services, should be made available from these intermediate stations, in order to give full customer service.

Routine maintenance and refurbishment programmes should include access improvements.

8.1.3. Interim or intermediate solutions

Recognising that it will take a long time to introduce new rolling stock and rebuild stations on basis of a uniform European platform height, there are nevertheless many things which can be done - often at low cost - to improve access on a much shorter time scale.

For instance,

- Boarding aids (whether station or train based). Table 8.1 shows that the cost of ramps lies between Euro 500 and 2,300 and on board lifts cost between about Euro 4,000 and 8,000.
- Toilets in trains.
- Handrails in trains.
- Instead of making a whole dining car accessible, trolley services could be offered.

8.1.4. Additional cost elements

Information. Providing better information to travellers, as described in chapter 6, will require both effort and some expenditure. It quickly becomes clear that such effort is critical for the railways to attract and retain *all* passengers, not just those with disabilities. The expenditure therefore should not be viewed as as on-cost of accessibility, but as part of the normal marketing and customer service budgets.

Staff training. A similar argument would also apply to the cost of training staff. Staff training is fundamentally about customer service, again applicable to *all* passengers. Such

cost should not be viewed as an on-cost of making railways accessible to people with disabilities.

Staff levels. Some of the recommendations within the report indicate the need for additional staff to assist passengers with disabilities. It is obvious that whenever assistance of staff is required this will add cost. Currently, rail companies are actively working to reduce staff numbers. It should be appreciated, however, that staff availability is a key issue for passengers, and rail operators would be well advised not to go too far in reducing staff. For example, staff availability is also an important consideration in relation to passenger perceptions of personal safety, a factor which may influence women travellers.

In the context of disabled passengers, since the long-term goal is to have a fully accessible rail service which people with reduced mobility can use independently, the need for assistance for the majority of people is temporary.

Again, no specific cost can be given, as these will vary between rail operators. Where they can be identified, such cost should be put in the context of the entire operation.

Boarding times. Use of boarding aids, such as ramps and lifts, can mean an increase of the dwell time at a station, when they are deployed. As they will normally only be required for boarding/alighting of wheelchair users, the frequency of their use will not be statistically significant within the rail operating cost.

8.1.5. The operational cost of wheelchair accessibility

It is sometimes alleged that accessibility of public transport for wheelchair users is prohibitive for smooth and quick stopovers at stations. It is, therefore, essential to observe that the use of public transport by wheelchair users will be limited in numbers, compared to the use of such transport

in total. For instance, in The Netherlands there are some 80,000 wheelchair users. Should they use public transport as much as the average Dutchman they would travel on average 0.1 times per day. On an annual basis this would amount to maximum 3 million additional journeys. That again would amount to some 5 per thousand additional journeys.

But there will be a cost, particularly if staff assistance is required to operate the equipment and assist the passenger. The long term goal has to be level access. When that becomes a reality, experience with low-floor buses has shown that any increase in boarding times due to wheelchairs has been more than offset by a reduction in boarding time for other passengers.

Experience with low floor buses gives no reason to assume a negative effect of wheelchair accessibility on the stopover times at bus stops. It has been shown to be perfectly achievable to remain within the regular schedules. That is only logical, since most passengers embark and disembark even quicker on low floor equipment. The number of passengers who will need a boarding aid is limited and is negligible with regard to causing extended stopover times.

The overall conclusion is, therefore, that even increasing numbers of wheelchair users will not cause a significant problem for time schedules.

8.5. Benefits

Chapter 2 highlighted the potential numbers of additional passengers resulting from demographic trends within Europe, who could be reached with policies for full accessibility. It is also important to note that these same demographics show that the traditional market for railways, the proportion of people aged between 15 and 59, will

progressively decline over the next few decades, making the search for such new markets even more important.

This report has not tried to calculate these developments in hard figures for rail transport. Examples have been sought of actual changes in passenger patronage arising from the introduction of fully accessible transport, either in rail or more particularly in bus travel.

It is difficult to translate such potential into real demand, particularly for the rail industry which has little experience of accessibility at the present time. However, elsewhere in public transport, accessible bus services have been established in various parts of Europe for some time and there have been some very positive increases in passenger patronage achieved in many instances.

Results from studies on and experiences with accessible bus transport show an increase in patronage of some 15%.

