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Building construction — Accessibility and usability of the built environment

Construction – Accessibilité et facilité d'utilisation de l'environnement bâtiment

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Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO Technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies voting.

ISO 21542 was prepared by Technical Committee ISO/TC 059, *Building construction*, Subcommittee SC16, *Accessibility and usability of the built environment.*

This edition cancels and replaces ISO/TR 9527:1994, which has been technically revised and further developed.

Introduction

This International Standard is a document providing building users, architects, designers, engineers, builders, building owners and managers, manufacturers, policy makers and legislators with requirements and recommendations to create a sustainable built environment which is accessible to all.

The purpose of this standard is to define how the built environment should be designed, constructed and managed to enable people of all abilities to approach, enter, use, egress from and evacuate a building independently, in an equitable and dignified manner and to the greatest extent possible.

These principles are supported by Preamble (g) and Articles 9, 10 and 11 of the United Nations Convention on the Rights of Persons with Disabilities.

NOTE 1 The convention on the Rights of Persons with Disabilities, with its Optional Protocol, was adopted by the General Assembly of the United Nations on 13th December 2006. It came into force, i.e. became an international legal instrument, on 3rd May 2008. Furthermore information about the Convention and its text can be found on the United Naitons WebSite: http://www.un.org/disabilities/ . The Convention is serviced by a joint secretariat, consisting of staff from both the United Nations Department of Economic and Social Affairs (DESA), based in New York, and the Office of the High Commissioner for Human Rights (OHCHR) in Geneva.

This standard sets out the objectives, design considerations, requirements and recommendations that ISO believes will, when fully implemented, result in accessible and usable buildings.

This standard may be applied to new and existing buildings.

If these design requirements are taken into consideration in the early stages of building design, the costs of providing accessibility and usability measures are minimal or even zero and raise the value of the property in terms of sustainability. Where alterations and refurbishment are taking place the additional cost depends on the size and complexity of the particular building and its adaptations.

NOTE 2 Further information on costs of accessible buildings see ETH-Study from Switzerland: http://www.hindernisfrei-bauen.ch/kosten_f.php

This document contains a combination of essential requirements, i.e. provisions which are essential to the contribution of accessibility and usability of the built environment and recommendations for an improved environment. The essential requirements are preceded by the word “shall”. For recommendations which are desireable the provisions are preceded by the word “should”.

This standard may be applied in accordance with the National Regulations of the Member Bodies who have adopted this standard and stated in their National Foreword the terms under which it is to be applied.

This standard may be used by:

a) National authorities to determine a specific programme of implementation;

b) Building owners to fulfil their responsibilities according to anti-discrimination and equity legislation, or on a voluntary basis.

As most buildings will be subject to refurbishment, upgrade or change of use at some stage during their life cycle, national regulations may require all or part of this standard to be applied.

National building regulations may include considerations of equality legislation, particular building and site constraints, different types of buildings, and the costs and benefits to society generally. It is also important to ensure that existing buildings of historical, architectural and cultural importance are accessible. In such cases it might be necessary for national authorities to allow some exceptions to this standard, as well as recommending appropriate alternative accessibility measures.

This International Standard should lead to continuous improvement in the built environment. Whilst the objectives will always remain unchanged, the means of achieving them will be part of a continuing process of change, i.e. as human knowledge and building technology improve and as the relationship between generally accepted building practice and technology alters.

ISO/IEC Guide 71 and its guidance document ISO/TR 22411 should be used to augment and assist in understanding the requirements of this standard.

Within the figures all dimensions are given in mm and measured from finished surfaces, unless otherwise stated. All figures are provided as examples.

1 Scope

This standard includes a range of requirements and recommendations for many of the elements of construction, assemblies, components and fittings which comprise buildings. These requirements relate to the constructional aspects of access to buildings, to circulation within buildings, to egress from buildings in the normal course of events and evacuation in the event of an emergency. An informative annex is also included which deals with aspects of accessibility management in buildings.

The intention of this standard is to meet the needs of the greatest feasible number of people and to accommodate the diversities of age and of human condition on a minimum level reached by consensus between the different countries all over the world. In some countries higher requirements are common due to their long experience in accessible building standards and regulations. These higher national requirements shall have higher priority than the minimum level of requirements stated in this ISO standard.

