European Commission

Directorate-General for Research

COST Action 335

Passengers' accessibility to heavy rail systems

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1. Executive Summary

Executive Summary

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

In this handbook we describe our thinking behind the good practice we recommend, and highlight some of the specific design recommendations. The stations working group believes that making rail travel accessible to disabled people will increase the overall quality of railway travel. 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 not well defined. 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.

Access and disabled people

To provide a framework in which to consider improving access, the Stations Working Group identified five categories of impairment. We believe that measures to provide access to people in these five categories will help disabled people with other impairments. The five categories are:

1. People with **mobility** impairments
2. People with **sight** impairments
3. People with **hearing** impairments
4. People with **environmental** impairments (such as asthma)
5. People with **intellectual** impairments, including

orientation problems

Some people will clearly fall into one category or another. But many disabled people have multiple impairments, and many people who would not consider themselves disabled experience problems in one or other category. So measures to address access based on these five categories will help a lot of other passengers.

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

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.

2. Introduction

Introduction

COST 335, Passengers' Accessibility of Heavy Rail Systems is 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 primary audience for this report is the rail industries and the public authorities responsible for transport.

The COST 335 Action incorporated four working groups, namely:

A Stations
B Rolling Stock
C Information and Training
D Economics and Marketing

The Stations Handbook

The principal output of the stations working group is a design handbook for accessible stations.[1]

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

In this handbook we describe our thinking behind the good practice we recommend, and highlight some of the specific design recommendations.

The stations working group believes that making rail travel accessible to disabled people will increase the overall quality of

[1] You can find more information on COST 335 on the Internet at www.cordis.lu/cost-transport/home.html

railway travel. 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 not well defined. 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.

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4. People with **environmental** impairments (such as asthma)
5. People with **intellectual** impairments, including **orientation** problems

Some people will clearly fall into one category or another. But many disabled people have multiple impairments, and many people who would not consider themselves disabled experience problems in one or other category. So measures to address access based on these five categories will help a lot of other passengers.

People with mobility impairments include elderly people who walk slowly and cannot carry heavy luggage. They also include families with small children and a lot of luggage, including perhaps a pram or pushchair. These groups often choose the private car because of luggage. And everyone with two suitcases, one in each hand, will have difficulty entering a station if the door does not open automatically. Department stores have understood this for a long time.

Clarity of visual information helps everybody. 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. People with visual impairments are not all blind. Some have residual vision and require strong colour contrast, adequate lighting, easy to find signs and large lettering to make best use of their vision. All of these can be valuable to other passengers as well.

Not all people with hearing impairments are totally deaf. Many of them use hearing aids, and require clarity of spoken announcements with visual support. A great number of passengers may have difficulty with loud-speaker announcements because they were not listening – or they could not hear because of a passing train or the children screamed at the wrong moment. Clear spoken information helps everyone.

Orientation problems are not only caused by intellectual impairments. Many passengers are strangers in the area or in the country. Many passengers don't know the language, and they also need support in wayfinding. Pictograms may solve some language problems. Other solutions are the design of stations, especially the physical lay-out. Too many tunnels and stairs and 180 degrees turns will make every passenger disorientated. And too many shopping kiosks blocking the route may confuse even the most experienced passengers. Feeling lost in a strange station is not just confined to passengers with intellectual impairments.

People are increasingly developing allergies, including asthma, and clean air is vital if they are to travel by train. Providing well-defined areas of 'clean air' assists everyone.

And we can all expect to develop mobility, sight, hearing or even intellectual impairments if we are looking forward to a ripe old age. So everybody is included in the long term.

Our philosophy is that everyone should be able to travel independently. However, there will always be some people who must travel accompanied, because they need personal assistance, and it is not appropriate for railway staff to provide this.

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 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.

Individual companies in the rail industry do not always have full control over station and its the environment. Parts of the environment may be under the control of local government authorities, local businesses or other rail companies, for example. 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.

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

- there has been a recent trend towards making rail passengers self-reliant and reducing the number of available staff. Some passengers can cope with this, but it presents a barrier to many others – for example, people with visual impairments, or learning difficulties, people who speak a different language, people with heavy luggage, and people who are using the station for the first time.
- assistance provided should be discreet, but readily available
- all assistance staff should be trained in effective customer care, including disability awareness

✓ emergency planning should take account of disabled people

- many disabled people need more support in an emergency
- staff need to be aware that people may not be able to hear / see emergency instructions

3. Dahl Charts

3.1 Circulation
3.2 Visibility
3.3 Environment
3.4 Arrival & Wayfinding
3.5 Pre Travel
3.6 Station facilities
3.7 Platforms & tracks
3.8 Sounds & acoustics
3.9 Emergencies

3.1 Circulation

Transport Interchanges

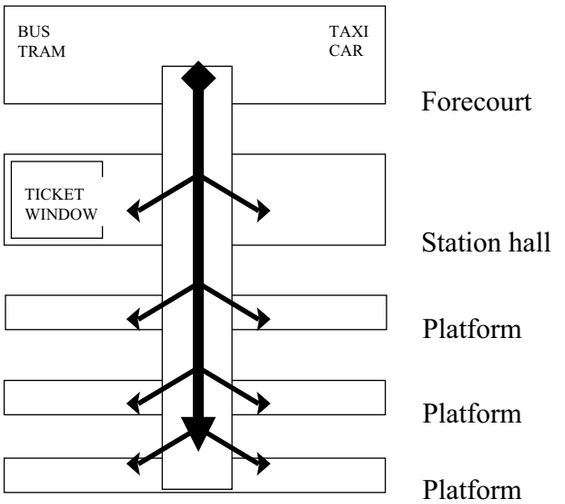
Purpose
• To ensure that passengers have a smooth journey from start to finish
• To encourage other transport providers to work with the railways to make transport interchanges easy to use
• To bring continuity into the design of transport interchanges across Europe so that passengers can orientate themselves wherever they travel

Best:	Clear wayfinding (signage, visual and audible information) for all passengers, but especially those with visual or cognitive impairments
	Good, consistently presented information about transport connections
	Step-free and barrier free access for all passengers, but especially wheelchair users and visually impaired people
	Tactile guide paths between key points of the station, and technological guidance systems for visually impaired people
	The shortest possible route from one mode of transport to another, with electric buggies available for passenger use
	Safe, warm, dry shelter and resting places for people to wait for transport for the next phase of their journey
Recommended	Clear wayfinding (signage and audible information)
standard:	Good information about transport connections
	Tactile guide paths
	Seating and shelter for people waiting for transport for the next phase of their journey
	Electric buggies available for passenger use
Minimum:	Clear wayfinding (signage and audible information)
	Good information about transport connections
	Seating and shelter for people waiting for transport for the next phase of their journey

Open Space Stations

Purpose
• To ensure that passengers can clearly and comfortably find their route through the station
• To ensure that passengers' journeys are not spoiled by claustrophobic feelings or fear of hidden danger

Railway Station:



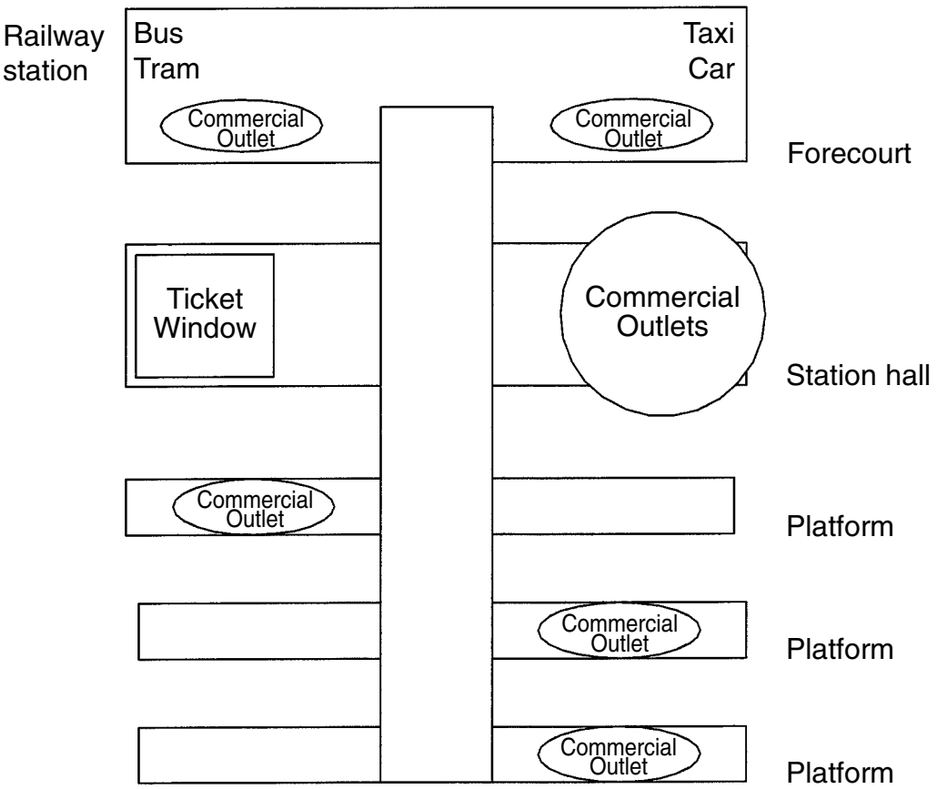
Best:
Routes to all significant station facilities visible from the entrance
No commercial outlets blocking view of station facilities
Routes to other levels (lifts, stairs etc.) visible from entrance
Route options located adjacent to each other (e.g. lift / stairs)
Commercial and station information signs clearly differentiated
Information for trains on concourse and at platform entrances
Doors glass within solid framework, or with long, wide vision panels

Recommended standard:
Route to platforms visible from station entrance
Commercial and station information signs clearly differentiated
Routes to other levels (lifts, stairs etc.) visible from entrance
Information for trains on concourse and at platform entrances
Doors glass within solid framework, or with long, wide vision panels

Minimum:
Route to platforms visible from station entrance
Commercial and station information signs clearly differentiated
Information for trains on concourse and at platform entrances
Doors glass within solid framework, or with long, wide vision panels

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

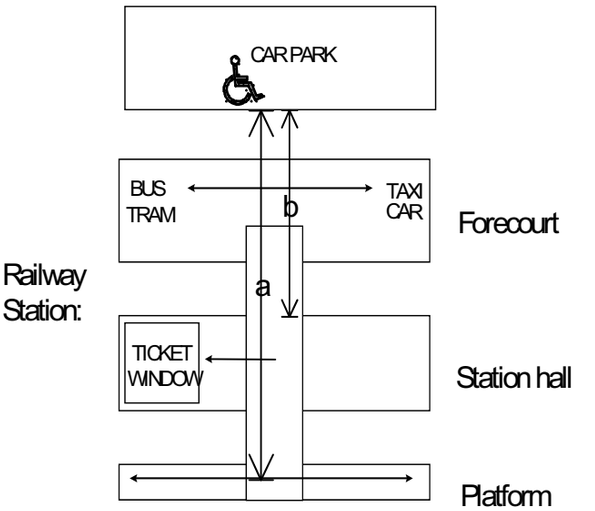
Walking distances

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.

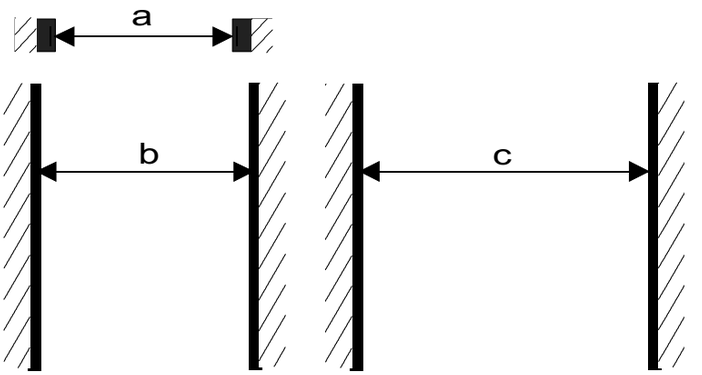
4. Route distance information

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

Passages and space for turning

Purpose
• To ensure that layouts have sufficient floor space to allow circulation by wheelchair and other mobility aids.

1. Widths of corridors and passages

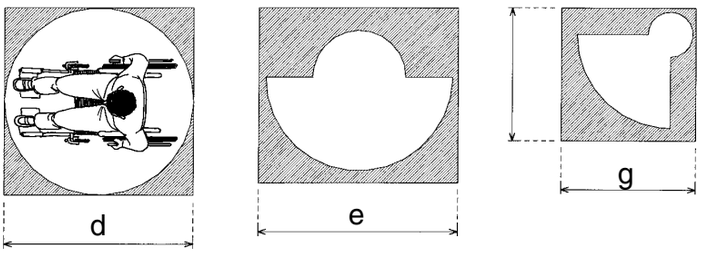


a. at a point. Minimum 800 mm. Best 900 mm
b. continuous (single) Minimum 1.2m. Best 1.2m
c. continuous double circulation. Minimum 1.6m Best 2m

Notes:

a. Width at a point	Applies to short passages, maximum 500 mm in length, such as passages between columns, through doorways, control barriers etc.
b Continuous single circulation	Refers to secondary circulation spaces such as short passages to toilets, offices and service areas.
c. Continuous double circulation	Applies to all major circulation routes.

2. Wheelchair turning



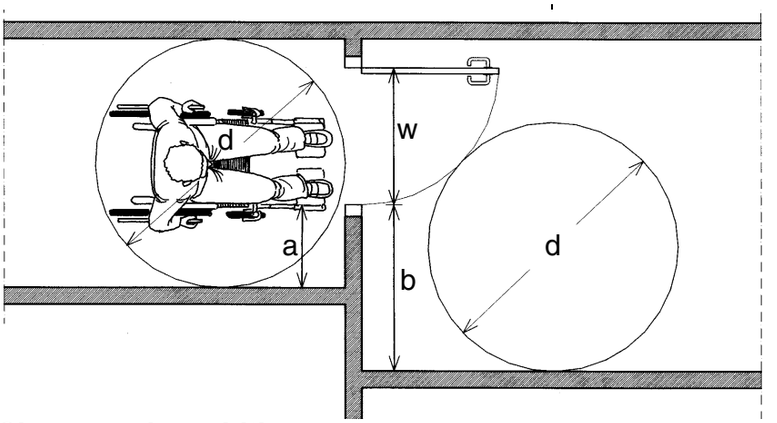
d. 360 degree turn: Best diameter 1.7m. Minimum diameter 1.5m.
e/f. 180 degree turn: Best 1.7/1.8 m. Minimum 1.5/1.4m
f=g. 90 degree turn: Best diameter 1.7m. Minimum diameter 1.4 m

Note:
Turning requires floor space unobstructed by door swings, fixtures and fittings, panels or screens. Major circulation routes should allow 360 degree turning space.

Doors

Purpose
To ensure functional door design and sufficient free floor space for all users.

1. Horizontal dimensions



Clear opening widths:

External doors:	w. Best 1.0m.	w. Minimum 900 mm
Internal doors:	w. Best 1.0m.	w. Minimum 900 mm
Double doors one leaf	w. Best 900 mm	w. Minimum 800 mm

Free floor space

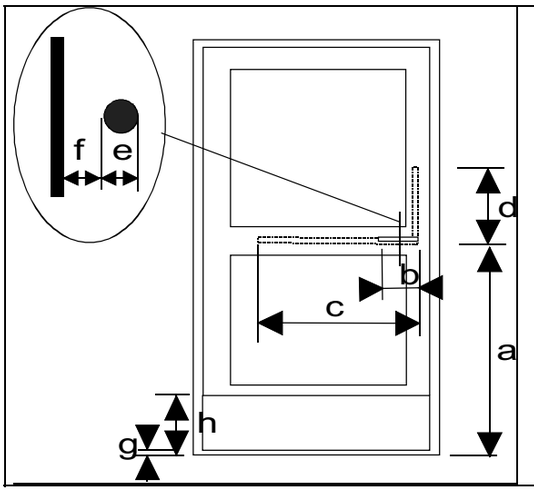
a. Best 500 mm. Minimum 300 mm
b. Best 1.3m. Minimum 800 mm
d. Best 1.7m Minimum 1.4m. (Turning circle see chart "Passages and Space for Turning"):

Notes:

Clear opening widths:
Differences between external and internal doors are due to the difference of the thickness of the door leaf; the requirements for external doors therefore apply equally to internal doors of heavy duty construction

Free floor space:
The requirement is for free floor space unobstructed by door swings, fixtures and fittings, panels or screens. Major circulation routes should allow the "best" dimensions.

Doors 2. Vertical dimensions



Door furniture, standards:

a. Handle/bar height
   900 +/-5 mm
b. minimum length of handle
   120mm
c. minimum length of bar
   300mm (best 400mm)
d. minimum height of vertical bar
   300mm (best 400mm)
e. diameter
   minimum 25mm (best 35mm)
f. clearance
   minimum 30mm (best 45mm)

Door leaf/threshold

g. Threshold (when used):	Maximum height 25 mm	Best 20 mm
h. Kick plates h (when used)	Minimum 300-400mm	

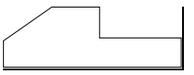
3. Other dimensions, standards

Force needed to open doors:	Best 15, Max 30 N
Width at which electric/automatic door opener is required:	1.2m
Automatic doors opening time:	6 seconds
Automatic doors speed of opening:	500 mm/second

Notes

Thresholds

Doors without thresholds are recommended wherever possible. If, due to fire, climatic or other reasons thresholds cannot be avoided, the problem of crossing the 20-25mm high end should be alleviated through chamfering:



Revolving doors

Revolving doors may cause problems for disabled people due to insufficient space for wheelchair users and users of mobility aids, as well as orientation problems for visually handicapped people and people with learning difficulties. Revolving doors are therefore not recommended. If revolving doors are used, they should be supplemented with a hinged door, positioned in the main line of access.

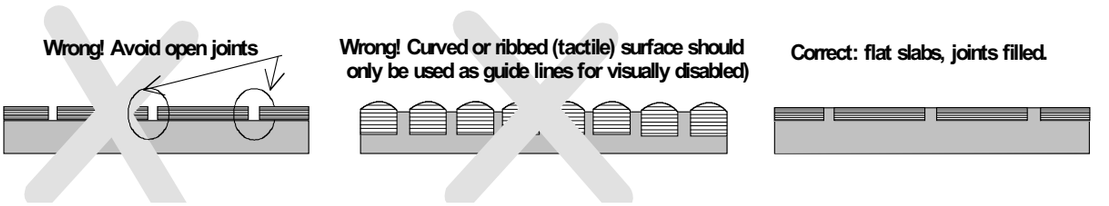
Paving outdoors

Purpose
To outline the basic requirements for outdoor paving which can be easily traversed by disabled people.

Functional requirements

- Paving should provide a level or gently sloping, non-slip, hard surface, incorporating features to aid orientation for the visually disabled.