Conclusions from a 1993 study of travel intentions undertaken in the Netherlands on accessibility effects show that with a minimum scenario of accessibility improvements the number of journeys by people of 55 years of age and older in rail transport would increase by two additional trips per person per year. Within the Netherlands that means between 3.9 and 4.8 million additional trips by train.

All in all and taking into consideration that the populations are getting older fast, it is fair to assume that accessible rail transport - combined with accessible transport in the pre and post phases of the journey - will generate more passenger kilometres and thus more income from revenue for the rail operator.

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9 Marketing

9.1. Development of a marketing strategy

From consideration of the general needs of the growing population of disabled and elderly people across Europe, and the guidance and examples given in this report, it is clear that increases in passenger numbers *can* be achieved through making public transport accessible to disabled people. This requires much more than just providing boarding equipment for wheelchair users to use trains.

What is required is a commitment to a two-fold strategy:

a) The removal of *all* barriers to travel by rail, for *all* members of society.

b) Positive marketing plans to promote rail travel, particularly targeted at groups and individuals who are prevented by the lack of access from considering rail travel.

9.2. Marketing strategy

Exploitation of the opportunities described, even with governmental support, requires a comprehensive marketing plan.

It is not enough for railways to make the services available; they must be also targeted at the potential customers and fully supported in a comprehensive manner.

Given an overall objective to increase passenger numbers through an accessibility policy, there would be two main elements to Marketing Strategy:

I. Identification of target market sectors and their detailed needs.

II. Development of plans to meet these needs, focused on these target market sectors.

9.2.1. Identification of markets

a. Mobility impaired and elderly people include people with a wide variety of needs and travel patterns.

   Amongst mobility impaired people, for example, as the total environment becomes more accessible, we can expect that their travel needs will be broadly similar to those of other people in the same age group. But the emphasis may differ, and so might the travel pattern.

   The travel needs of elderly people will also differ, if taken as a group. Cost will remain a major factor, introducing opportunities in off-peak travel, for example.

   Quantifying and segmenting the markets has to be a major goal.

   A major study which indicates positive approaches was conducted for Travel and Tourism for All in 1993. This study analysed tourism in relation to people with disabilities and found that only 3% of tourists have a disability, compared to some 14% of the total population.

   Further work analysed the tourist group by levels of disposable income, severity of disability, and the desire to travel. It concluded that around 21 million Europeans would enter the travel market if all facilities and transport were accessible.

   Further investigation by railway companies is required into the travel intentions and potential demand from disabled and elderly people, if railways are to target their markets most effectively.

b. In parallel, there are fast-growing opportunities arising for travel to and from Eastern Europe. These opportunities were clearly identified in the Seminar held in Paris in February 1995 by the ECMT Working Group on People with Mobility Handicaps. Many Eastern European countries were involved.

c. Tourism represents an additional area of opportunity. The Travel and Tourism for All study on European tourists has already been cited. There are additionally further external markets. For example, some 50 million Americans have disabilities; they are becoming accustomed to an accessible environment thanks to the Americans with Disabilities Act (ADA). Some of these Americans would be interested in visiting Europe if they could be certain that accessible public transport is generally available.

   That is only one country; one external market to be identified. There will be many others.

   There is scope for discussion of the external opportunities for tourism to be taken up with DG Enterprise of the European Commission.

9.2.1. Developing market plans

Railways need to develop market-led strategies based on a closer identification of potential markets if they are to maximise their opportunities

Marketing is not only about the identification of market needs; it is also concerned with providing the means to satisfy these needs, and ensuring that potential customers are fully aware of what is available.

A comprehensive marketing plan is a significant undertaking and each railway has to address it in its own

way. Nevertheless, there is a key role for the International Union of Railways (UIC) to encourage a compatible framework and address the issues at a pan-European level.

Marketing plans would also include identification of railways' strengths and weaknesses as a means of shaping strategies to create opportunities.

A major plus for railways in this context is that *main stations are in city centres.* This is of great benefit to disabled and elderly people in comparison with air travel and offers good marketing potential.

Conversely, rail travel in itself cannot be door-to-door. Recognition that railways are in the *travel* market, not the *rail* market can lead to re-defining strategies to deal with this. Such strategies can include:

- Intermodal transfers.
- Partnerships with bus and taxi operators.
- Through ticketing schemes.
- Liaison with local authorities on door-to-door systems.