The standard contains provisions with respect to features in the external environment directly concerned with access to a building or group of buildings from the edge of the relevant site boundary or between such groups of buildings within a common site. However, the standard does not deal with those elements of the external environment, such as public open spaces, whose function is self-contained and unrelated to the use of one specific building, nor does the standard deal with single family dwellings, other than those circulation spaces and fittings that are common to two or more such dwellings. At present, consideration is being given to the development and publication of additional parts to this standard to deal with the types of external environments described above and single family dwellings.

For existing buildings there are options included in some paragraphs which appear as *"exceptional considerations for existing buildings in developing countries"* (see "Guidance on the Implications of the ISO Global Relevance Policy for CEN Standardization", 2005) and as *"exceptional considerations for existing buildings"* where a lower order of provisions than expected in new constructions are accepted due to technical and economic circumstances only.

NOTE This standard is primarily written for adults with disabilities but it includes some specifications regarding the specific accessibility requirements that would suit children with disabilities. However, it is envisaged that future revisions of the standard will include more detailed requirements.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4190-1, *Lift (Elevator) installation - Part 1: Class I, II, III and IV lifts*

ISO 4190-5, *Lift (Elevator) installation - Part 5: Control devices, signals and additional fittings*

ISO 7000, *Graphic symbols for use on equipement – Index and synopsis*

ISO 7001, *Graphical symbols – Public information symbols*

ISO 7730 *Moderate thermal environments - Determination of the PMV and PPD indices and specification of the conditions for thermal comfort*

ISO/DIS 7176-5, *Wheelchairs - Part 5: Determination of dimensions, mass and manoeuvring space*

ISO 9386-1, *Power-operated lifting platforms for persons with impaired mobility - Rules for safety, dimensions and functional operation — Part 1: Vertical lifting platforms*

ISO 9386-2, *Power-operated lifting platforms for persons with impaired mobility - Rules for safety, dimensions and functional operation — Part 2: Powered stairlifts for seated, standing and wheelchair users moving in an inclined plane*

ISO/DIS 12055, *Building construction – Guardrail systems and rails for buildings*

ISO 16813, *Building environment design - Indoor air quality – General principles*

ISO 16814, *Building environment design - Indoor air quality - Methods of expressing the quality of indoor air for human occupancy*

ISO/IEC Guide 71, *Guidelines for standards developers to address the needs of older persons and persons with disabilities*

IEC 60 118-4, *Methods of measurement of electro-acoustical characteristics of hearing aids - Magnetic field strength in audio-frequency induction loops for hearing aid purposes*

ISO/TR 13570-2, *Wheelchairs – Typical values and recommended limits for dimensions, mass and manoeuvring space as determined in ISO 7176-5*

ISO/TR 22411, *Ergonomic data and ergonomic guidelines for the application of ISO/IEC Guide 71 to products and services to address the needs of older persons and persons with disabilities*

3 Terms and definitions

This standard contains terms that were either not considered for inclusion in ISO 6707-1: 2004, *Building and civil engineering – Vocabulary-Part 1: general terms,* or have assumed a broader meaning since the latter standard was finalised.

For the purposes of this document, the terms and definitions given in ISO/IEC Guide 71 and the following apply:

3.1
ability
an identifiable human attribute, including but not exclusively, to walk, to speak, to hear, to see, to feel by touch, to taste, to understand, to recognise

3.2
accessibility
with respect to buildings or parts of buildings, means that people, regardless of disability, age or gender, are able to gain access to it, into it, within it or exit from it

NOTE Accessibilita includes ease of independent approach, entry, evacuation and/or use of a building and its services and facilities, by all of the building's potential users - with an assurance of individual health, safety and welfare during the course of those activities.

3.3
area of rescue assistance (fire)
a building space directly adjoining, and visible from, a main vertical evacuation route - robustly and reliably protected from heat, smoke and flame during and after a fire - where people may temporarily wait with confidence for further information, instructions, and/or rescue assistance, without obstructing or interfering with the evacuation travel of other building users

3.4
assisted egress
a strategy that exists during which a designated person or persons provide assistance, during an emergency, to another person to leave a building or a specific part of the *built environment* and to reach a final place of safety

3.5
assistive technology, assistive device
piece of equipment, product system, hardware, software or service that is used to increase, maintain or improve functional capabilities of individuals with disabilities (ISO/TR 22411:2008)

NOTE These can be acquired commercially off-the-shelf, modified or customized. The term includes technical aids for persons with disabilities. Assistive devices but may lessen the difficulty an individual has in carrying out a task or activity in specific environments.