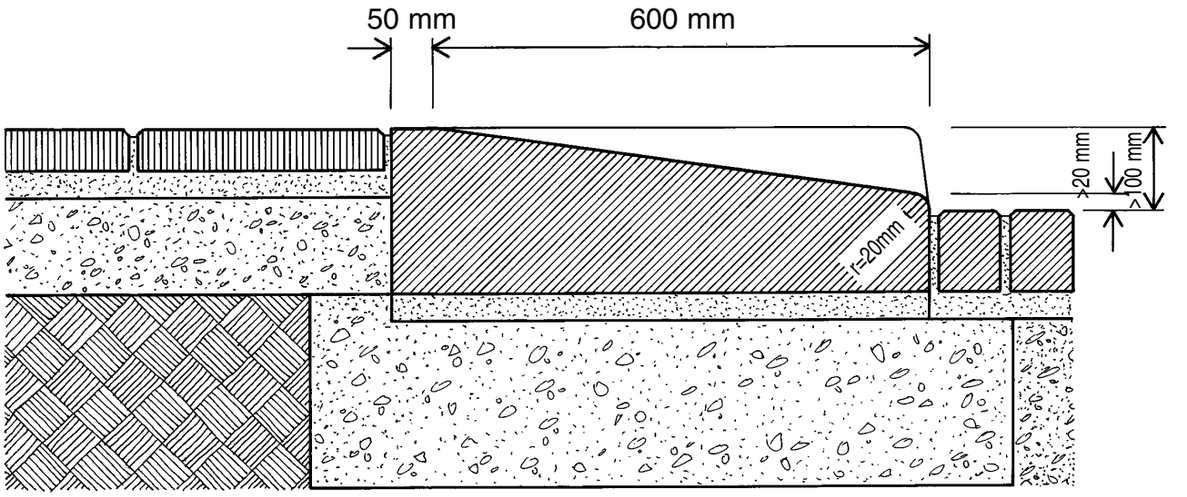
Design and choice of materials



- Gaps between paving slabs should be filled with a hard material to the same level as the slabs. Open joints should be avoided.
- Rectangular, flat slabs should be preferred.
- In dark places, the choice of paving should aim for light colours
- Structure, surface and colour should be chosen to provide variations to aid visually disabled.
- The surface structure should be sufficiently coarse to achieve a non-slip surface in all weather conditions, with a slip-resistance co-efficient of between 0.6 and 0.75.

Dropped Kerbs

Purpose
• To ensure that wheelchair users can get on and off kerbs

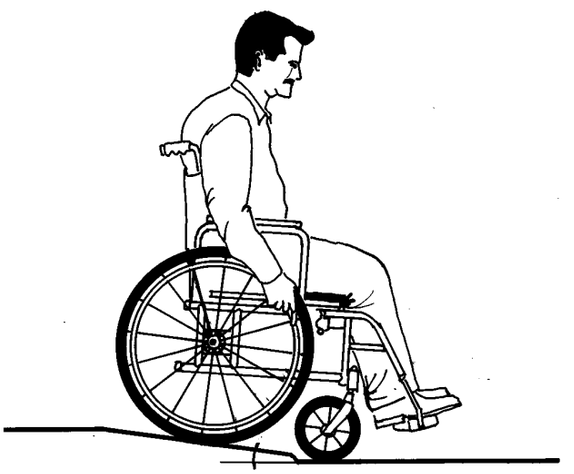


h < 0.10 m	minimum slope:	16 % (1:6)	minimum width:	900 mm
	best slope:	10 % (1:10)	best width:	1.2 m

Best technique: pavement height reduction. Where this is not possible, prefabricated concrete access and exit strips can be used

Non-slip surface

Light level: Best 100 lux, Standard 50 lux, Minimum 20 lux



Floors (indoors)

Purpose

- To ensure that floor surfaces can be easily navigated by disabled people.

Functional requirements

- The floor material and finish should provide a level or gently sloping, non-slip, hard surface that is easy to clean, and should incorporate features to aid orientation for visually impaired people.

Design and choice of materials

- Paving: see chart "Outdoor Paving"
- The surface structure should be sufficiently coarse to achieve a non slip surface with slip resistance co-efficient of best 0.6 (max 0.75, min 0.4)
- Structure, surface and colour should be chosen to provide variations to aid visually impaired people.
- Best solution incorporates guidepaths in accordance with charts "Guidepaths" and "Tactile flooring"

Recommendations:

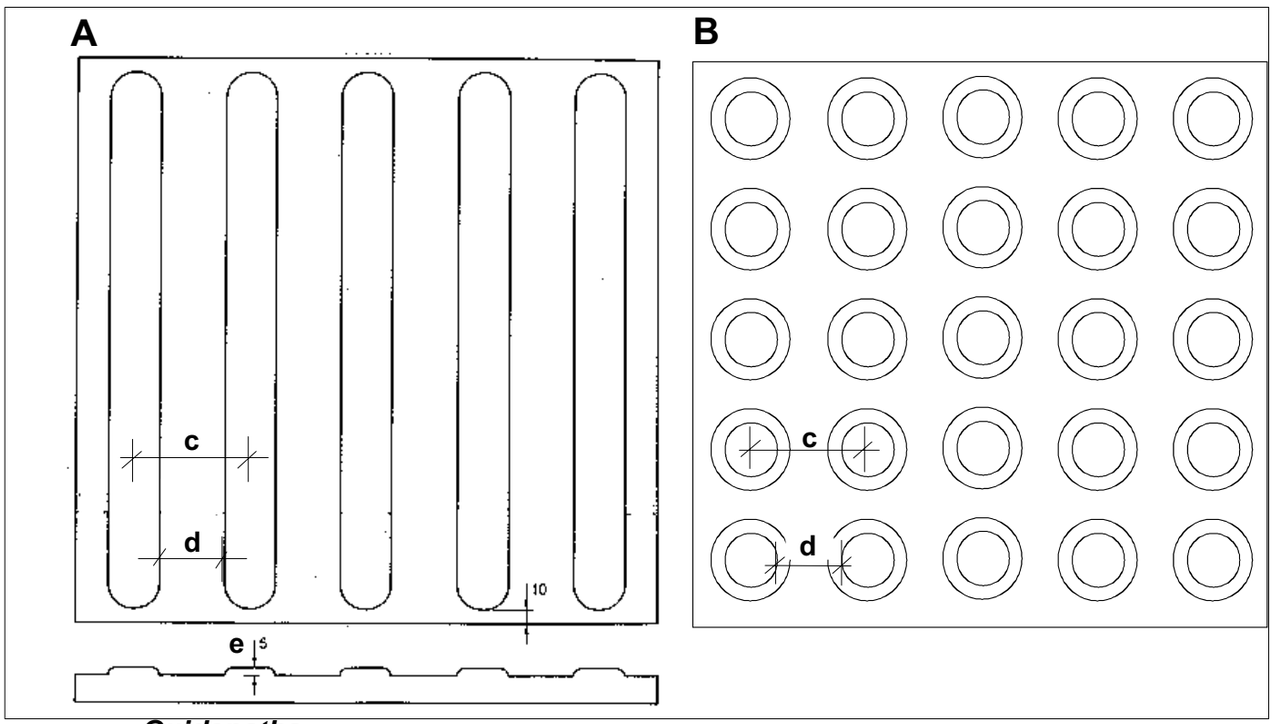
Materials:

- Ceramic tiles
- Concrete slabs/tiles
- Natural/artificial stone tiles
- Vinyl/plastic sheets or tiles

Tactile flooring

Purpose
• To give visually impaired passengers a clear indication of the safe routes around the station to key points
• To warn visually impaired people of hazards

These recommendations are for countries where there is no national standard. Where there is a national standard, it should always be used. The person who specifies the project must find out whether a national standard exists – the national transport authority is a good starting point.



Guidepaths

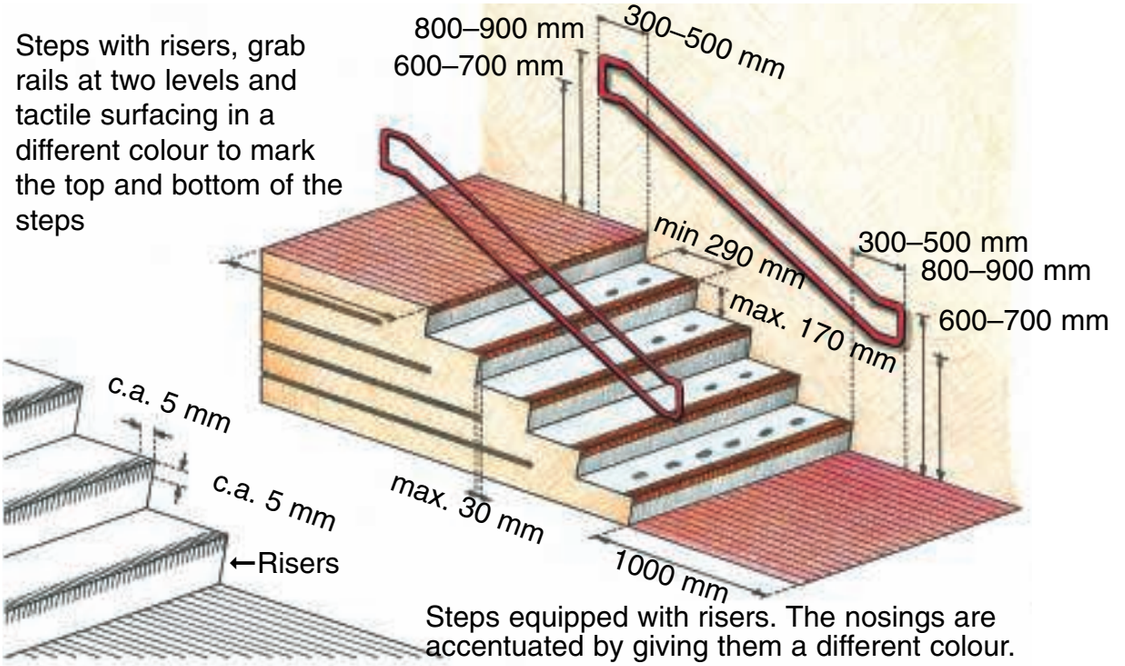
Recommended solution:	Ribbed tiles	
	Centre to centre (c):	> 45 mm
	Distance between ribs (d):	>23 mm
	Depth (e):	3-6 mm
	Width of path:	>=0.6m/<=0.8m
	Reflection-factor:	+ 0,10 or - 0,15
	Sound:	> 15 dB / Hz
	Lighting:	50 lux

Hazard Warning

Recommended solution:	Domed tiles	
	Centre to centre (c):	> 40-45 mm
	Distance between domes (d):	12-23 mm
	Depth (e):	3-6 mm
	Reflection-factor:	+ 0,10 or - 0,15
	Sound:	> 15 dB / Hz
	Lighting:	50 lux

Stairs

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



Steps equipped with risers. The nosings are accentuated by giving them a different colour.

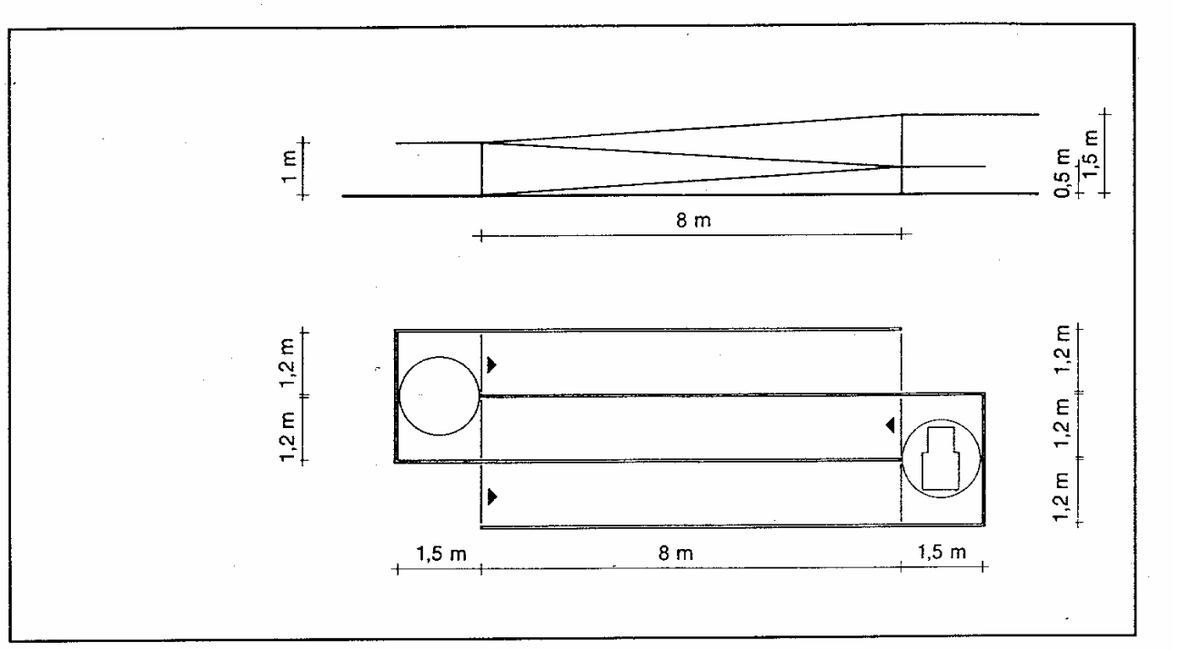
Best:
Straight flight(s); Each flight >3 and <12 steps with landings
Closed risers, height 100-120mm, 1 tread + 2 risers = 620mm
90º angle between tread and riser;
Width of stair 1.2m to 1.5m between handrails
Colour contrasted hazard warning at top/bottom of flights (>= 1m width)
Treads with contrasting 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)

RAMP (1 of 2)

Purpose
• To ensure that wheelchair users and those who cannot manage stairs can access all levels of a station where lifts cannot be provided.



h < 500 mm	minimum slope:	12 %	(1:8)	minimum width:	900 mm
	standard slope:	8 %	(1:12)	best width:	1.2 m
	best slope:	5 %	(1:20)		
500 mm < h < 1 m	minimum slope:	9 %	(1:11)	minimum width:	900 mm
	standard slope:	8 %	(1:12)	standard width:	1.2 m
	best slope:	5 %	(1:20)	best width:	1.8 m
100 < h < 6.00[1] m	minimum slope:	6 %	(1:16)	minimum width:	1.2 m
	best slope:	5 %	(1:20)	best width:	1.8 m

Steps should always be provided as an alternative to a ramp, as many people with walking difficulties find steps or stairs easier than a long ramp. It is most important to ensure that where ramped access is provided in addition to steps, the two routes are perceived to be of equal importance. People who have no option but to use the ramp should not be seen to be using a 'second-class' entrance.

A lift is recommended rather than a very long ramp.

[1] 100 < h < 6.00 m = Minimum solution (because many wheelchair users cannot manage the maximum ramp length of 132 m)

RAMP (2 of 2)

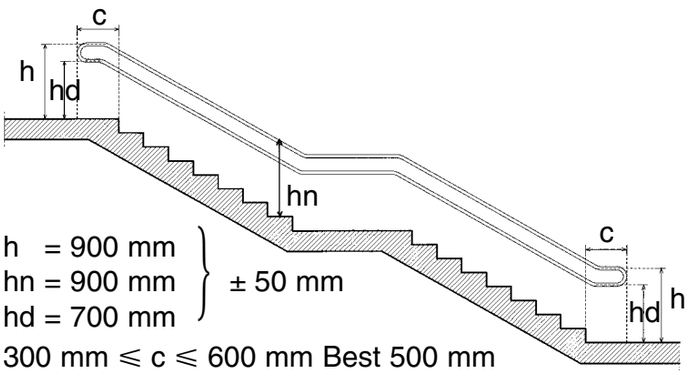
maximum transverse slope: 1.5% (1:65)

minimum landing every 0.6 m rise	minimum landing circle: 1.20 m
best landing at every 0.5 m rise	standard landing circle: 1.40 m
best landing circle:	1.50 m

other issues	handrail (see Handrails chart)
	smooth, non-slip material
	roll-off protection height minimum 400 mm
	light level: best 100 lux, standard 50 lux, min. 20 lux
	notice board with slope percentage

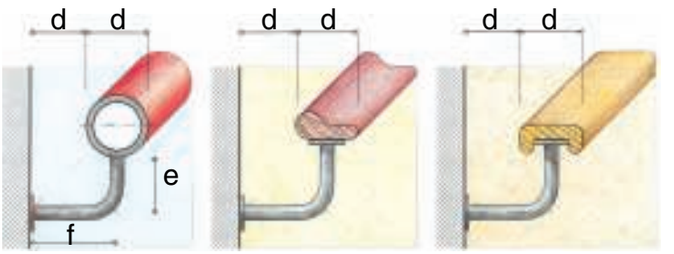
Handrails

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



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

300 mm ⩽ c ⩽ 600 mm Best 500 mm



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

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

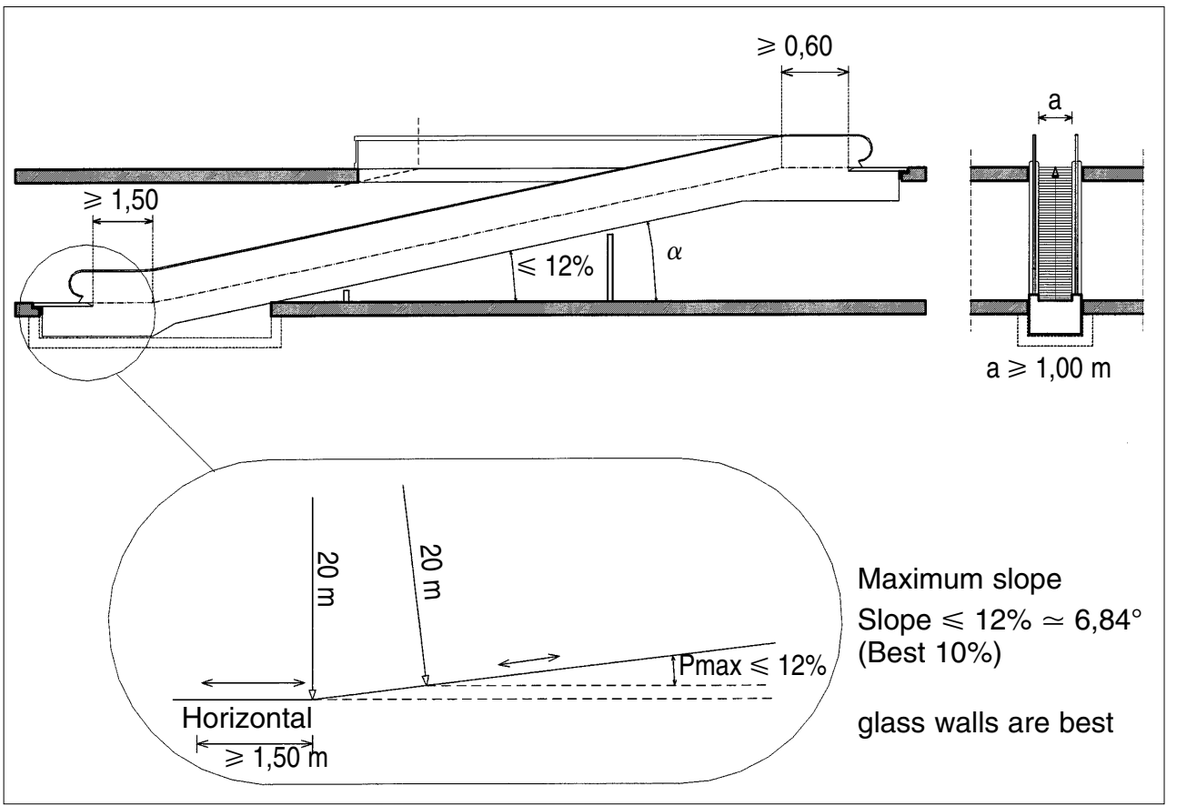
Material colour contrasted, rust-free, warm or neutral to touch, not containing nickel, rubber or chromium