The Dutch *Treintaxi* and the Swedish *Tågtaxi* ("train taxis") are good examples of the approach.

Railways also have a strong case to offer on environmental grounds and *the avoidance of road congestion.* European Union policies, for example under the Citizens' Network plans, can be used in support of this in marketing the railways.

The above instances indicate some plus features which need to be refined and demonstrated to both the general public and governments. The UIC's role is extremely important in this respect.

Having developed the key selling points, the other major element is to reach the potential users. This must rely on

the detailed identification of market segments previously discussed.

It is, however, most important for the railways to become more vigorous in their marketing and not just rely on potential users to find the railways.

It is crucial to remember that the objective is to attract people who have seldom or never travelled by train, or possibly not travelled at all. They need to be encouraged to make the first steps, and the key to the marketing effort will be to fill them with confidence.

Railways in general, and their governments, need to take a bolder approach.

9.3. Conclusions

- There is a very large potential demand for rail travel for disabled and elderly people. That demand will increase in the future.
- That potential demand can only be reached through a strategy of progressive removal of barriers to travel, affecting disabled and elderly people.
- To turn the potential into real demand, railways must also develop marketing strategies which segment the demand, identify the key user benefits and communicate with the target markets.
- The railways of Europe have much to gain and little to lose from a planned approach to accessibility. Substantial market growth can be achieved.

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Annex II List of Disability Organisations

A large number of disability organisations across Europe were consulted on this draft final report. We would like to thank the following organisations, whose comments have been of great help for the conclusion of this report.

Organisation	Country
UNISDA	F
BG BONN EV	D
ÖZIV-Tyrol	A
Ass. of Disabled Persons in the Czech Republic	CZ
DHR-Swedish Federation of Disabled Persons	S
Danish Association of the Blind	DK
The Danish Council of Org. of Disabled People	DK
The Norwegian Ass. of the Disabled	N
National Ass. of the Disabled	FIN
Finnish Epilepsy Association	FIN
The Finnish Rheumatism Association	FIN
Mav RT, Gépészeti Szakigazgatosag, Személykocsidivizio	H
Parkinson Disease Society	UK
COLITRAH	F
KVG-Vorming vzw	B
Blinderzorg licht en liefde vzw	B
Behinderte und Öffenlicher Verkehr	D
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Handikappförgundens Samarbetsorgan	S
VDK Deutschland	D
Italian Deaf Association	I
VZW Toengankelijkheidsbureau	B
Unione Italiana Ciechi	I
RADAR	UK

Annex III COST 335 Memorandum of Understanding

Brussels, 4 July 1996
COST 283/96

Memorandum of Understanding

for the implementation of a European Concerted Research Action designated as
COST Action 335

"Passenger accessibility of heavy rail systems"

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.

2. The main objective of the Action is to produce guidance for governments and railway operators on best practice in achieving full accessibility to their services and facilities. The Action will address both technical and economic issues and, in particular, the extent to which totally independent access can be achieved.

3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 2,5 million at 1996 prices.

4. The Memorandum of Understanding will take effect on being signed by at least 5 Signatories.

5. The Memorandum of Understanding will remain in force for a period of 3 years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

TECHNICAL ANNEX

COST 335

Passenger accessibility of heavy rail systems

A. BACKGROUND

Justification

Disabled and elderly people can only plan and undertake journeys if they can be confident that all stages of the journey will provide compatible levels of accessibility. Rail travel, both local and long distance, is an obvious field in which compatibility between access provisions is required. Without it, the scope for disabled and elderly people to make use of the European rail network is very limited.

There has already been some useful work at a European level in this area. A joint working party of the UIC and the ECMT has drawn up guidelines on access to rolling stock for EuroCity and other International services. In addition, the UIC itself has set up a working group of national railways to look at the scope for compatibility between practices and specifications in this area.

While this work is making a valuable contribution to technical understanding of these matters, its remit does not extend to the wider social and political considerations.

The purpose of the Action is therefore to provide a framework for this wideranging approach and to give renewed impetus to this key area of transport policy.

A COST Action is a particularly appropriate forum for this work because it can bring together a wide range of participating countries on the basis of sharing expertise and experience and of working together to formulate new technical and policy directions.

This forum will also encourage the implementation of this approach in line with the development of the Task Force "Trains and railway systems of the future" recently initiated by the European Union.