3.6
attention pattern
TWSIs that call attention to particular decision points

3.7
audio description
verbal narration that conveys the visual aspects of a presentation or performance

3.8
building related ill-health
any adverse impact on the health of building users - while living, working, generally occupying or visiting a specific building - caused by the planning, design, construction, management, operation or maintenance of that building

3.9
buffer zone (fire)
the compartments and/or spaces immediately adjoining the fire compartment in a building

3.10
built environment
External and internal environments and any element, component or fitting that is commissioned, designed, constructed and managed for use by people

NOTE Loose items are excluded because decisions with respect to their location within the built environment are more likely to be under the day-to-day control of facilities managers and not of those who commission, design or construct the built environment.

3.11
circulation space
unobstructed space necessary for access to, into and within and egress from any part of the built environment

Linked terms: '*circulation route*'

3.12
clear width
free unobstructed space necessary for access through a doorway, along a passage way, or other route element (e.g stairway)

NOTE 'effective clear width': the unobstructed width of a circulation route or the available width for passage through a door opening, clear of all obstructions such as handles , when the door is opened 90 °, or when a sliding or folding door is opened to its fullest extent.

3.13
colour deficiency
the inability to percept certain colours and to clearly distinguish between combinations of these colours

NOTE The colours that the majority of people with a colour deficiency are not able to distinguish between are green, olive green, yellow, orange, pink and red. Any combination or variation of these colours may not, when used together, be distinguished from each other by people who have a colour deficiency, sometimes incorrectly referred to as colour blindness.

3.14
common
serving more than one single-family dwelling or more than one building or more than one tenancy

3.15
contraflow (fire)
emergency access by firefighters / rescue teams into a building and towards a fire, while people are still moving away from the fire and evacuating the building

3.16
disorientation
inability of a person to orient himself/herself with regard to space, time and context in either the built environment or virtual environment

[Commentary: acute disorientation brought on by the use of alcohol, 'social' drugs and some medicines, or dramatic alterations in a person's circumstances, e.g. involvement in a fire incident, is not uncommon or abnormal. Long term progressive disorientation is a symptom of a variety of psychological and/or neurological disorders.]

3.17
doorset
a building component consisting of a fixed part (the door frame), one or more movable parts (the door leaves), and their hardware, the function of which is to allow, or to prevent, access and egress

[Commentary: a doorset may also include a door saddle / sill / threshold.]

3.18
egress
independent emergence of user(s) from a building, under normal ambient conditions, and removal from its immediate vicinity

3.19
evacuation from a fire building
to withdraw, or cause to withdraw, all users from a fire building in planned and orderly phased movements to a Place of Safety remote from the building

3.20
evacuation lift
lift that may be used, during an emergency, for self or assisted egress

3.21
faculty
an identifiable human attribute, including but not exclusively, to walk, to speak, to hear, to see, to feel by touch, to taste, to understand, to cognize, to recognise.

3.22
feasible
generally acceptable, having regard to the reasonableness and practicability of the provision.

3.23
fire compartment
the building compartment of fire origin

3.24
fire defence plan
the elaboration - usually in hard copy and/or electronic format and comprising fire engineering drawings, descriptive text, fire safety related product/system information, with supporting calculations and fire test data - of the particular fire engineering strategy which has been developed for a specific building

3.25
fire engineering strategy
a coherent and purposeful arrangement of fire prevention, fire protection and fire management measures which is developed in order to attain specified fire engineering design objectives

[Commentary: some 'fire safety objectives' may be requirements of legislation]

3.26
fire prevention
all measures necessary to prevent an outbreak of fire in a building, including such secondary activities as fire research and education of the public concerning fire hazard

3.27
fire protection
the use of spatial planning, building design, construction, services, systems, personnel and equipment in order to control and extinguish fire, and minimize any adverse or harmful environmental impacts caused

3.28
fire resistance
the inherent capability of a building assembly, or an element of construction, to resist the passage of heat, smoke and flame for a specified time during a fire

3.29
fire resisting doorset / shutter assembly
a doorset / shutter assembly, properly installed or mounted on site, the function of which is to resist the passage of heat, smoke and flame for a specified time during a fire

3.30
going or tread
horizontal distance between two consecutive *nosings*, measured on the walking line or the horizontal distance between the start and finish of a *flight* of a *ramp*

3.31
guiding pattern
Tactile walking surface indicators (TWSI) to indicate a direction of travel

3.32
habitable room
room, intended for dwelling purposes, including a kitchen, a bathroom and a utility room

3.33
handrail
component of a stair or of a ramp or other building components that provides guidance, balance and support (modified cf. ISO 6707, 5.2.73)

3.34
hearing enhancement system
piece of equipment, product system, hardware, software or service that is used to increase, maintain or improve listening capabilities of individuals with hearing impairments

3.35
impairment
limitation in body function or structure such as a significant deviation or loss which can be temporary due, for example, to injury, or permanent, slight or severe and can fluctuate over time, in particular, deterioration due to ageing (ISO/TR 22411:2008)

NOTE 1 Body function can be a physiological or psychological function of a body system; body structure refers to an anatomic part of the body such as organs, limbs and their components (as defined in ICIDH-2 of July 1999).