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



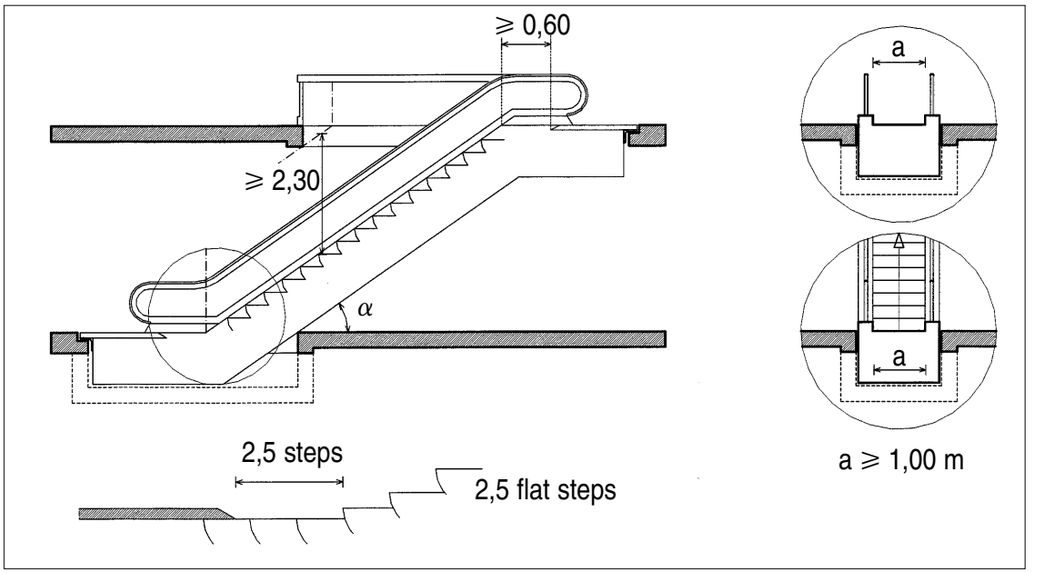
Best:
Width >= 1.5m
Level travel
Speed <= 0.75 m/s
Handrail available (see handrail chart)
Handrail and travelator
Slip-resistant flooring
2.3m height clearance along the length

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.

Escalators

Purpose
• To provide additional means of changing level for those unable to use stairs



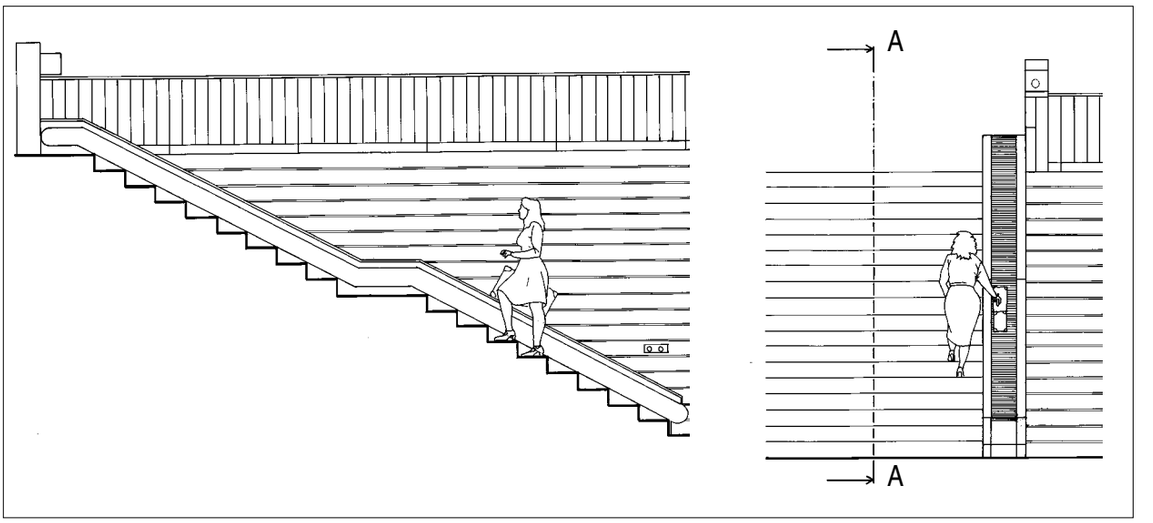
Best:
Width >= 1m
Speed <=0.5 m/s OR <= 0.75 m/s if angle of rise <30º
Handrail available
Handrail and escalator move at same speed
Slip-resistant flooring
900mm colour contrasted strip at top and bottom
2.3m height clearance along the length

Recommended standard:
Width >= 1m
Speed <=0.5 m/s OR <= 0.75 m/s if angle of rise <30º
Handrail available
Handrail and escalator move at same speed +2%
2.3m height clearance along the length
900mm colour contrasted strip at top and bottom
900mm slip resistant flooring at start and finish

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

Luggage Conveyor Belts

Purpose
• To enable passengers carrying luggage to get up stairs easily



Luggage conveyor belts can be used where it is not possible to provide lifts. However, they may present problems for people with walking difficulties who are unable to maintain a constant speed while climbing stairs. A handrail should always be provided on the other side of the stairs.

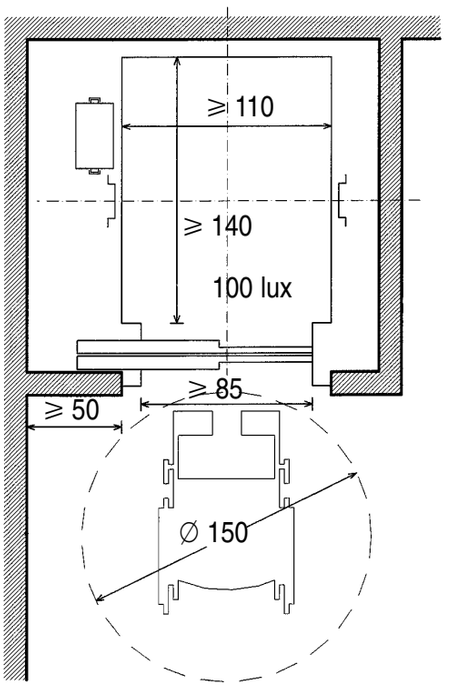
Recommended standard:

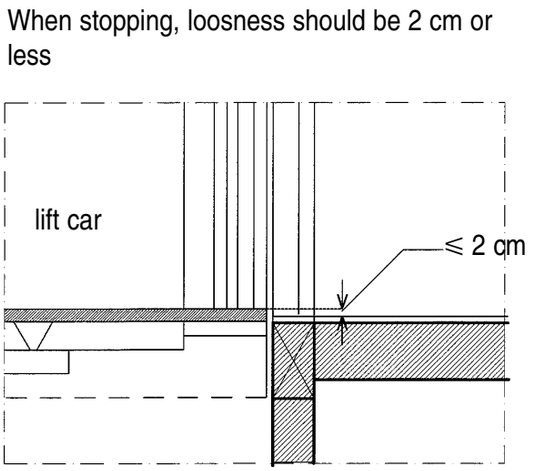
Conveyor belt width 300mm
Gradient 30º
Clearance width 500 mm
Construction stainless steel
Rubberised surface with slip resistance co-efficient >=.75
Speed 0.3 m/s

These conveyor belts can be added to existing staircases.

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



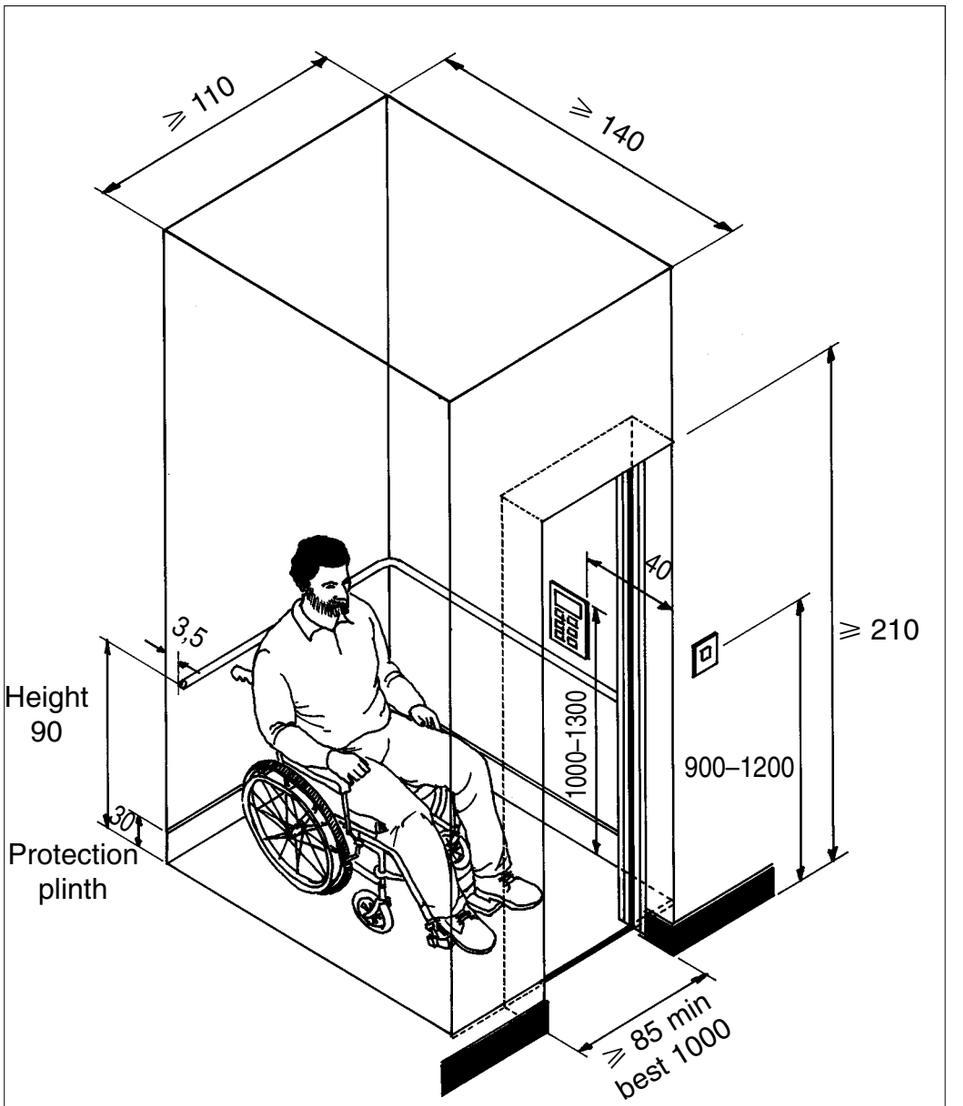


Best:

- 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:

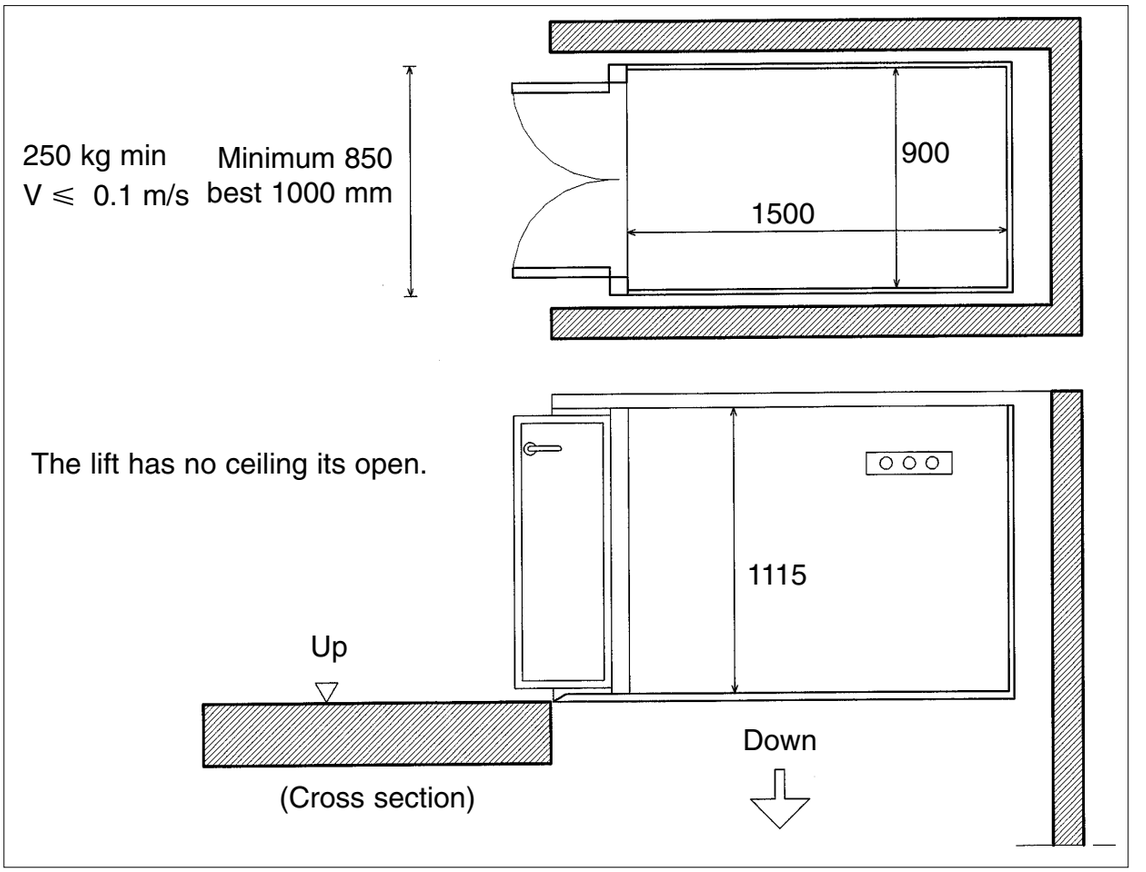
- Clearly signed from and close to the stairs
- Non-reflective glazed panels
- Automatic entry doors, with sensor preventing doors closing on passengers, baggage etc.
- Slip resistant flooring
- Handrail around lift car (see handrail chart)
- Visual indicators of floor level and facility
- Acoustic information for floor level, doors closing and opening
- Emergency telephone
- Visual information opposite lift door indicating floor level
- Weight capacity >650kg
- Contrasting colour door
- For controls, see lift control chart



Perimeter round section handrail 3 cm ⩽ ∅ ⩽ 5 cm.

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



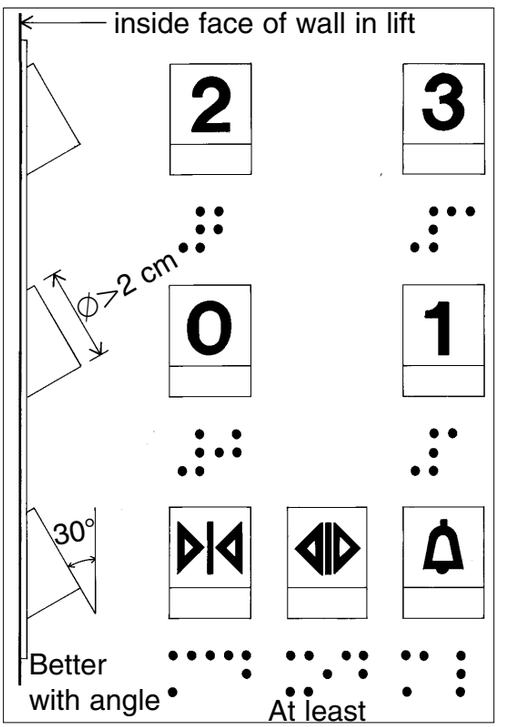
Recommended standard:

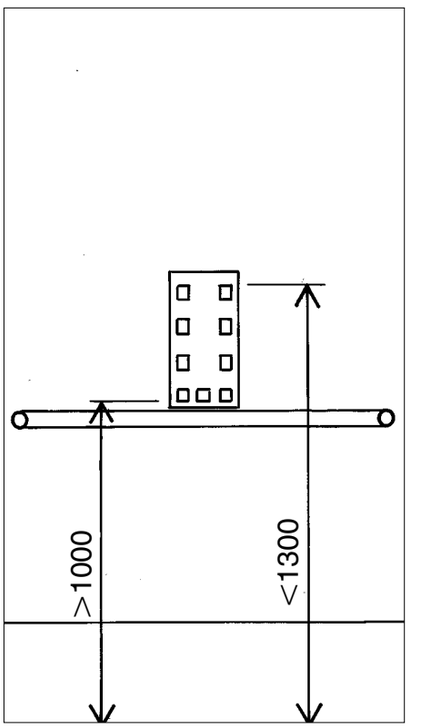
User-operated
Automatic door(s)
Doors cannot be opened unless lift is on that level
At rest in the ‘down’ position for safety
Sensors to detect obstructions
Emergency stop button clearly visible
Handrails on both sides of the car (see handrail chart)
Sign recommending wheelchair users to apply brakes

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

Lift Controls

Purpose
• To provide passengers with an easy-to-use method of operating the lift





Best:	Controls at angle of 30º
	Control size >= 20mm
	Controls between 900mm and 1200mm from floor
	No border around controls, so that they may be operated with, e.g. elbow, fist
	Raised characters
	Indicator signs or words instead of numbers where appropriate (▲ ▼'platform' 'concourse' etc.)
	Logical arrangement of controls (e.g. up higher than down)
	Controls mounted on colour contrasted background
	Braille signs
Recommended	Control size >= 20mm
standard:	Controls between 900mm and 1300mm from floor
	No border around controls, so that they may be operated with, e.g. elbow, fist
	Raised characters
	Indicator signs or words instead of numbers where appropriate (▲ ▼'platform' 'concourse' etc.)
	Logical arrangement of controls (e.g. up higher than down)
	Controls mounted on colour contrasted background

3.2 Visibility

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 illuminance on the platform edge relative to the average illuminance 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

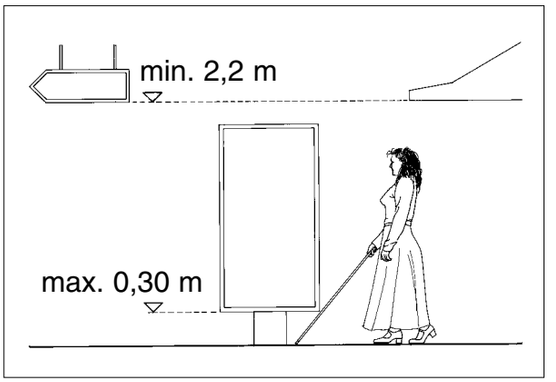
- Tunnel/Crossing: Best 100 lux, Standard 50 lux. Good, clear lighting is required in (subway) passages.