Scope

The approach is based on non-discrimination. It is in line with the European Union Green Paper on the Citizens' Network calling for developing public transport systems with higher quality and equitable access for all.

Measures for accessibility – such as self-opening doors, ramps etc. – will increase the quality for other people as well. Measures for quality – such as good information, serving meals at seat, train taxis etc. – will increase the accessibility for disabled and elderly people as well.

There is a substantial actual and potential passenger market for the railways in this area. The term "disability" covers a wide range of very different impairments – physical, sensory and cognitive. Some definitions relate to medical conditions; it is, however, more appropriate in a travel-related context to consider functionallybased criteria to describe the wider range of people who might have difficulty in travelling. Additionally, there are many people who are not disabled, but to whom policies and facilities designed for disabled people would be helpful.

These include:

- elderly people;
- people encumbered by luggage, pushchairs, heavy shopping, small children, etc.;
- those unable to speak or understand the local language, such as tourists.

On the previous broad definition the scope of "disability" would include:

- people with mobility handicaps including:
  - wheelchair users;
  - people with severe or slight walking difficulty;
  - people unable to climb steps;
  - people with difficulties in gripping and balancing;
- people with sensory impairments including blind people and those with impaired vision;
- people with impaired hearing and profoundly deaf people;
- people with speech impairment or without speech;
- people with cognitive difficulties.

Potential market

There is inconsistency between countries in both the detailed definitions of disability and in how measurement is effected. It is, therefore, difficult to collate international statistics with any precision. The current consensus view, however, is that approximately 12% of the population of the European Union is disabled. (This is derived from both formal and informal studies).

This represents some 41 million disabled people in the EU alone and over 50 million in Europe as a whole.

The corresponding figure for the USA is 43 million disabled people.

Within these figures some other useful points can be noted:

- wheelchair users represent only around 6-7% of the total number of disabled people;
- approximately two-thirds of disabled people have a mobility handicap, i.e. around 7,5% of the population;
- approximately two-thirds of disabled people are elderly (i.e. aged 60 or over).
- a significant number of disabled people will travel with at least one other person.

The correlation between disability and age is an important one. Around 20% of the total European population – approximately 76 million people – are currently aged 60 or above. Eurostat forecasts indicate that this will grow to 110 million, or 28% of the total population, by the year 2000. This is coupled with an absolute decline in numbers of those aged under 60.

From this data, the combined total of disabled and elderly people is approximately 24% of the total European population, i.e. around 100 million, and this figure is expected to rise to over 130 million, above 30% within 25 years.

In order to understand how to reach this potential market it is necessary, on the one hand, to conduct an indepth market study and, on the other hand, to identify the requirements for design and refurbishment.

B. OBJECTIVES AND BENEFITS

The main objective of the Action is to produce guidance for governments and railway operators on best practice in achieving full accessibility to their services and facilities. The Action will address both technical and economic issues and, in particular, the extent to which totally independent access can be achieved.

Secondary objectives will include the raising of awareness among train operators of the actual and potential size of the market for rail travel among disabled and elderly people and giving them a clear indication of the wide range of issues involved in realizing that market potential.

The Action will also consider the implications of its recommendations both for public spending and for competitiveness in the commercial environment.

There will be particular emphasis on the scope for and benefit of cooperation between policy makers, manufacturers, operators and users in moving towards solutions that are both effective and sustainable.

C. SCIENTIFIC PROGRAMME

The Action needs to include a systematic evaluation not only of the facilities and services relevant to the station and rolling stock, but to the whole journey from door-todoor. For many people with mobility difficulties, journeys can only be undertaken if every link in a chain of accessibility is complete. This chain starts with information about the journey before the person has left home and ends only once they have reached their final destination.

In order to draw together all the necessary information, the Scientific Programme will include the following elements:

Economic aspects:

- defining the market;
- the commercial case for accessibility;
- costs of measures, public or private financing, social issues;
- marketing opportunities (niche and core market developments).

Pre-travel information:

(Particular reference to the need to standardize information between operators regarding the continuous provision of transport chain information. Relevant data can be drawn from the RICA Report on transport information for people with disabilities).

- content (what facilities, what services, what help, who to contact);

- quality (accuracy, accessibility, ease of understanding);
- format (large print, braille, audiotape, text telephones);
- availability (interactive terminals and others including teletext, minitel, local radio, local press, etc.).