NOTE 2 This definition differs from that in ISO 9999:2002 and, slightly, from ICIDH-2/ICF: May 2001, WHO: ‘any loss or abnormality of a body function, or body structure’

NOTE 3 The word 'abnormality' is strictly used here to refer to a significant deviation from an established population mean, within measured statistical norms. Impairments may be physical, mental, cognitive or psychological.

3.36
impairment, cognitive
a deficiency of neuropsychological function which can be related to injury or degeneration in specific area(s) of the brain

3.37
impairment, mental
A general term describing a slower than normal rate in a person's cognitive developmental maturation, or where the cognitive processes themselves appear to be slower than normal - with an associated implication of reduced, overall mental potential

3.38
informed consent
consent freely obtained - without threats or improper inducements - after appropriate disclosure to a person of relevant, adequate and easily assimilated information in a form (e.g. oral, written, braille) and language understood by that person

3.39
kerb ramps
construction, in the form of an inclined plane that makes it possible to pass from street level to a higher pedestrian path

3.40
keypad
arrangement of buttons wiith numbered keys in accordance with the standard telephone layout.

3.41
landing
platform or part of a floor structure at the end of a flight of a stair or a ramp or at the entrance to a lift car (modified cf. ISO 6707, 5.5.21)

3.42
levelling accuracy
maximum vertical distance between a car sill and a landing sill during loading or unloading of the lift

3.43
lifting platform
device permanently installed to serve fixed landing levels, comprising a guided platform whose dimensions and means of construction permit the access of disabled passenger(s), with or without wheelchair(s) (cf. ISO 9386-1)

3.44
light reflectance value LRV
the proportion of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source

LRV is also known as the *luminance reflectance factor*

NOTE The LRV is expressed on a scale of 0 – 100, with a value of 0 points for pure black and a value of 100 points for pure white.

3.45
differences in LRV
should be used to assess the degree of visual contrast between surfaces such as floors, walls, doors and ceilings and between key fittings/fixtures and surrounding surfaces

3.46
luminance
the amount of light emitted from a source in a given direction. (see ISO 6707-1 for variation)

3.47
manoeuvring zone
the minimum three dimensional space within which it is feasible to complete a manoeuvre needed to gain access to a specific facility, component or fitting; in particular while using a wheelchair or a walking aid

3.48
moving walkway
a moving accessible path of travel, either level or with an inclination up to 6 °

3.49
nosing
projecting front edge of a tread or landing that may be rounded, chamfered or otherwise shaped (modified cf. ISO 6707, 5.5.26)

3.50
place of relative safety (fire)
any location beyond the buffer zone surrounding a fire compartment in a building

3.51
place of safety (fire)
any location beyond a perimeter which is [100] metres from the Fire Building or a distance of [10] times the height of such building, whichever is the greater; and where necessary medical care and attention can be provided, or organized, within one hour of injury; and where people can be identified

[Commentary: this definition is applicable in the case of a building fire, without an associated explosion hazard. If there should be a risk of explosion, the quantities shown in square brackets above must be increased, at least by a factor of 4.]

3.52
platform
construction that provides a horizontal surface above the level of an adjoining surface

3.53
principal entrance
the entrance or, if there is more than one with equal status, the entrances that a pedestrian visitor would normally expect to approach and to enter in order to *use* the building or other facility

3.54
principal entrance storey
in the context of a building, the storey that contains the *principal entrance* or *principal entrances* to the building

3.55
ramp
construction, in the form of an inclined plane that is steeper than or equal to 1:20 (5 %) from the horizontal, together with any intermediate landing, that makes it possible to pass from one level to another (modified cf. ISO 6707, 5.5.29)

3.56
reflectance
the measure of light reflected in a given direction by a surface [in its installed environment] and which is expressed in a unit term from 0 to 100 on a scale, respectively, that represents a greyscale progression from the notional extremes of total light absorption (black) to total light reflection (white)