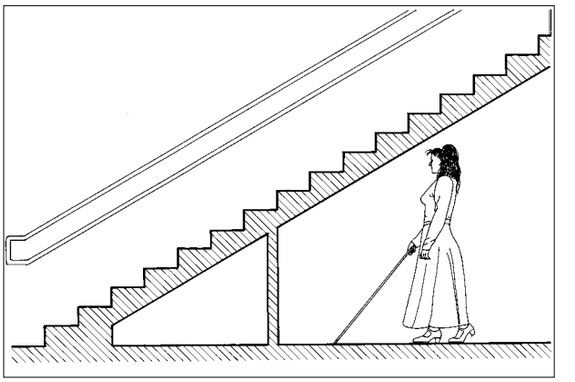
- Station forecourt: Setting down and picking up points, crossing points, disabled parking spaces: Best 100 lux, Standard 50 lux, Min. 20 lux

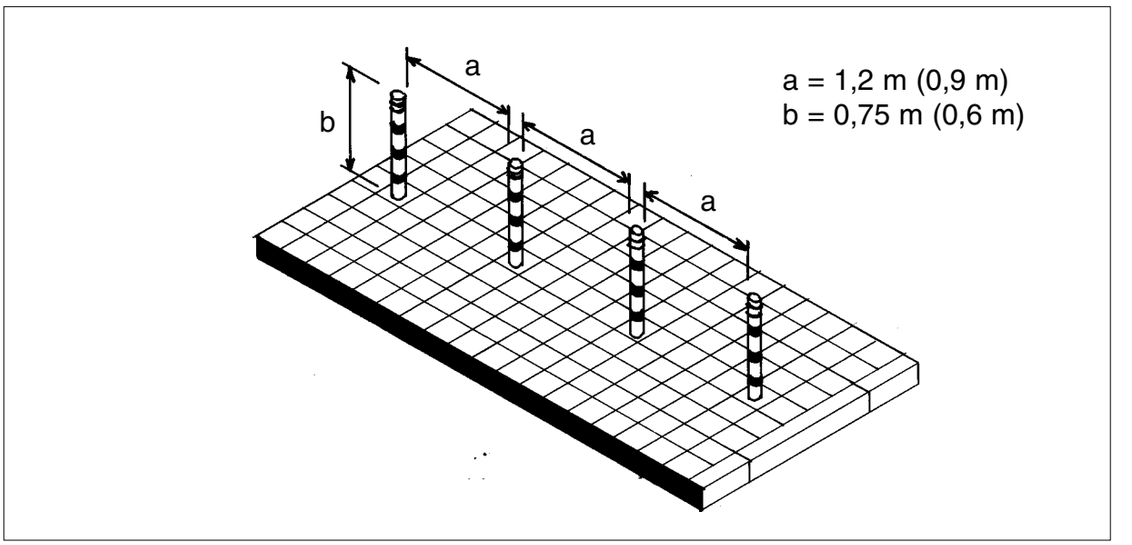
- Additional, even downlighting should be provided at ticket counters and timetables
- Low pressure sodium should not be used due to poor quality light with poor colour rendering properties
- Lighting should never be used as flush mounted floor fittings so that they shine in people's faces
- Lighting should not produce glare or dazzle

Protection from obstacles

Purpose
• To ensure that passengers, especially those with visual impairments, have a safe passage through the station







Best:

All obstacles (lamp posts, litter bins, timetable stands etc.) well out of the line of passenger travel

All obstacles well-lit

No free-standing staircases – all stairs to be fully blocked in

For glass markings see separate chart

Recommended standard:

All obstacles clearly contrasting in tone / colour with their background

Height of obstacle <300mm (for white-stick users) or >2.2m from ground level

All obstacles well-lit

No free-standing staircases – all stairs to be fully blocked in

Bollards >=750 mm high, 1.2m apart and clearly marked

For glass markings see separate chart

Minimum:

All obstacles marked with contrasting tone / colour at 700mm and 1500mm from ground level

Height of obstacle <300mm (for white-stick users) or >2.2m from ground level – tapping rail at 300mm for all other structures

All obstacles well-lit

Free-standing staircases to be blocked off underneath with rails or other physical means

Bollards >=750 mm high, >900mm apart and clearly marked

For glass markings see separate chart

Colour & Contrast

Purpose

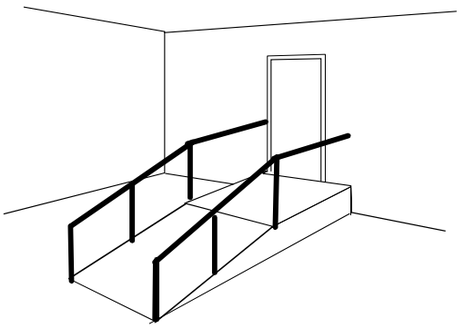
- To aid people with visual impairments in identifying their surroundings and finding facilities
- To warn people with visual impairments of obstacles in their route
- To aid all passengers in wayfinding

Interpretation

- The important factor in good colour or tonal contrast is not the difference of colour on its own, but the difference in the luminescence (light/dark quality and intensity) of the colours.
- Thus, a clear tonal contrast between two shades of the same colour, such as beige and dark brown, may be a better contrast than two colours, such as beige and pale yellow.
- Lighting makes a difference to colour perception, and the choice of contrast should be appropriate to the lighting used in the location.

Usage

- **Identifying surroundings and facilities**



For people with low vision, good contrast between e.g. ceiling and walls, walls and floor, can help them get an overview of their surroundings. Contrast also aids identification of specific items or facilities, including items such as coins on a counter surface. This is especially important in an area where people do not wish to use their sense of touch, such as toilets.

- **Wayfinding**

Careful use of contrast can help those who have difficulty in orientation to find their way around the station. Markings on floors can highlight the difference between ticketing facilities, and retail facilities, for instance. If doors to platforms are in one colour and doors to exits in another, passengers will readily be able to distinguish their route. Contrast is especially important in subways where wayfinding is more complex.

- **Obstacles**

Where there are obstacles on the route, such as seating and litter bins, they must be contrast with the background. So, columns viewed against an asphalt platform should be painted in a contrasting colour/tone, and also have a band of different contrast applied at eye-height (c. 1500mm from the ground).

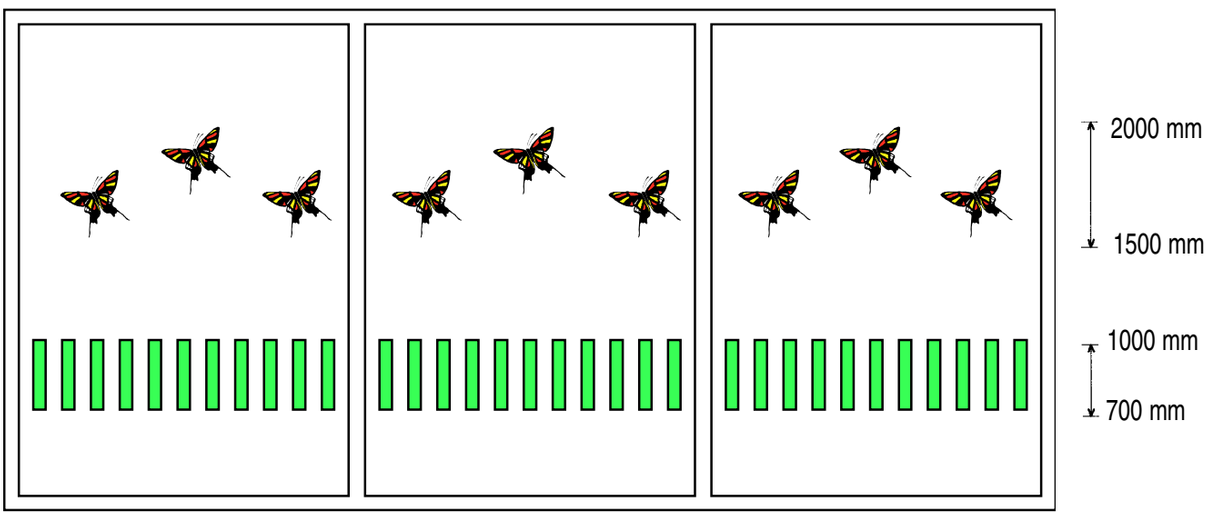
Stair nosings, and the riser of the top and bottom stair, should contrast with the surroundings. Other changes in level, such as short internal ramps, or internal and external flights of steps should also be marked with colour.

For glass, see glass manifestation.

Glass Wall Marking

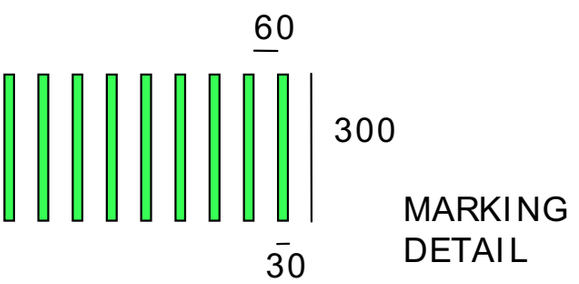
Purpose
• To ensure that passengers – especially those with visual impairments – do not mistake large expanses of glass as open space

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

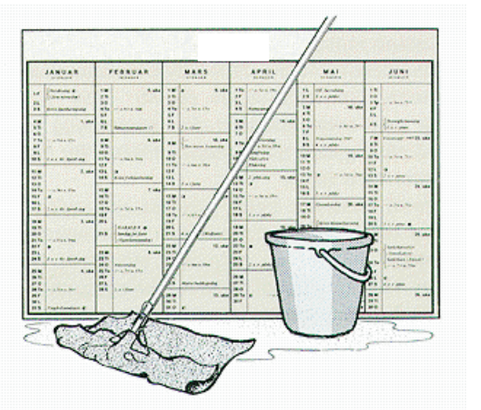
Best: Marking at 1.50-2.00 m and at 0.85-1.00m,
Markings contrast with the surrounding area
Markings > 150 mm



3.3 Environment

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
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:

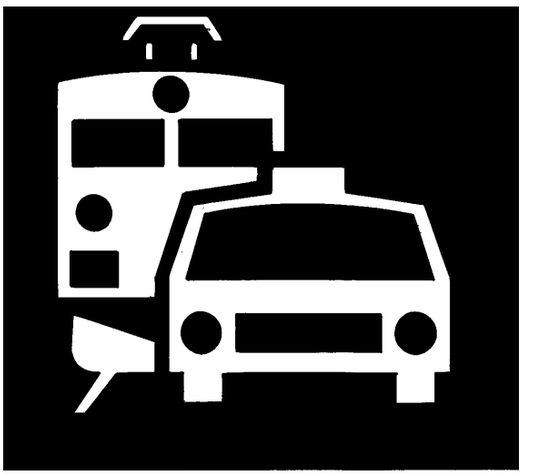
Clearly signed no-smoking areas available in all facilities
Staff request passengers not to smoke if necessary
Some facilities with 'animal-free' zones, especially if enclosed
Cleaning materials to be stored out of the way in their own cupboards
Regular cleaning according to overall plan for station
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.

3.4 Arrival & Wayfinding

Taxis and Traintaxis

Purpose
• To ensure that passengers have transport from the station to their final destination
• To make the planning and reservation of this transport straightforward



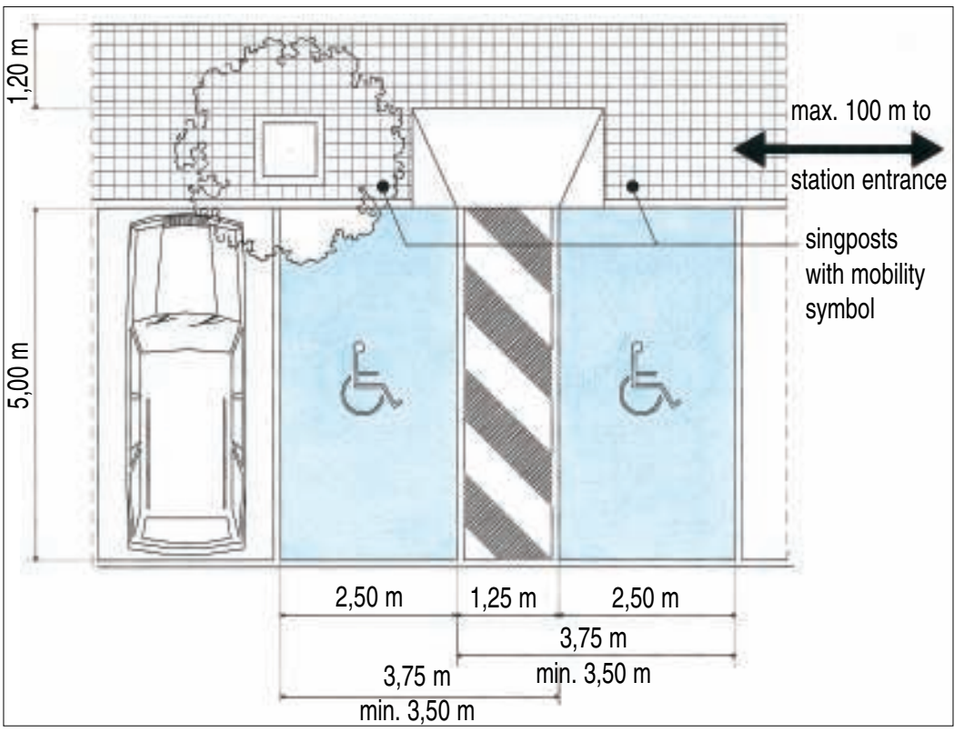
Best:
Reasonably priced
Drivers with good knowledge of the local area
Safe, courteous drivers
Quality assurance system for drivers and vehicles
Clear, quick queueing system with staff assistance
Sheltered waiting area with seating
Taxis may be booked through the train company

Recommended standard:
Reasonably priced
Drivers with good knowledge of the local area
Safe, courteous drivers
Clear, quick queueing system
Sheltered waiting area with seating
Taxis may be booked through the train company

Minimum:
Drivers with good knowledge of the local area
Safe, courteous drivers
Clear, quick queueing system
Taxis may be booked through the train company

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 standard:
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 (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

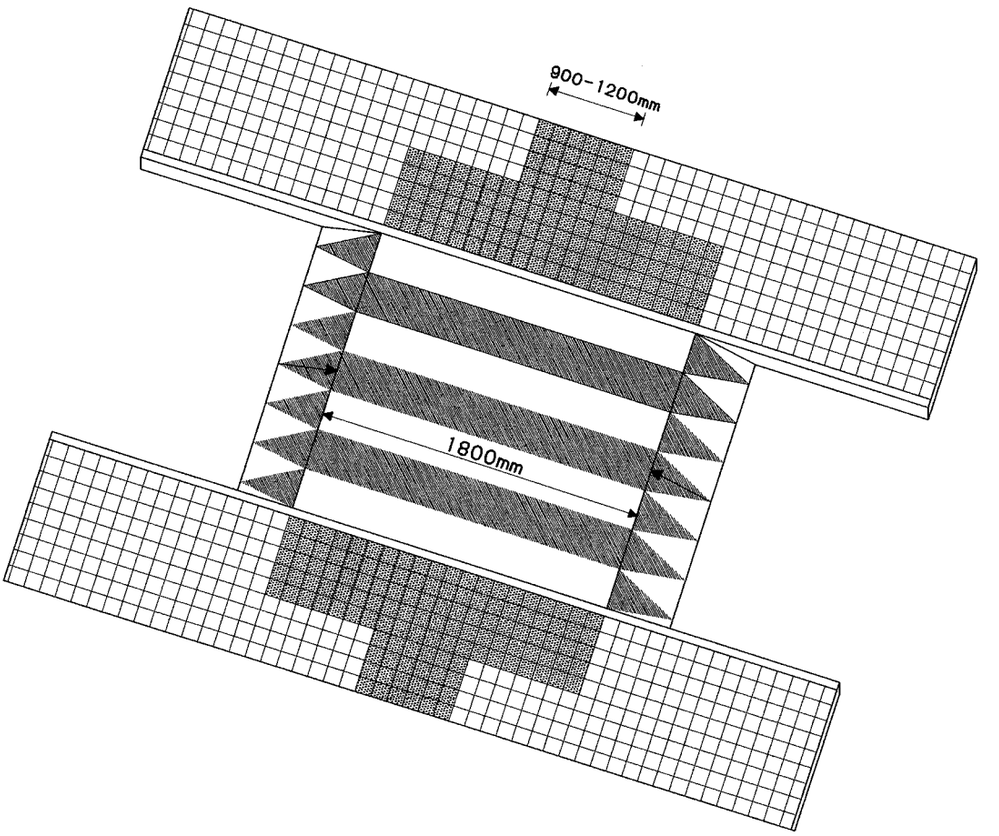
Minimum:
Full range of parking options - short / long-stay, drop-off, pick-up
Parking space at least 3.75m wide
Parking for people with reduced mobility clearly reserved
Fines for people parking illegally in reserved spaces

Pedestrian Crossings

Purpose
• To ensure safe passage across motorised traffic for pedestrians
• To ensure minimal disruption to motorised traffic