Access to and within stations:

(Particular reference to establishing both the fundamental minimum requirements and the optimal requirements for accessibility and the importance of compatibility between stations.)

- ease of access (reduction of internal movements, ease of the intermodal connections);
- ticket purchase (including reservations);
- waiting areas;
- toilet facilities;
- catering;
- information and signing (including audible, visual, real time).

Interface between station and rolling stock:

(Emphasis on user needs and functional requirements and on compatibility between crossborder requirements will be done. After the inventory of national situations, the recommendations for achieving a more coherent network will distinguish between new and old facilities).

- platform height (European pre-standardization);
- tactile marking/surfaces;
- boarding/alighting equipment;
- other boarding/alighting aids;
- rolling stock technology to minimise horizontal/vertical gaps;
- luggage transfer.

Rolling stock design:

(For single and double deck trains, for suburban and long distance including the couchette train. In this area relevant data can be drawn from the UIC/ECMT Guidelines).

- doorway width/height;
- gangway width;
- seating layout;
- wheelchair space;
- toilet facilities;
- catering;
- lighting;
- position of handholds;
- colour contrasts, etc.;
- on-train information;
- access to emergency facilities.

Staff:

(With reference to the close link between rolling stock design and the role of staff)

- availability;
- skills and training;
- health and safety issues.

Fare structures:

(With reference to the economic, competitive and deregulation environment of the railways).

- information;
- incentives to travel/fare concessions;
- through ticketing (including transferring between modes).

Group travel:

- availability of wheelchair spaces;

- booking arrangements;
- training/information to the users.

Compatibility and inter-modal transfer:

- compatibility between systems of information, facilities, ticketing, luggage registration;
- transfer/transit information (facilities, availability of staff).

Regulatory framework:

- legislation/regulation;
- codes of practice/guidance;
- maintaining and monitoring standards.

D. ORGANIZATION AND TIMETABLE

The exchange of information will be supported through technical visits and circulation of documents. Common work will be achieved through working groups which will be set up where appropriate.

The following phases will be included:

Phase 1

- To gather and analyse experience from participating members on topics identified above and to identify gaps in knowledge and experience on these topics.
- To draw up principles for good practice under each topic and to develop an evaluation methodology.

Phase 2

- To stimulate the collection of data to fill gaps in knowledge and experience identified in Phase 1.
- To assess scope for compatibility/coordination of existing practices and standards.

Phase 3

- In the light of the results of Phase 2; to establish best practice in each area through case studies, codes of practice and guidelines.
- To disseminate and promulgate best practice to governments and operators.

The dissemination plan includes an opening seminar during Phase 1, an interim report after Phase 2 and a conference after Phase 3.

The estimate of the total duration of the project is three years. Each phase is expected to last one year.

E. ECONOMIC DIMENSION

The economic dimension of the Action is the sum of the national costs incurred by the countries participating in the Action, the costs incurred by international organizations participating in the Action, and the coordination, which will partly be paid by the Commission.

The national costs comprise the personnel costs arising from the involvement of staff in the Action, translation costs not covered by the Commission, acquisition of equipment where necessary and travel expenses not covered by the Commission.

Nine countries and two international organizations actively participated in the preparation of this Action. They are Spain, Finland, France, Italy, Ireland, the Netherlands, the United Kingdom, Sweden, Switzerland, International Union of Railways (UIC) and the European Disability Forum (EDF). On the basis of the information available during the preparation of the Action, they planned to earmark an average of ECU 78 000 each and per year.

The estimate of the total costs including the coordination costs partly paid by the Commission is ECU 2,5 million.

This estimate is valid only if the abovementioned countries and organizations participate in the Action. Any withdrawal or other participation would alter this estimate.

Annex IV. COST Transport Overview

COST Transport is one of 17 domains existing in COST at the present time.

It was to be one of the seven areas seen as best suited for this new form of collaboration, which was officially set up by a Ministerial Conference in November 1971.

The Transport area lends itself particularly well to the COST framework, both because it combines aspects from a number of disciplines, and because of the need for harmonisation at European level. Liaison with the Transport Ministries and Administrations in the various countries is a key element of these COST Actions.

The COST Transport Secretariat is located within the Directorate General for Transport of the European Commission. The location with the staff managing the Fourth and Fifth Framework Transport RTD Programme, as well as the proximity with the Common Transport Policy Directorates, enables close collaboration between Transport Research activities and serves as a basis for further political action.