3.57
rise
vertical distance between the upper horizontal surfaces of two consecutive treads, or of a *landing* and the next treads above or below it, or of a *flight* between consecutive *landings*. (cf. ISO 6707, 9.2.23)

3.58
riser
vertical component of a step between a tread or a *landing* and the tread or *landing* above or below it. (cf. ISO 6707, 5.5.23)

3.59
skill
the ability of a person - resulting from training and regular practice - to carry out complex, well-organized patterns of behaviour efficiently and adaptively, in order to achieve some end or goal

3.60
smoke
the visible suspension of solid and/or liquid particles in gases resulting from fire or pyrolysis

3.61
stair lift
appliance for transporting a person (either seated or standing) or a person in a wheelchair between two or more landings by means of a seat or platform moving in an inclined plane (c.f. EN 81-40)

3.62
stopping accuracy
maximum vertical distance between the car sill and landing sill at a moment when a car is stopped by the control system at its destination floor and the doors reach their fully open position

3.63
suitable
in the context of *access* to, or into, or within, or to *use* of, the *built environment*, means design, construction, installation and location that satisfies the needs of the *intended user*

3.64
tactile walking surface indicators (TWSI)
profiled paving surface with visual contrast criteria to provide a person with impaired sight using a long cane, underfoot or visual identification to become aware of a specific route (guiding pattern) or of the presence of a *hazard* (attention pattern) see Annex C

3.65
usability
a characteristic of the *built environment* whose degrees of convenience and risk in use can be determined by measurement or other agreed means

3.66
usable
a characteristic of the built environment that means that its use by the *intended user* is possible with degrees of convenience and risk that, considered together, are generally acceptable

3.67
user
person who interacts with the product, service or environment (ISO/TR 22411:2008)

3.68
visual contrast
the perception of a difference visually between one element of a building and another by reference to their light reflectance values LRV as the most relevant factor

3.69
wayfinding
descriptive of a system whereby appropriate information is provided to assist a person to pass through the *built environment* towards a specific destination

NOTE Wayfinding includes orienting where you are, knowing your destination, following the best route, recognizing your destination and, finding your way back out. People who are blind or who have a vision impairment benefit from tactile information to facilitate wayfinding.

4 General design considerations

The requirements in this standard relate to the principal human abilities that need to be considered when designing, constructing and managing the built environment. These abilities are described in Annex B which gives an overview of design considerations that should be taken into account for each of the different abilities.

4.1 Design requirements according to human abilities

When fully implemented, the standard will be of benefit to all people, including

— people with hearing impairments,

— people with vision impairments,

— people with mobility impairments,

— people with cognitive impairments,

— people with hidden impairments (such as strength, stamina and dexterity)

— people with diversities in age and stature (including frail older people, children etc.).

4.2 Key accessibility issues

Entering, using and evacuating buildings should be safe and easy for individuals, families and groups which include persons with disabilities.

The main considerations are:

— designated parking near main entrance

— accessible path to the entrance,

— short distances,

— level entrances and exits to exterior facilities,

— simple and logical layouts,

— level circulation with no steps or obstacles on storeys,

— easy access to information desks, lifts and toilet compartments for disabled persons,

— intuitive and obvious fire evacuation routes for use in emergencies,,

— spacious lifts,

— safe stairs that are easy to use, and facilitate safe assisted evacuation/rescue in emergencies; ,

— slip resistant walking surfaces,

— wide door openings and easy door operation, sufficient space around doors that makes it possible to open and close them when seated in a wheelchair,

— adequate manoeuvring space,

— adequate height, location and easy operation of controls and switches,

— good lighting,

— good visual contrast of walls, floors, doors and signage,

— good signage,

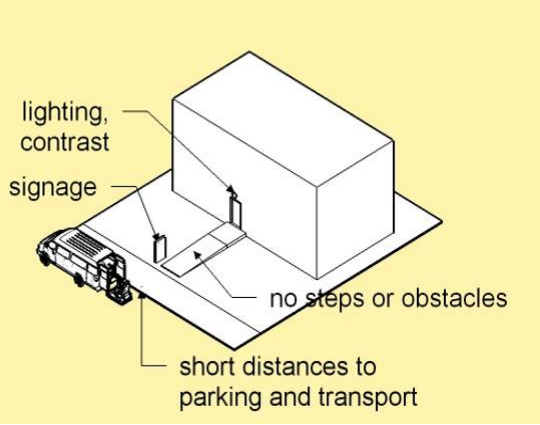
— important information communicated via two senses or more (tactile, audible and visual),