Best solution

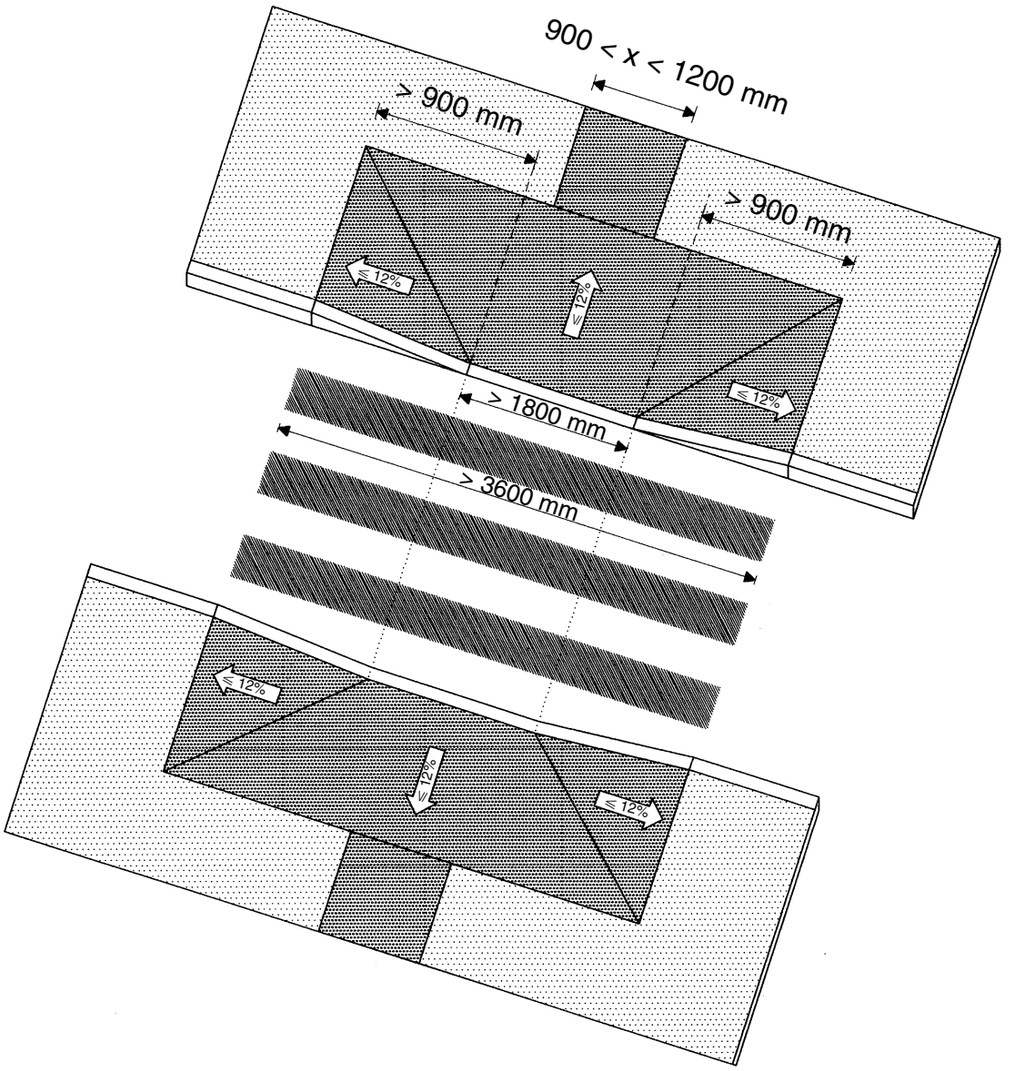
- Pedestrian crossing at the same level as the pavement
- Priority to pedestrian traffic
- Change in level between the crossing and the roadway achieved by ramps with a gradient <20%
- Lighting on and around the crossing >= 100 lux



- Width of table 2m (min. 1.8m)
- Vertical projection between pavement and the start of the ramp max. 20mm
- 'T'-shape paving as shown in contrasting colours with tactile surface

Minimum solution

- Pedestrian crossing at the same level as the roadway. They will only be used when the exit leaves the minimal width of 900mm from any obstacles …… (What does this mean?)



- Minimum horizontal width of crossing 1,8m
- 'T'-shape paving as shown in contrasting colours with tactile surface
- Width of markings minimum 900mm
- Kerbs should be dropped, see chart "Dropped kerbs".

Routeing systems

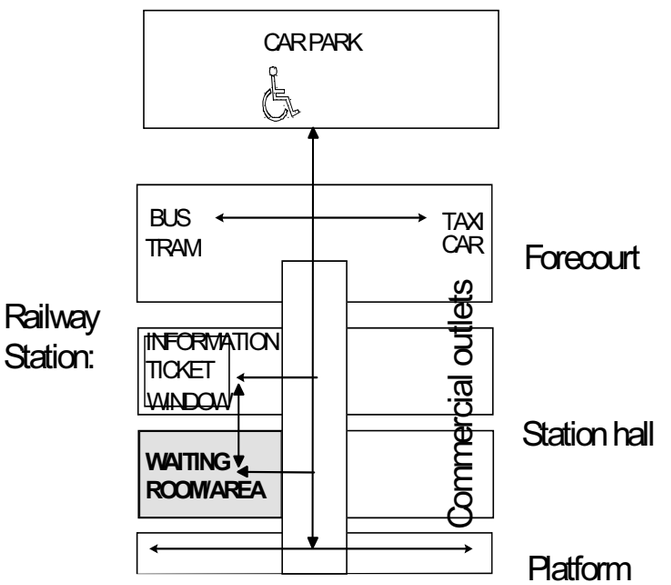
Purpose
To give guidance regarding the main layout of the station.

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

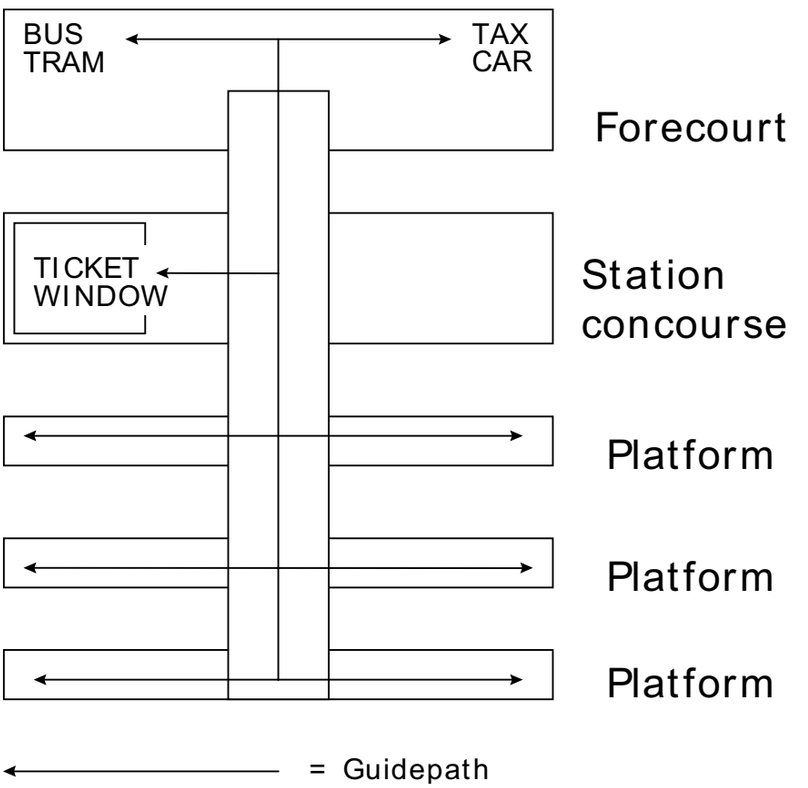
- All passengers should follow the same route, as a matter of principle
- Functions/facilities located adjacent to, not intruding into main circulation space
- For passengers to maintain a sense of direction, the route should follow a straight line through a clearly defined space.
- Changes of direction 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 Stations

Purpose
• To enable visually impaired passengers to find their way around the whole station, with an uninterrupted route.

Railway Station:



Best: An uninterrupted route to and through station facilities

Combined with a technological wayfinding system to provide key information at decision points

Recommended standard: Leading into the station from the forecourt

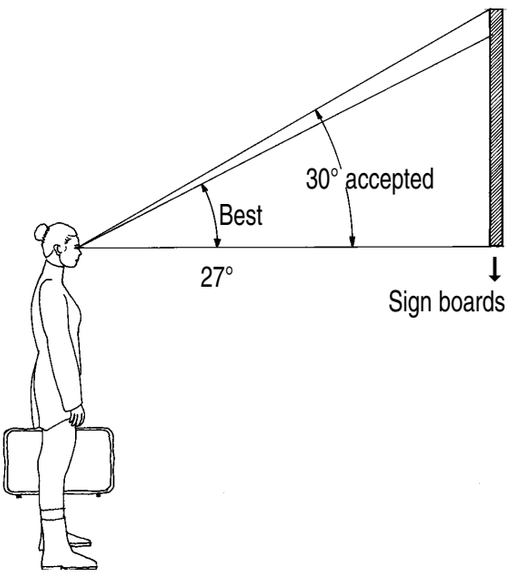
Leading to the ticket office from the station entrance

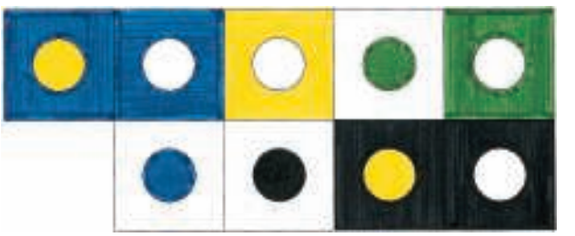
Leading to platforms, and along the platform to a safe waiting area

Minimum: Through complex or hazardous parts of the station, leading visually impaired passengers to safe areas

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
Height of lettering = reading distance / 250mm
Matt surface with maximum 15% gloss factor

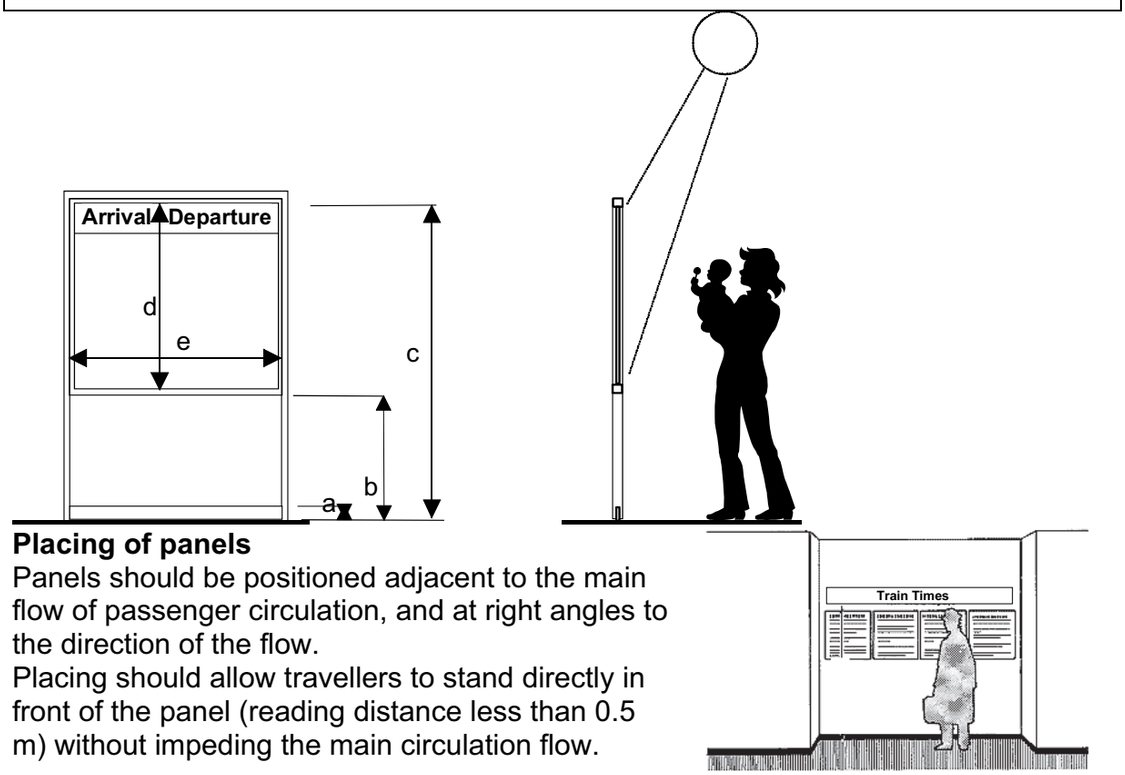
Recommended standard:
Sans serif font, mixed case, letters evenly spaced
Lighting from the back or side
Contrasting colours as indicated
Angle of elevation < 25º
Height of lettering = reading distance / 250-300mm
Maximum 40% gloss factor

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

* 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.

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

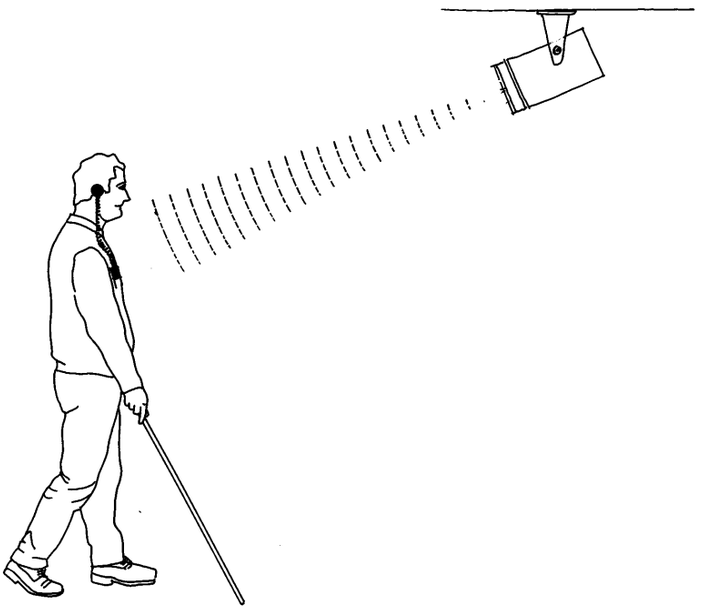
d. Height 1.0 – 1.2 m e. Width 800 mm – 1.1 m

Lettering

- Colour and contrast: see chart "Sign Boards"
- Text: Mixed case, Best 30 mm Minimum 25 mm

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.

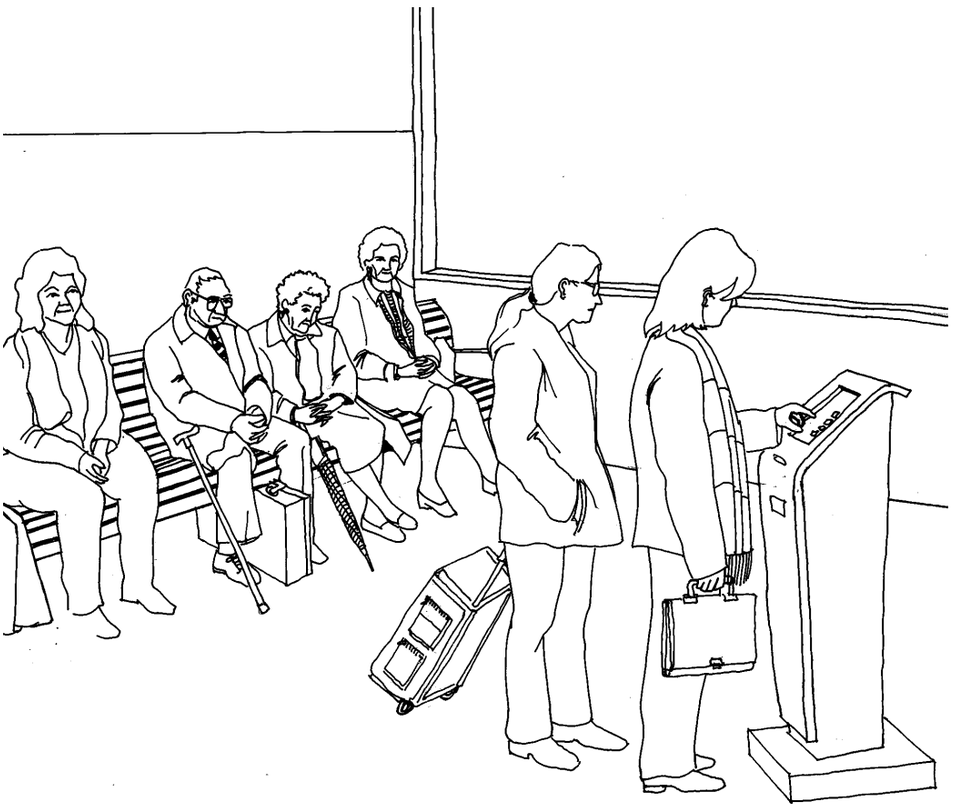
There are two types of system – infra-red and radio frequency. Infra-red (BOS, Easywalker, Open, Infravoice and Talking signs) is line of sight only, and radio (RNIB React, Czech Blind United, pe, RIS) is non-directional.

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)

3.5 Pre Travel

Queuing systems

Purpose
• To ensure that passengers can buy tickets in comfort
• To ensure that passengers with reduced mobility are not left till last when buying tickets



Recommended standard:

Single queuing system

Seating available for passengers who need it

System (e.g. numbers) for queueing without waiting in line

Machines (e.g. queue number) >900mm and <1200mm

Clear system for people with learning difficulties

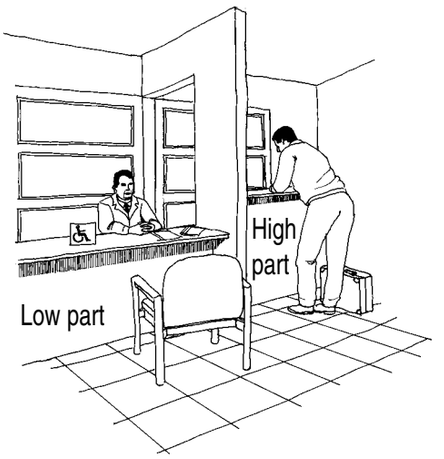
Audible and visual queuing system for people with sensory impairments

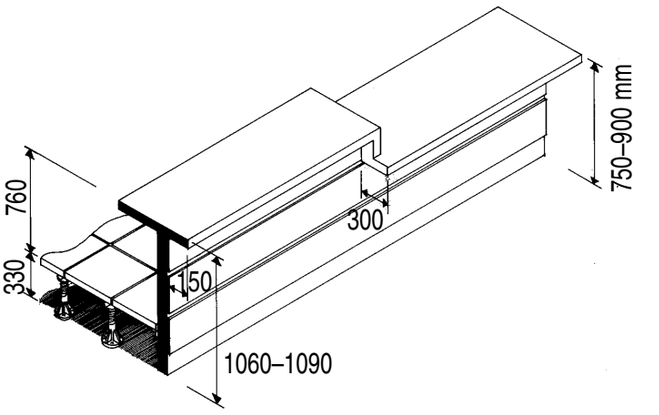
Queue layout consistent from day to day

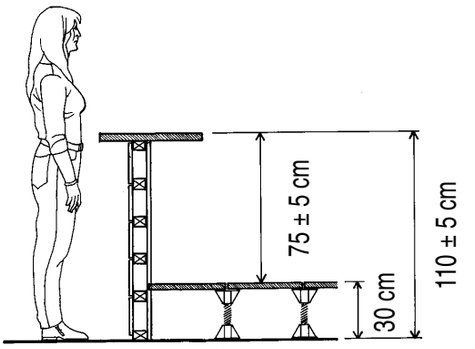
Fixed barriers that can be used as a support (see handrail chart)

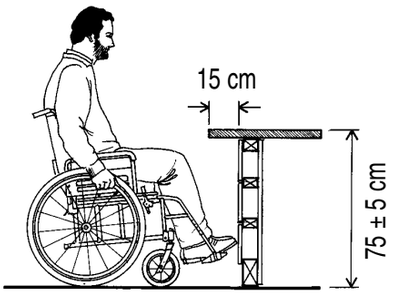
Ticket Desks

Purpose
• To give passengers easy and stress-free access to purchase tickets and obtain information