COST Transport Actions are authorised and supervised by the COST Technical Committee on Transport which, in turn, reports to the COST Committee of Senior Officials. Both of these decision-making bodies comprise representatives of the national governments of the COST countries.

By the end of 1999, the COST Transport domain comprised 13 ongoing Actions, with a total estimated cost of EURO 42.5 Million. 32 Actions have been completed, and a further 4 Actions have been selected and are under preparation.

Completed Actions

COST 30: Electronic Traffic Aids on Major Roads
COST 30 bis: Electronic Traffic Aids on Major Roads: Demonstration Project and Further Research
COST 301: Shore Based Marine Navigation Systems
COST 302: Technical and Economic Conditions for the Use of Electric Road Vehicles
COST 303: Technical and Economic Evaluation of National Dual-mode Trolleybus Programmes
COST 304: Use of Alternative Fuels in Road Vehicles
COST 305: Data System for the Study of Demand for Interregional Passenger Transport
COST 306: Automatic Transmission of Data Relating to Transport
COST 307: Rational Use of Energy in Interregional Transport
COST 308: Maintenance of Ships
COST 309: Road Weather Conditions
COST 310: Freight Transport Logistics
COST 311: Simulation of Maritime Traffic
COST 312: Evaluation of the Effects of the Channel Tunnel on Traffic Flows
COST 313: Socio-economic Cost of Road Accidents
COST 314: Express Delivery Services
COST 315: Large Containers
COST 317: Socio-economic Effects of the Channel Tunnel
COST 318: Interactions between High-speed Rail and Air Passenger Transport
COST 319: Estimation of Pollutant Emissions from Transport
COST 320: The Impact of E.D.I. on Transport
COST 321: Urban Goods Transport
COST 322: Low Floor Buses
COST 323: Weigh-in-Motion of Road Vehicles
COST 324: Long Term Performance of Road Pavements

COST 325: New Pavement Monitoring Equipment and Methods
COST 326: Electronic Charts for Navigation
COST 328: Integrated Strategic Transport Infrastructure Networks in Europe
COST 329: Models for Traffic and Safety Development and Interventions
COST 330: Teleinformatics Links between Ports and their Partners
COST 331: Requirements for Horizontal Road Marking
COST 333: Development of New Bituminous Pavement Design Method
COST 335: Passengers' Accessibility of Heavy Rail Systems

Actions Underway

COST 327: Motorcycle Safety Helmets
COST 332: Transport and Land-Use Policies
COST 334: Effects of Wide Single Tyres and Dual Tyres
COST 336: Use of Falling Weight Deflectometers in Pavement Evaluation
COST 337: Unbound Granular Materials for Road Pavements
COST 339: Small Containers
COST 341: Habitat Fragmentation due to Transportation Infrastructure
COST 342: Parking Policy Measures and their Effects on Mobility and the Economy
COST 343: Reduction in Road Closures by Improved Maintenance Procedures
COST 344: Improvements to Snow and Ice Control on European Roads and Bridges
COST 345: Procedures Required for Assessing Highway Structures
COST 346: Emissions and Fuel Consumption from Heavy Duty Vehicles

Actions in preparation

COST 338: Drivers' Visual Information Overload

COST 340: Towards a European Intermodal Transport Network: Lessons from History

COST 347: Pavement Research with Accelerated Loading Testing Facilities

COST 348: Reinforcement of Pavements with Steel Meshes and Geosynthetics

Up-to-date information on COST Transport can be found on the World Wide Web, at the following address: http://www.cordis.lu/cost-transport/home.html.

European Commission

EUR 19328 – COST 335 – Passengers' Accessibility of Heavy Rail Systems

Luxembourg: Office for Official Publications of the European Communities

1999 – 260 pp. – 17.6 x 25.0 cm

ISBN 92-828-8223-3

Price (excluding VAT) in Luxembourg : EURO 24.00

This report is the output of a collaborative European project in which experts from 17 countries and 4 international organisations took part. The participants represented railway operating and manufacturing industries, goverments and academic experts in the field and representatives of disability organisations.

The purpose of this report is to provide guidance on best practice in meeting the needs of rail travellers with reduced mobility. The report deals with the technical and economic issues involved in achieving access to rolling stock and to stations and with issues of information and training.