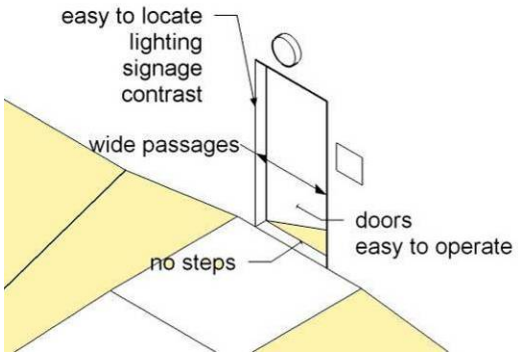
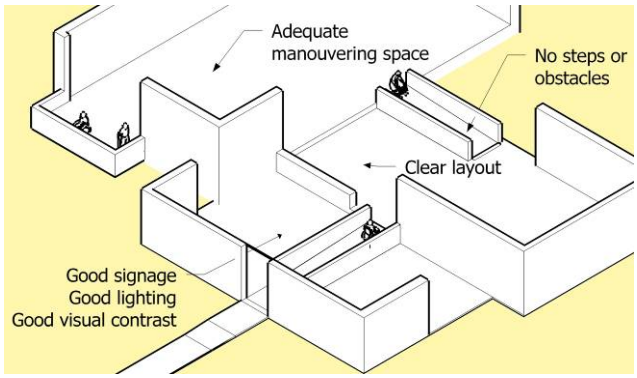
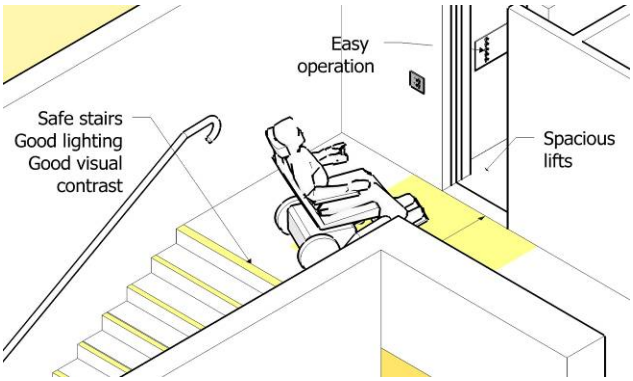
— good acoustics,

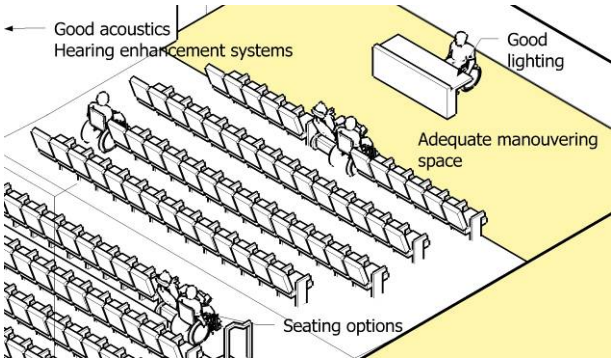
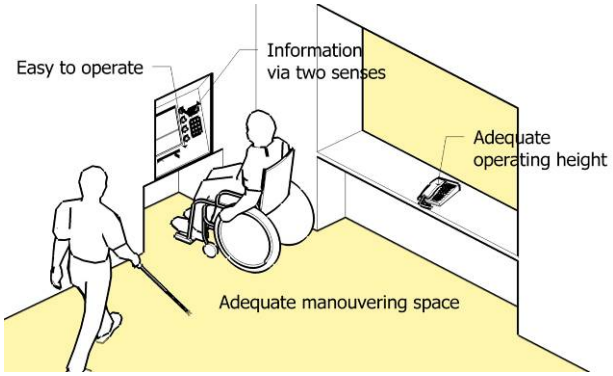
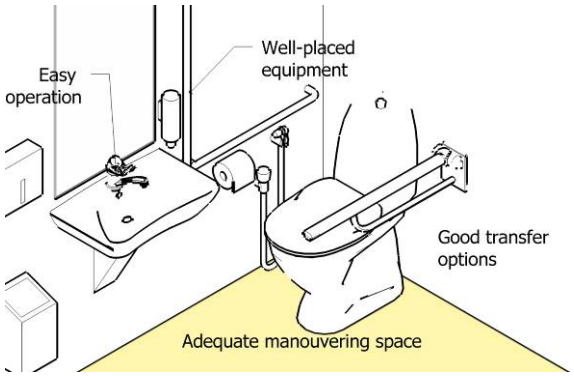
— hearing enhancement systems.