Recommended standard:	Automatically adjustable, or dual height desks
	Open front desks giving direct access to station staff
	Comfortable, adjustable seating available
	Induction loops, well-signed (see chart)
	Resting place for cane / walking stick
	Well positioned lighting that does not cast shadows
Minimum:	One or more lower ticket sales positions for wheelchair users and short people
	Non-reflective glass at windows
	Sound enhancement system at suitable height for seated and standing passengers
	Induction loops, well-signed (see chart)
	Resting place for cane / walking stick
	Well positioned lighting that does not cast shadows

Induction loops

Purpose
• To enable passengers who use hearing aids to hear spoken information clearly

Recommended standard:

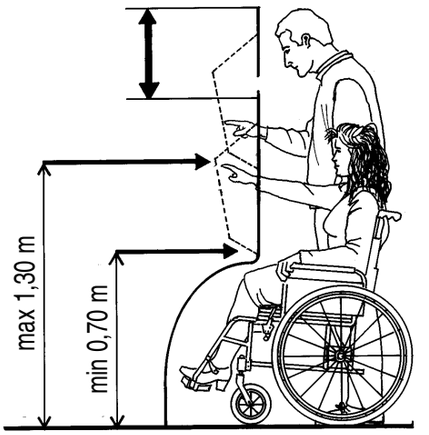
Type of induction loop appropriate to environment

Loop well signed with international symbol

Loops available at all information positions and on public address systems

Ticket Vending Machines

PURPOSE
• To enable disabled passengers to purchase tickets by machine when the ticket office is closed, or they do not wish to queue



Best:

Topmost control / coin or ticket slot no higher than 1300mm
Clear text (=18point sans-serif black on white/yellow) for visually impaired and elderly passengers
Non-reflective glass (if screen is used)
Colour-contrasted controls easy to use for people with limited manual dexterity (force max 15 Newtons[1])
Map of line with stops on or close to ticket machine
Pictograms for people with limited command of national language
Clear instructions, logical method of use, with confirmation of actions
Good lighting in the surrounding area
Ability to use disability discounts if other passengers can use discount cards

Recommended standard:

Topmost control / coin or ticket slot no higher than 1300mm
Clear text (=18point sans-serif black on white/yellow) for visually impaired and elderly passengers
Non-reflective glass (if screen is used)
Colour-contrasted controls easy to use for people with limited manual dexterity (pressure max 15 Newtons[1])
Map of line with stops on or close to ticket machine
Clear instructions, logical method of use, with confirmation of actions
Good lighting in the surrounding area

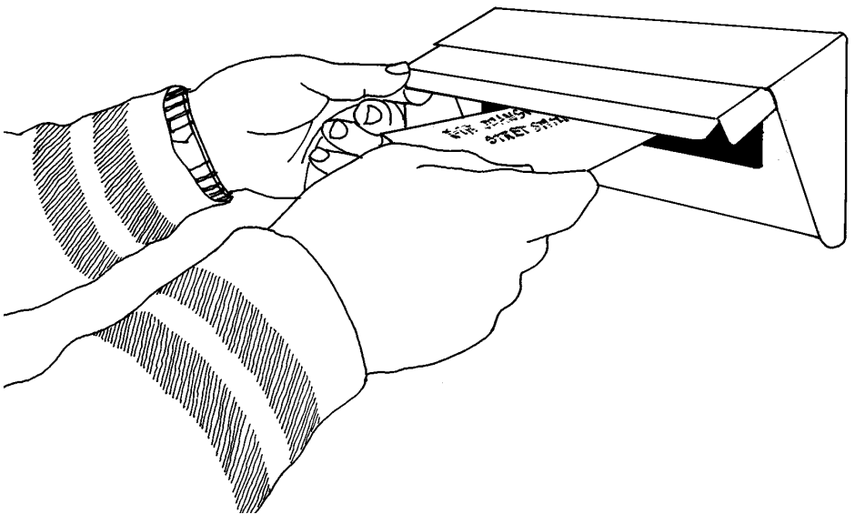
Minimum:

Topmost control / coin or ticket slot no higher than 1300mm
Clear text (=18point sans-serif black on white/yellow) for visually impaired and elderly passengers
Controls easy to use for people with limited manual dexterity (pressure max 15 Newtons)

[1] Controls may need to be designed with a lower force to allow for degradation over time

Tickets sent home

Purpose
• To ensure that passengers who cannot visit the station in advance can buy their tickets before travelling



Best:

Tickets can be ordered by:
- telephone (voice or text)
- post / fax
- e-mail / internet

Tickets can be received:
- by post
- from specified local shops (e.g. newsagents)

Tickets can be paid for by:
- cheque on receipt of invoice
- credit card
- cash at a specified local shop

Recommended standard:

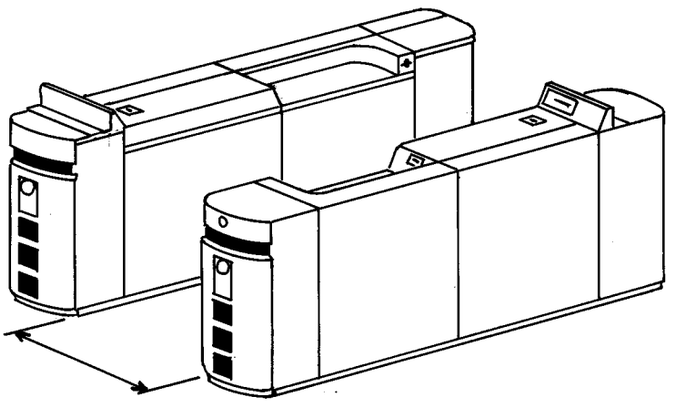
Tickets can be ordered by:
- telephone (voice or text)
- post / fax

Tickets can be received:
- by post

Tickets can be paid for by:
- pre-paid cheque
- credit card

Ticket Control Barriers

PURPOSE
• To ensure that disabled people are able to use ticket control barriers where these are considered absolutely necessary
• To ensure that ticket control barriers do not present a hazard to disabled people - in particular people with visual impairments



These recommendations can also, as appropriate, be applied to ticket validation devices

Best:	No ticket control barriers
Recommended standard:	Ticket control barriers that can be used by everyone, including disabled people
	Well signed, manual swing gate for people to use who are not able to go through the barrier (some people with mental health problems, haemophilia, pregnant women etc.) – easily accessible through / across passenger flows.
	Gates 900mm wide, and contrasted with their surroundings
	If gates are glazed, use a single marking in a solid contrasting colour
	'Paddle' gates to be made from or covered with soft material
	Height for ticket slot between 750mm and 900mm
	Controls contrasted with the gates
	Large controls able to be used by people with limited manual dexterity (pressure max 15 Newtons)
	Barriers staffed all the time, fully open when unstaffed
Minimum:	Well signed, manual swing gate for those who cannot get through the barrier
	Barriers staffed all the time, fully open when unstaffed

3.6 Station facilities

Waiting rooms/areas

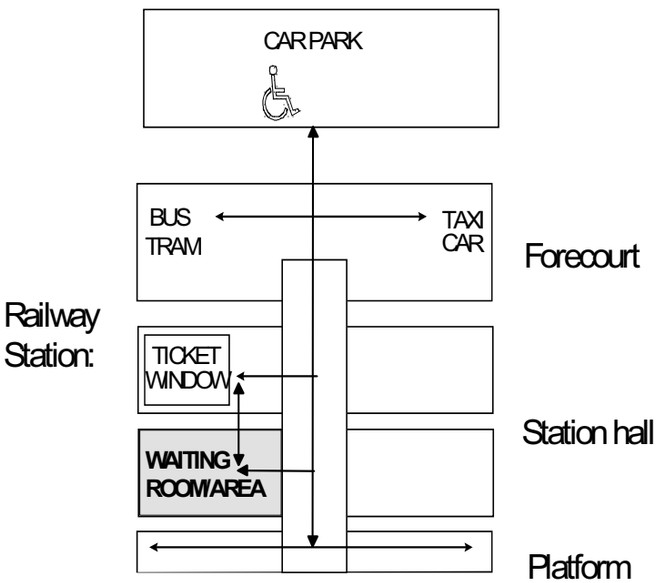
Purpose
• To ensure that passengers have a comfortable, clean, safe environment to wait for trains, with information easily available

1. Functional requirements

The waiting room should be easy to find and should give the travellers a chance to relax but at the same time stay informed of arriving trains, departures and changes while waiting.

2. Wayfinding and siting.

The waiting room should be signposted at information points and in communication centres. Ideally, the waiting room should be positioned close to ticket facility or travel centre and close to the main access route to the platforms.



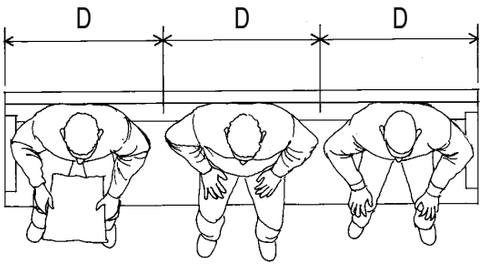
3. Furnishing and fittings

Best: Seating (see Seating chart)
PA system with induction loop
Visual customer information screens with real-time information
Doors and walls to the station hall should be glazed for visibility and clearly marked (see Glass Wall Marking chart)
Coffee/soft drinks machine
Telephone/fax facilities

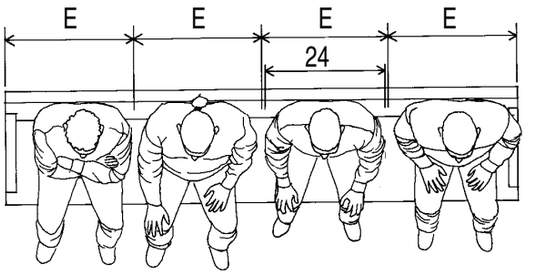
Standard / Minimum:
Seating (see Seating chart)
PA system with induction loop
Visual customer information screens with real-time information
Doors and walls to the station hall should be glazed for visibility and clearly marked (see Glass Wall Marking chart)

Seating

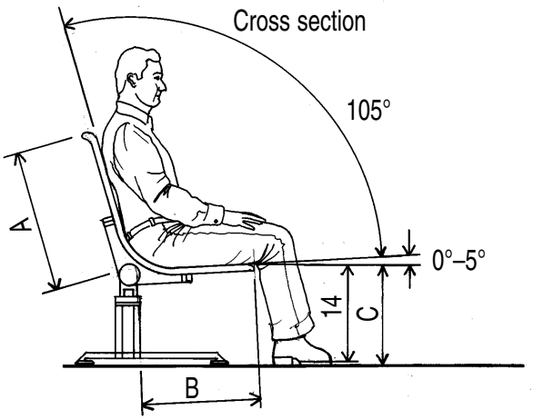
Purpose
• To ensure that passengers who have difficulty standing have somewhere safe and comfortable to sit and wait



Low density



High density



Recommended standard:

10% of seating at a lower height for children and short people

Some seating at 550 mm for people who have difficulty getting up

Seats positioned in well-lit areas

Heating and / or air-conditioning should be supplied as appropriate to local weather conditions

Good visibility from the seats to the platforms / trains

Some seating with arms that can be grasped, some without

Seating kept clean and dry

All seating colour / tonally contrasted with surroundings and out of the line of passenger flow

Rounded seat edges in order not to cut off circulation in the legs

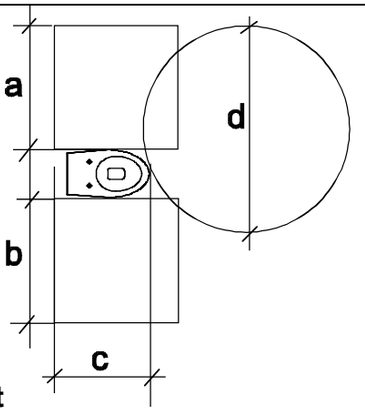
Toilets

Purpose

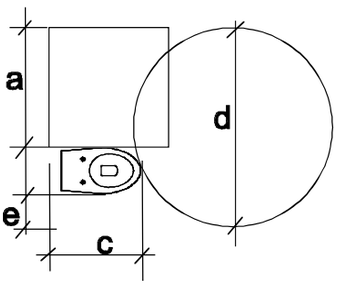
- To ensure that all passengers have easily accessible toilet facilities to use.

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

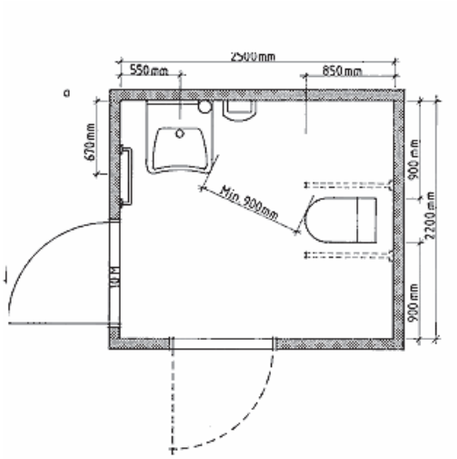


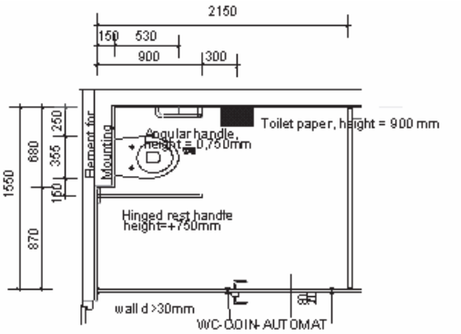
Minimum
Wide free floor space on one side of the WC

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.





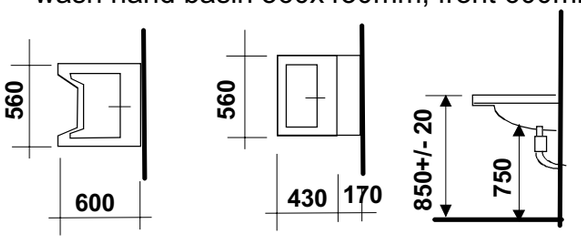
Toilets

2. Fittings and fixtures

Hinged handrail: c/c 600mm, height 750-800mm. Front of handrail should be in line with the front of the WC

Toilet paper holder: Wall mounted, height 650 mm**.** Holders for toilet papers may be wall mounted or fixed to the handrail.

Wash hand basin: Best choice: Large wash hand basin with curved front. Minimum: wash hand basin 560x430mm, front 600mm from the rear wall. Height: see sketch



Taps: Single grip, lever type, water temperature max 30°

Soap dispenser: Height: top of dispenser 1000mm

Hand drier: Warm air drier: height of warm air outlet 1000mm, regulated flow, automatic switch off. Paper towels, height of paper towel dispensing slot 1000mm

Waste disposal: Wall mounted

Mirror: Top: 1.8-1.9 m. Bottom: max 900 mm

Alarm: The risk of falling is greatest during transition between wheelchair and toilet and while seated on the toilet. An alarm that can be activated from the toilet and from a seated position on the floor is recommended.

WC: Best solution: Height 450 mm to top of WC seat (where more than one WC cubicle is provided, one WC should be higher – 550 mm). Cantilevered WC with back support, cistern built into the wall or hidden behind a cover fastened with special screws.

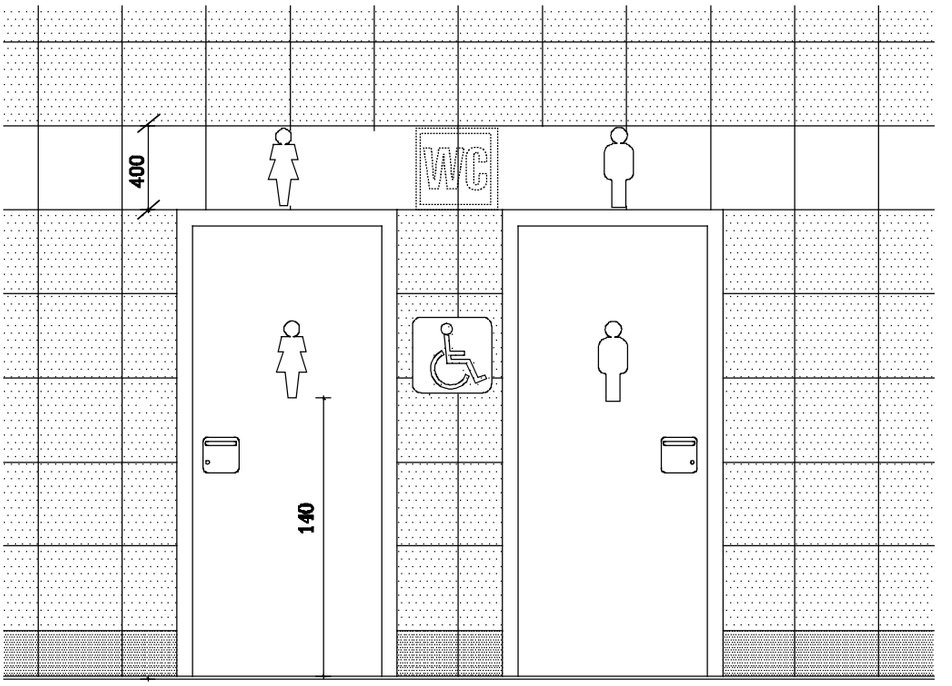
Flushing system: Best: Pull down action with large easy-grip handle – within reach of person sitting in wheelchair (i.e. not on wall side of WC). Signs showing the position of the flushing button/handle should be provided, both as visual information and in braille.

All fittings should be colour contrasted with their surround.

Toilets

3. Doors

Entrance layout and door dimensions should comply with the "Door" and "Passages and Space and for Turning" charts. Entrance doors should have tactile markings or be supplemented with braille letters, at touch height (900-1300 mm).



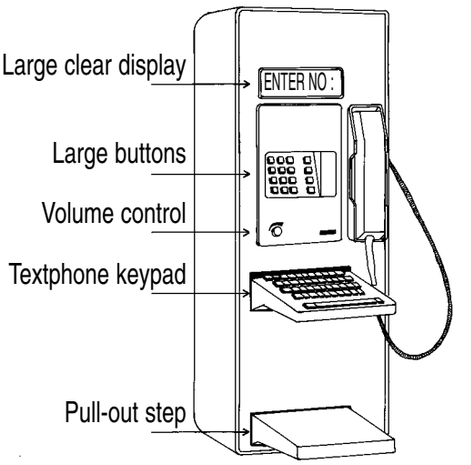
Example of entrance doors

Public Telephones

Purpose
• To ensure that all passengers have access to public pay phones
• To ensure that in an emergency, any passenger may use emergency telephone provided.

Recommended standard:

- Induction coupler for hearing aid users
- Volume control for people with some hearing loss
- Clear text display (LED) for people with visual impairments - (letters green, white or yellow - background black, size and clarity)
- Top control / slot between 900mm and 1200mm from ground
- Handset rest has sufficient space to allow easy grasping of the handset
- All payphones with pull-out shelf for portable textphone, and retractable handset cord long enough to reach this shelf
- Pay textphone for deaf and speech impaired users
- Large buttons with embossed numbers for people with visual impairments
- Wide spaced buttons for people with reduced manual dexterity
- Clearly signed facilities
- Phones sited away from general circulation and background noise

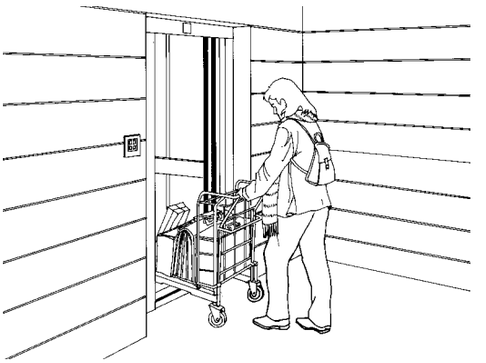


Minimum:

- Induction coupler for hearing aid users
- Volume control for others with hearing loss
- Clear text display (LED) for people with visual impairments - (letter / background contrast, size and clarity)
- Top control / slot between 900mm and 1300mm from ground
- All payphones with pull-out shelf for portable textphone, and handset cord long enough to reach this shelf or at least one pay textphone
- Large buttons with raised numbers for people with visual impairments
- Wide spaced buttons for people with reduced manual dexterity
- Clearly signed facilities
- Phones sited away from general circulation and background noise

Luggage Trolleys

Purpose
• To make it easier for passengers to move their luggage around the station
• To encourage people with a lot of luggage, or heavy luggage, to use the train



Best:
Parking brake that will operate by default and hold the trolley on a slope of at least 15%
Maximum load capacity 100kg
Handle height in the range 750-900mm
Length <=1m, turning circle <=1.5m
Soft plastic surround to protect other passengers in collisions
Easy for passengers to store and retrieve
Frequent storage points throughout the station
Staff available to collect and store loose trolleys
Able to be used in the station lifts[1]
Free usage

Recommended standard:
Parking brake that will operate by default and hold the trolley on a slope of at least 15%
Maximum load capacity 100kg
Handle height in the range 750-900mm
Length <=1m, turning circle <=1.5m
Easy for passengers to store and retrieve
Frequent storage points throughout the station
Able to be used in the station lifts
Easy to use payment system for people with visual impairments and people with limited manual dexterity

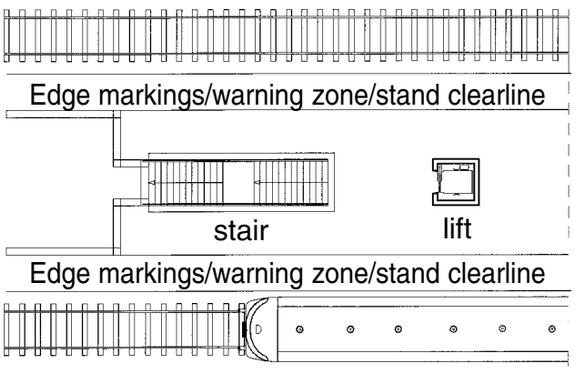
Minimum:
Parking brake that will operate by default and hold the trolley on a slope of at least 15%
Maximum load capacity 100kg
Handle height in the range 750-900mm
Length <=1m, turning circle <=1.5m
Easy for passengers to store and retrieve
Able to be used in the station lifts
Easy to use payment system

[1] Trolleys that can be used on escalators must have safety steps under the frame to support the trolley, and an adjustable safety strap capable of holding 100kg for securing the luggage to the trolley

3.7 Platforms and tracks

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

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' line[2] 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

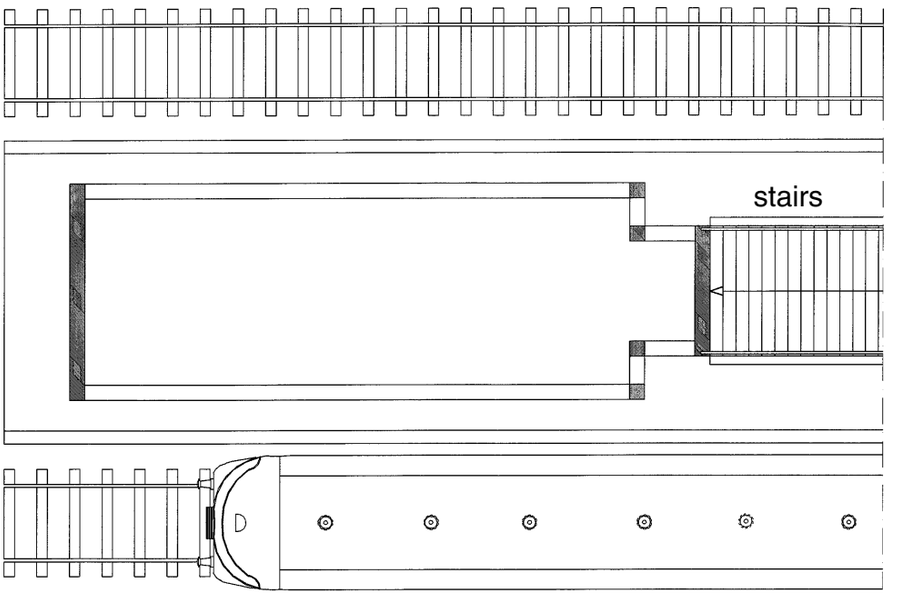
Sheltered waiting areas with seating, audible and visual train announcements, train timetables

Good even lighting (see Lighting chart), lighting columns placed out of line of travel

[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.

Guidepaths on Platforms

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



▨ Other (tactile) marking

▭ Guidepath

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 standard: 600-800 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 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

Preference for Footbridges

Purpose
• To enable passengers to orientate themselves when crossing the railway
• To reduce the danger of claustrophobia amongst passengers

Recommended standard:

New stations and major refurbishments to have footbridges rather than tunnels

Glass-sided (well-marked or protected) footbridges so that passengers can see the layout of the station and tracks, with glare protection designed in

Seating on the footbridge so that passengers may wait for trains and have a view of the tracks

Footbridges must be accessible by lift as well as stairs

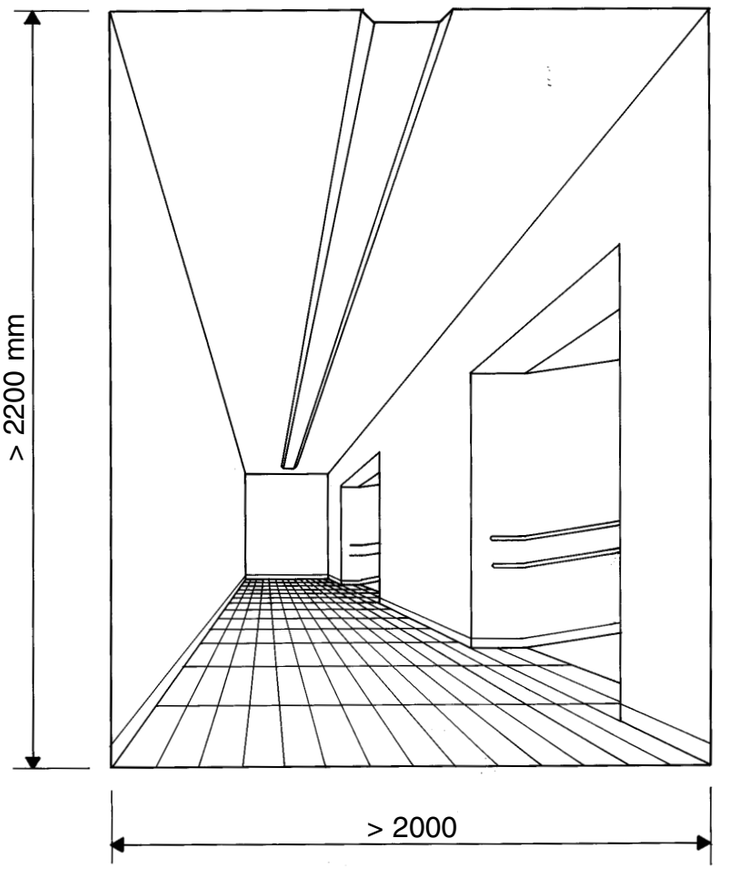
Minimum width 3m to allow passenger flow both ways

Handrails along walls and down stairs (see Handrail chart)

Lighting 100 lux, with 150 lux at tops of stairs / junctions

Tunnels / Subways

Purpose
• To ensure that subways are easy and safe for disabled passengers to use where necessary

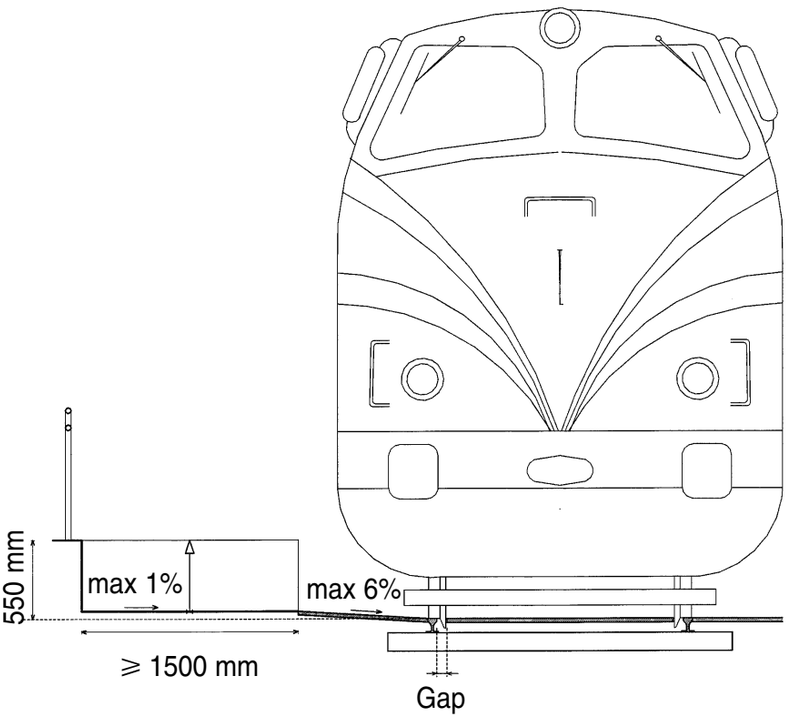


Recommended standard:
Width >= 2m
Headroom >=2.2m
Walls with smooth finish
Continuous handrail along walls (see Handrail chart)
Good clear lighting (see Lighting chart)
Use of colour contrast on the floor / walls to help find direction
Good signage leading to key points and out of the subway

Minimum:
Width 1800 mm (1200 mm where no passing is required)
Headroom >=2.2m
Continuous handrail along walls (see Handrail chart)
Good clear lighting (see Lighting chart)
Good signage leading to key points and out of the subway

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.

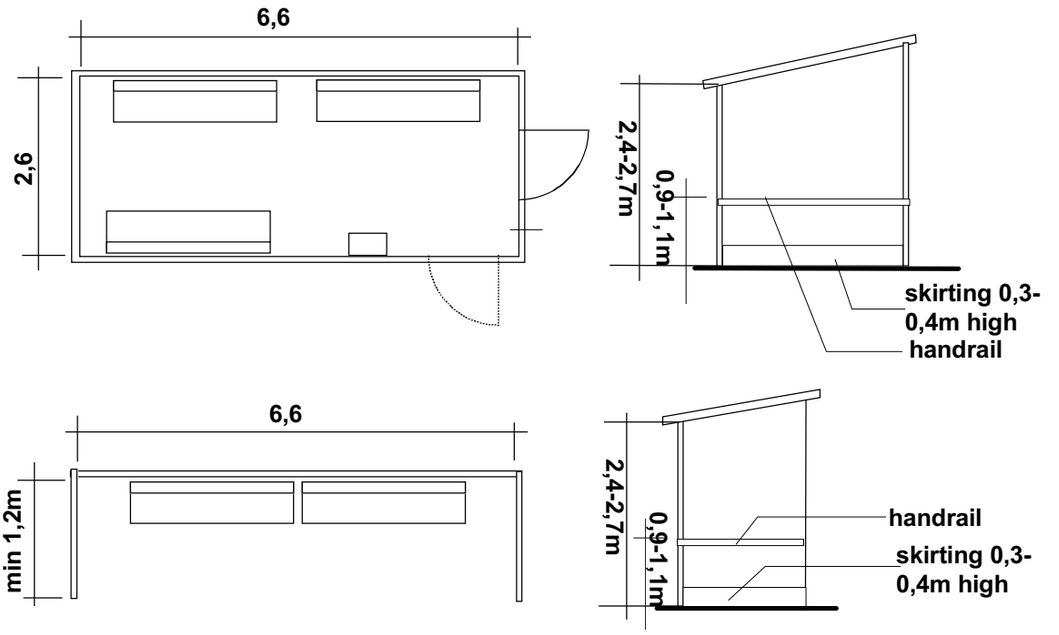
Recommended standard: Gap < 20 mm (for white cane users)
Gradient 5% (1:20)

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.

Weather Shelters

Purpose
• To provide a safe and comfortable environment on platforms for passengers to wait for trains



Best:
Shelter enclosed and heated where appropriate to local weather conditions
Range of comfortable seating (see Seating chart)
Visibility into and out of the shelter for security
Space for wheelchair user and turning circle 1500mm
Telephone available
Well marked and contrasted to avoid creating a hazard

Recommended standard:
Enclosed shelter
Seating available (see Seating chart)
Visibility into and out of the shelter for security
Space for wheelchair user and turning circle 1500mm
Well marked and contrasted to avoid creating a hazard

Minimum:
Seated area protected from rain
Visibility into and out of the shelter for security
Well marked and contrasted to avoid creating a hazard

3.8 Sounds & acoustics

Acoustics

Purpose
• To ensure that all passengers can hear normal conversation, and station announcements

Functional requirements

- The acoustic environment should be designed to allow a high degree of speech intelligibility, both with regard to normal conversation and to loudspeaker announcements.
- As speech intelligibility is adversely affected by background noise and reverberation time, the design should aim to keep these to a minimum

Calculations*

To be calculated
Reverberation time (inflection/absorption)
Ambient noise level
Speech Transmission Index (STI and RASTI)

Technical requirements

Speech Transmission Index	0,5-0,458 RASTI
Articulation Loss **	Best 10-15 %AL_{cons} Minimum15-30% %AL_{cons}

Notes:

***The need for calculations**

Variyng conditions due to the size, layout, use of materials and the density of traffic in the station necessitates calculations by acoustics specialists. The following values should be calculated: SPL at 1,2 m above floor level

**Equal coverage at 4kHz octave band

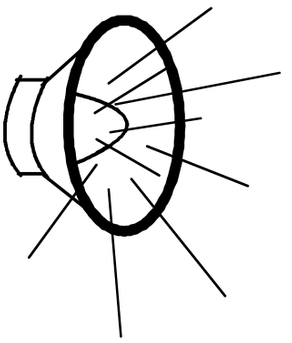
Definitions

AL: Articulation losses (of consonants in speech AL_{cons})
RASTI: Rapid speech transmission index (calculation of speech transmission for 500 Hz and 2 kHz octave bands)
SPL: Sound pressure level
STI: Speech transmission index

Loudspeakers

Purpose

- To ensure that all passengers can hear loudspeaker announcements



1. Functional requirements

Loudspeaker selection

- Speech must be transmitted and reproduced faithfully. Articulation losses, particularly loss of consonants should be kept to a minimum

Loudspeaker positioning*

- The loudspeakers should produce an even spread of sound. Positioning should aim to avoid the creation of areas of high sound pressure and areas where the audio signal will be insufficiently high.
- The audio signals should reach all areas used by the public with appropriate strength and clarity.
- Signals should be audible above any background noise

2. Calculations**

To be calculated:

- Reverberation time (inflection/absorption)
- Sound Pressure Levels (SPL)
- Ambient noise level
- Speech Transmission Index (STI and RASTI)

3. Technical requirements

Comfortable listening level***	Sound pressure level (SPL) 80dB
Loudspeaker positioning	Maximum 15 m apart
Speech Transmission Index	Best 10-15 $\%AL_{cons}$ Minimum15-30% $\%AL_{cons}$
Articulation Loss ***	0,5-0,458 RASTI
Frequency response	Minimum 400-5000 Hz[1]
Total Harmonic Distortion	< 10

Notes:

*1. The use of consultants
For new construction and refurbishments, acoustics consultants should be brought into the design process at an early stage, as the acoustics may be greatly influenced by building form, layout and the use of materials.

**2. The need for calculations
Acoustic conditions will vary due to the size, layout, use of materials and the density of traffic in the station. This necessitates calculations by specialists in acoustics and sound systems for each application.

3. Calculations
***SPL at 1,2 – 1,7 m above floor level
***Equal coverage at 4kHz octave band

[1] Many people with hearing impairments are better able to hear in the frequency range 800 – 2000 Hz

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 faithfully.	Articulation losses, particularly loss of 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

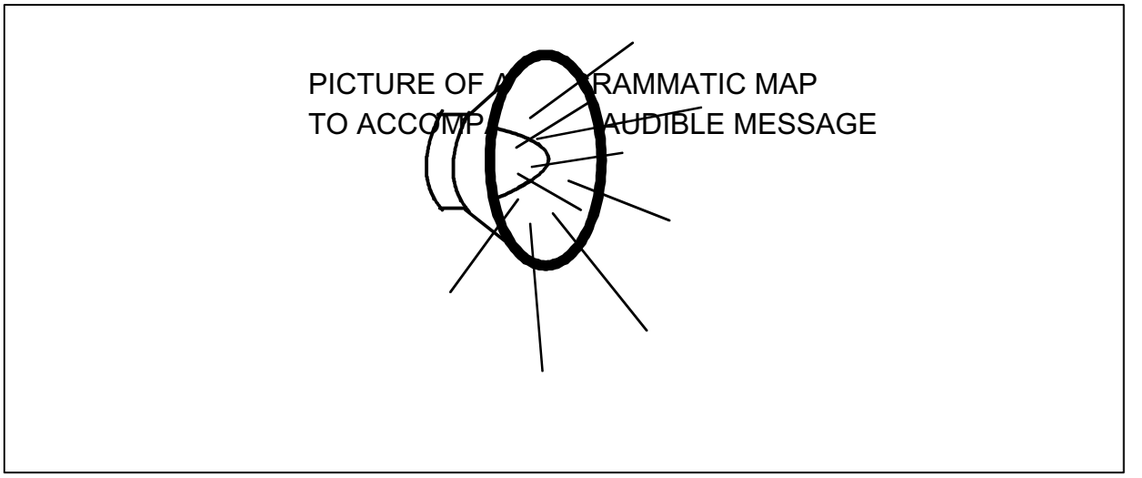
Minimum	**Best**
Messages repeated twice	Messages repeated three times
Messages should never conflict with other loudspeaker announcements	As minimum +: Messages timed when background noise is low
Before arrival, never after the train has departed	

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 $\%AL_{cons}$ Minimum15-3$\%AL_{cons}$
Articulation Loss	0,5-0,458 RASTI; equal coverage at 4kHz octave band
Frequency response	Minimum 400-5000 Hz
Total Harmonic Distortion	< 10

Pre-recorded messages

Purpose
• To provide travel and other information with minimal staff input
• To provide the information in audible and visual format for people with sensory impairments



Recommended standard:

Accurate information

Consistent format for messages

Consistency between audible and visual messages

Clear, well-pronounced audible messages

Accessible visual messages for people with low vision (e.g. contrast, size of lettering)

Visual pre-recorded messages easy to find, in common places across stations, more places for larger stations

Use of (international) pictograms and diagrams to enhance clarity and to support, not replace, text

Used for routine messages

Used for predictable exceptions (e.g. planned engineering works)

No advertising

Minimum:

Accurate information

Consistent format for messages

Consistency between audible and visual messages

Clear, well-pronounced audible messages

Accessible visual messages for people with low vision (e.g. contrast, size of lettering)

Use of (international) pictograms and diagrams to enhance clarity and to support, not replace, text

Used for routine messages

Advertising kept separate from information messages

3.9 Emergencies

Alert messages

Purpose
• To ensure that all passengers, including those with hearing impairments, are aware of important (changes of) information

Best:	Information provided to paging system (or similar) carried by deaf travellers Changes of information (such as platform changes) and important information provided both audibly and visually Visual information highlighted (e.g. reversed out) when changed
Recommended standard:	Changes of information (such as platform changes) and important information provided both audibly and visually Visual information highlighted (e.g. reversed out) when changed

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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.