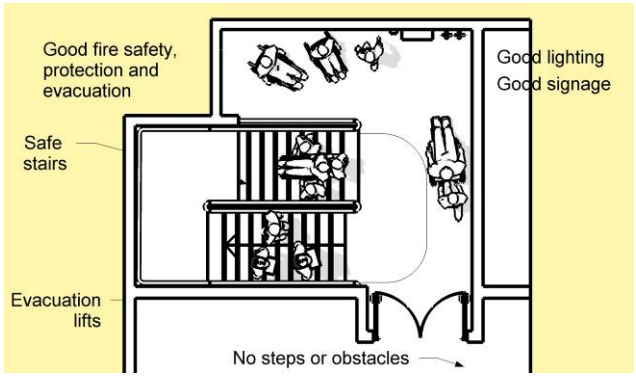
See Table 1 for examples of how these issues may be combined when planning a built environment.

Table 1 — Examples of key accessibility issues in the early stages of planning

Nr.	General requirement	Example
1	**Equitable approach to a building**, e.g. designated parking, clear pedestrian routes separate from vehicles and cyclists, no steps or obstacles, short distances from parking and public transport, good signage, good lighting and good contrast. Links to main chapters with details: 5, 6, 7, 8, 9, 33, 35 and 40	

Nr.	General requirement	Example
2	**Equitable entry via the same entrances,** e.g. easy to locate main entrances, no steps or obstacles, wide openings, low operating forces, good signage, good lighting and good visual contrast. Links to main chapters with details: 10, 18, 33, 35, 35 and 40.	
3	**Equitable use of the same paths in horizontal circulation**, e.g. no steps or obstacles, adequate manouvering space, wide door openings, easy to operate doors, resting places, clear layout, good signage, good lighting and good visual contrast. Links to main chapters with details: 11, 18, 33, 35, 38 and 40.	
4	**Equitable access to the same paths in vertical circulation**, e.g. safe stairs, spacious lifts with easy operation, good signage, good lighting and good visual contrast. Links to main chapters with details: 12, 13, 14, 15, 15.6, 17, 33, 35 and 40.	

Nr.	General requirement	Example
5	**Equitable use of the same rooms,** e.g. ample circulation space and different seating possibilities, good acoustics and hearing enhancement systems, good lighting and good visual contrast. Links to main chapters with details: 21, 22, 23, 24, 25, 32, 33 and 35.	
6	**Equitable use of the same equipment and facilities**, e.g. easy to understand and operate adequate manouvering space and operating height, information via two senses. Links to main chapters with details: 11, 19 and 35.	
7	**Equitable use of toilet and sanitary facilities**, e.g. good signage, adequate manouvering space, good transfer options, well-placed equipment, easy operation. Links to main chapters with details: 26, 39 and 40	

Nr.	General requirement	Example
8	**Equitable exit and evacuation routes, concepts for emergency planning**, e.g. no steps or obstacles, fire proof lifts, good signage, good lighting, good visual contrast, good fire safety, protection and evacuation, accessible evacuation routes Links to main chapters with details: 15, 33, 34, 35, 38 and 40	
9	**Important information via two senses or more**, e.g. visual, audible and tactile. Links to main chapters with details: 38 and 40	

5 Approach to the building

5.1 Arrival by motor vehicle

Space should be provided for drop-off and pick-up points for taxis, public transport and also for large vehicles such as vans etc. as near as possible to the main accessible entrance. Vehicle drop-off areas should be a minimum of 9 000 mm in length and served by a kerb ramp.

See designated accessible parking space in section 6.

5.2 Principal entrance

If there is a difference in level between the carriageway and the footpath, a kerb ramp (maximum slope 1:8 – see 8.1) shall be provided to facilitate the setting-down of passengers close to the principal entrance of a building. This will benefit a passenger who needs to transfer to and from a wheelchair and others.

An appropriate tactile walking surface indicator (TWSI) should be provided to lead vision impaired persons to the main entrance. See example in figure 5.

6 Designated accessible parking space

6.1 Location

The designated parking spaces shall be located as near as possible to the principal entrance, and the route from the accessible parking space to the main entrance should be 50 m or less.