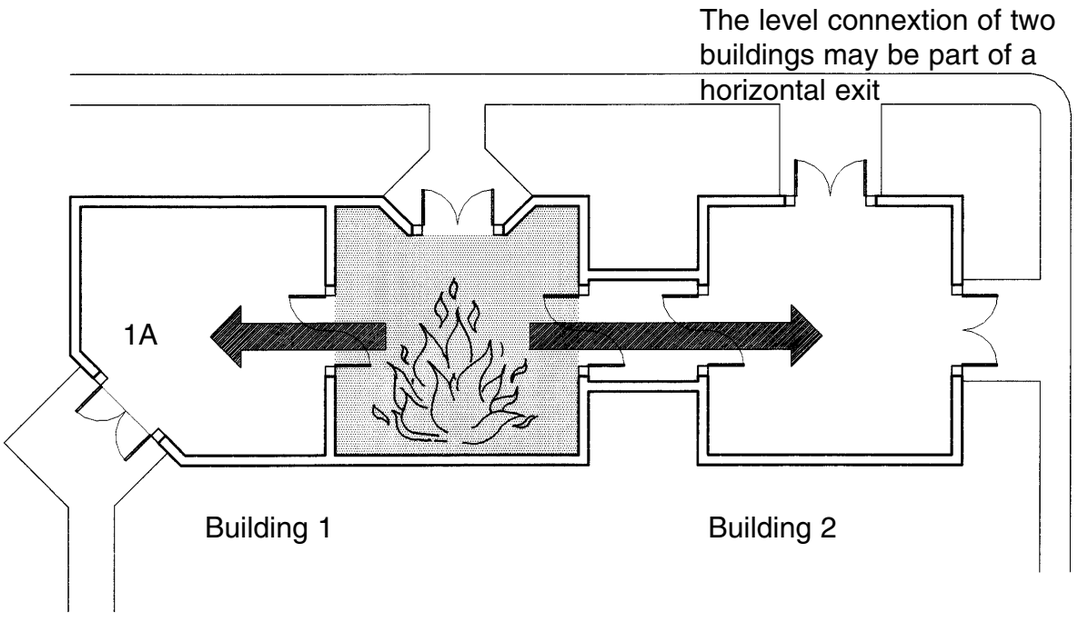
Where doors are positioned close to changes in direction, this can create almost insurmountable barriers for disabled people, and will cause considerably slower passenger flow.

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)

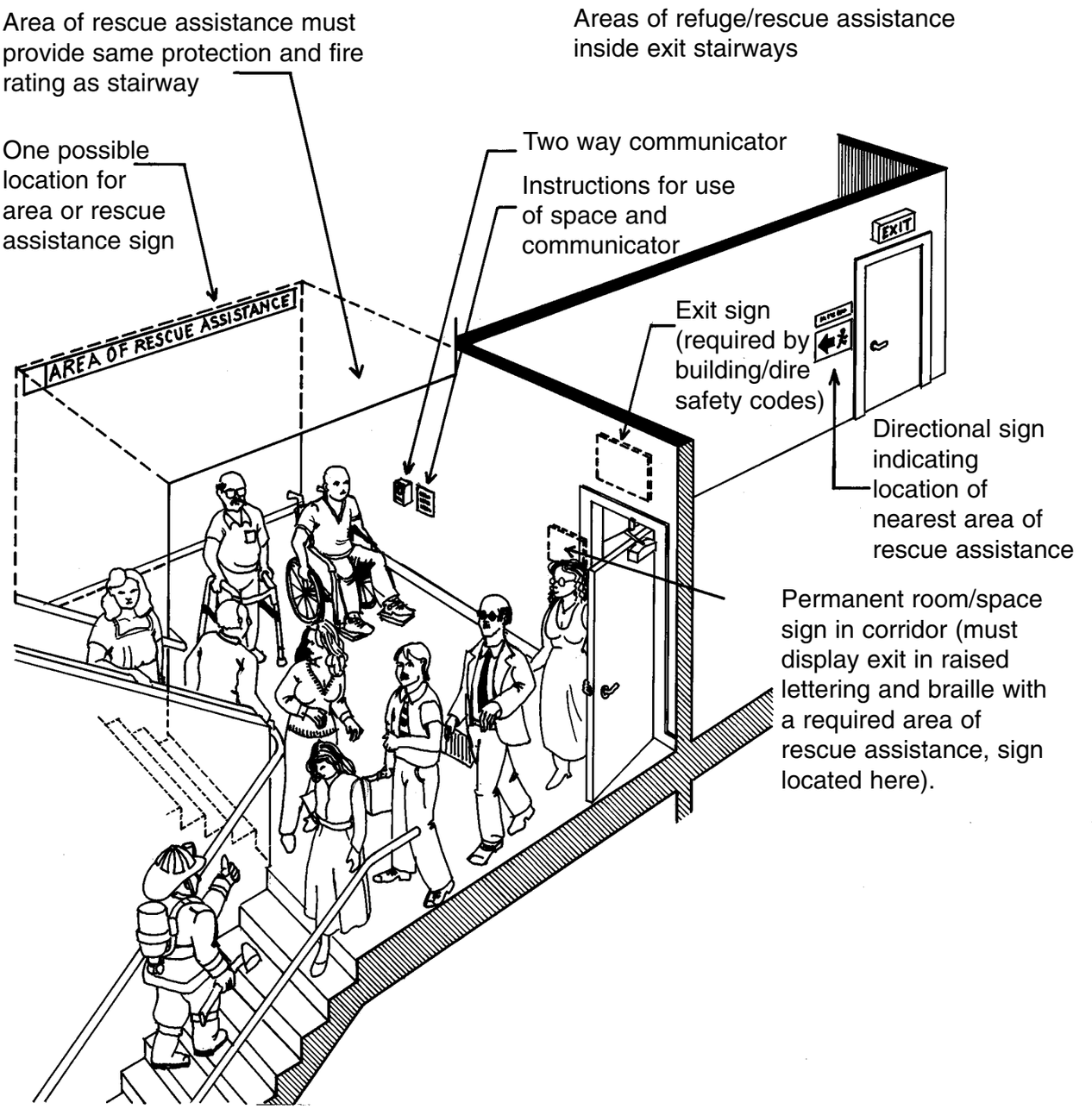
Example of a preferred solution

A horizontal exit can meet the requirement for areas of rescue assistance



The level connection between two areas separated by fire barrier, space, or other form of protection may be part of a horizontal exit.
Area 1A and Building 2 are refuge (areas of rescue assistance) when area 1B is threatened.

Example of a preferred solution

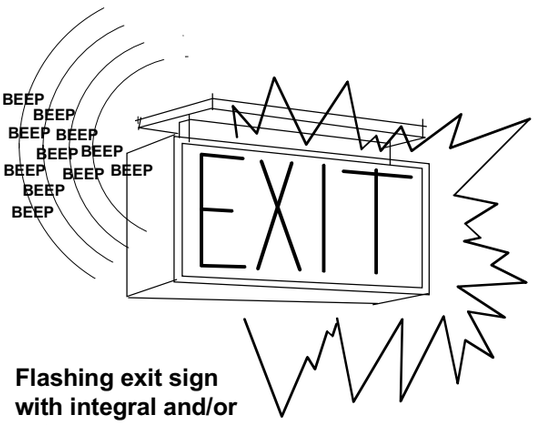


Alarms

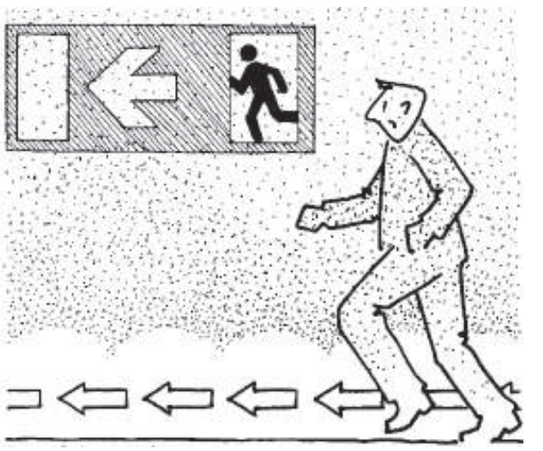
Purpose
• To ensure that all passengers are alerted by alarm systems for emergencies

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 integral 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

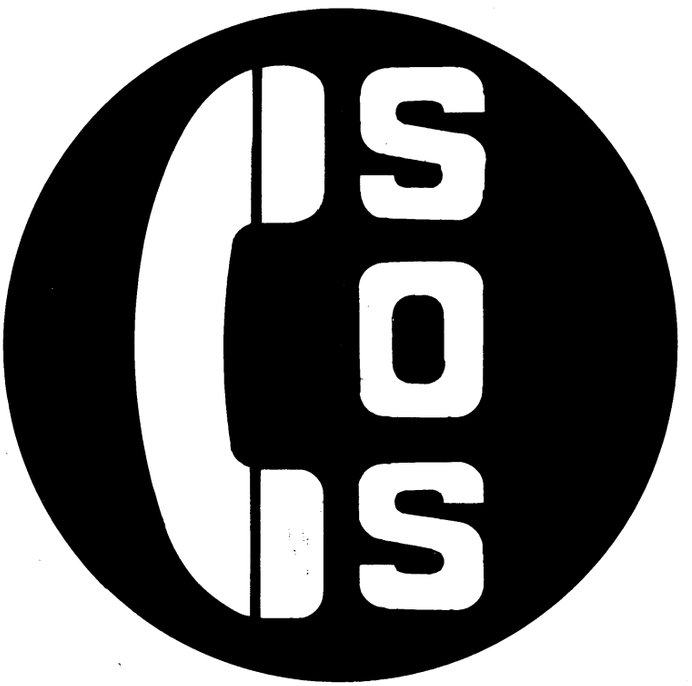
The warning system should use a combination of sound and light.
The best solution will provide information through loudspeakers (spoken message with *brief, clear* instruction), text displays/TV monitors and strips of leading lights.
Safety procedures must include rescue/escape assistance for disabled 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

SOS Telephones / Help Points

Purpose
• To ensure that passengers can get help in an emergency



Recommended standard:

Several phones placed around the station, especially on platforms, in lifts and toilets, at parking bays for disabled passengers and where staff cannot see passengers

Speaker or handset height between 900mm and 1300mm from ground level

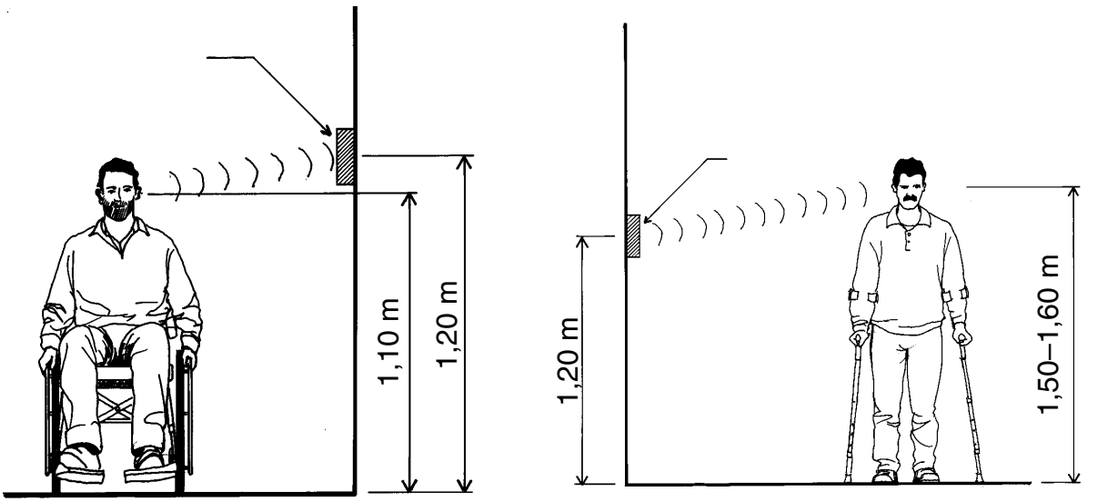
Induction coupler / loop available and clearly signed

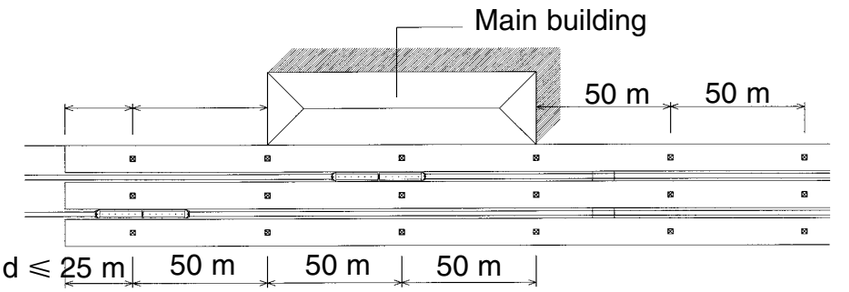
Visual display of simple messages

Easy to use controls, with large characters, contrasted

Simple instructions

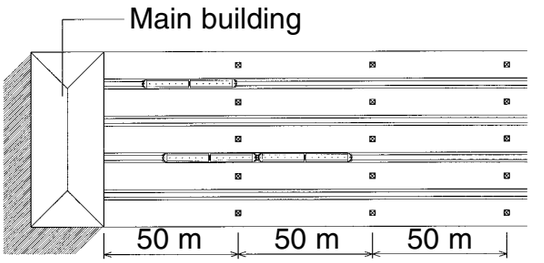
Automatic answering by trained staff



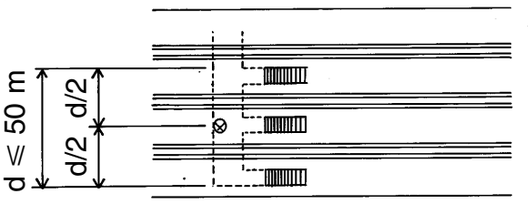


▨ sos telephones

1. Not ending station



2. Ending station (terminal)



3. Ground level crossing

Members of the COST 335 Stations Working Group

Chair:

Mr Kurt Hultgren
S.J. Persontrafik
Centralstationshuset
S – 10550 Stockholm
Tel: +46/8.762.44.77
Fax: +46/8.796.06.54
E-mail: kurt.hultgren@p.sj.se

Members:

Mrs Annie Brouder
Chargée de mission transport des personnes handicapées
SNCF
Tour Paris-Lyon
209/211, rue de Bercy
F – 75571 Paris Cedex 1
Tel: +33/1.53.25.78.10
Fax: +33/1.53.25.62.70
E-mail: annie.brouder@sncf.fr

Mr. Jon Christophersen
Byggforsk
Norwegian Building Research Institute
P.O. Box 123, Blindern
N – 0314 OSLO
Tel: +47/22.96.55.00
Direct: +47/22.96.58.04
Fax: +47/22.69.94.38
E-mail: jon.christophersen@byggforsk.no

Mr. Javier Dahl
RENFE
Avenida Pío XII, 110
E – 28036 Madrid
Tel: +34/91.300.61.16 or 300.65.26
Fax: +34/91.300.66.53
E-mail: Jdahl@renfe.es

Ms Mª Cruz Nieto
RENFE
Avenida Pío XII, 110
E – 28036 Madrid
Tel: +34/91.300.65.28
Fax: +34/91.300.66.53
E-mail: Jdahl@renfe.es

Mrs Alice Maynard Lupton
RAILTRACK PLC
Railtrack House
Euston Square
GB – London NW1 2EE
Tel: +44/171.557.93.69
Cel: 07979744653
Fax: +44/171.557.90.14
E-mail: luptona.railtrack@ems.rail.co.uk

Mr Patrick Mc Kay
Executive Customer Quality and Standards
Quality & Customer Standards
Iarnrod Eireann
Connolly Station – Room 213
IRL – Dublin 1
Tel: +353/1.703.26.34
Fax: +353/1.703.25.15
E-mail: pat.mckay@irishrail.ie

Mrs. Danae Penn
European Commission
B- 1049 Brussels

Mr Bèla Rimóczi
Generaldirektion M.A.V.
Andrássy út 73-75
H – 1062 Budapest
Tel: +36/1.322.06.60
Fax: +36/1.4323471

Mr. J.W.A. van Soeren
Senior Buildings Expert
NS Railinfrabeheer
Systems Development
Hoofdgebouw III
Moreelsepark 1 – Postbus 2025
NL – 3500 HA UTRECHT
Tel: +31/30.235.75.53
Fax: +31/30.235.70.08
E-mail: j.w.a.van-soeren@so-c.railinfrabeheer.ns.nl

Mr Rolf Vinzelj
Rail Operation Consult
Haizingergasse 8/20
A – 1080 Wien
Tel: +43/1.478.39.16
Fax: +43/1.478.39.16
E-mail: rvinzelj@aon.at

Mr. Ljubo Zerak
Manager
Prometni Institut Ljubljana d.o.o.
Institut of Traffic and Transport
Kolodvorska 11
SLO – 1000 Ljubljana
Tel: +386/61.291.4626/7
Fax: +386/61.319.277
E-mail: Ljubo.z@siol.ne
Izerak@guest.arnes.si

The ‘Dahl Charts’ are an original idea of Javier Dahl, member of the COST 335 Stations Working Group.

The drawings included in the Dahl Charts are made by Carlos Rodríguez Mahou