6.2 Number of designated parking spaces

If no national requirements or regulations are available, the following minimum requirements concerning the number of parking places shall apply:

– a minimum of 1 accessible designated parking space should be provided in every parking area,

– up to 50 parking spaces: 2 designated accessible parking spaces,

– up to 100 parking spaces: 4 designated accessible parking spaces,

– up to 200 parking spaces: 6 designated accessible parking spaces,

– over 200 parking spaces: 6 designated accessible parking spaces + 1 for each additional 100.

In specialized facilities such as health care facilities, shopping areas and recreational facilities, a greater number of designated accessible parking spaces should be considered.

Additionally some designated accessible parking spaces should be provided for motorists accompanied by a child in a perambulator or pushchair and shall be designated with a perambulator sign.

6.3 Car parking

The minimum width of the parking space for a car shall be 3 600 mm and the minimum length shall be 5 400 mm. This minimum width includes the transfer area beside the car with a minimum of 1 200 mm, figure 1 shows one single parking bay and aisle.

Two accessible parking spaces with one shared transfer area are widely used and shall have a minimum width of 6 000 mm

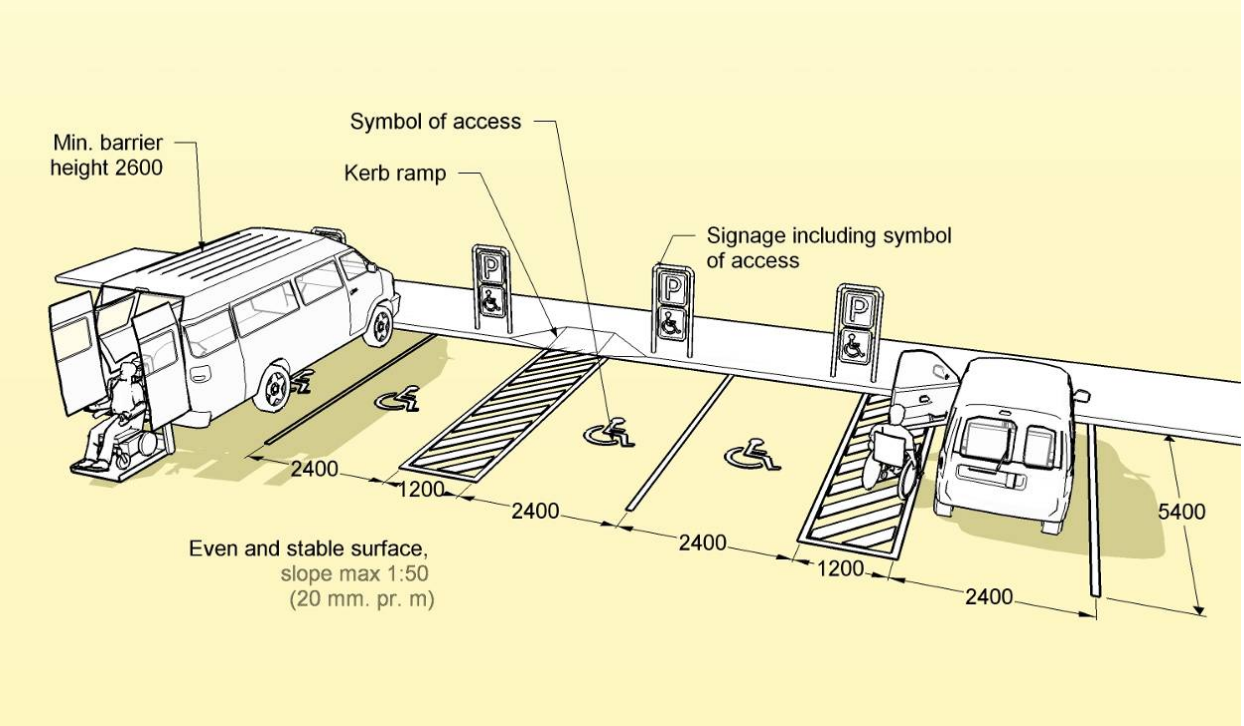


Figure 1 — Examples of designated parking spaces

6.4 Van parking with auxiliary movable ramps

The size and design of accessible vehicles varies from country to country. Some are fitted with ramps or hoists at the side or at the rear, therefore national standards should be used where they exist.

The minimum width of the accessible parking space for a van shall have at least the same dimensions as for car parking spaces (see 6.3). Transfer areas between spaces can be shared.

For multi-purpose vehicles with hoists or lifts, more space is needed; at least an additional 2 400 mm area beside the van and/or at the rear of the van. The dedicated parking space in this case shall be 4 800 mm wide and 9 000 mm long (see different types of designated parking spaces in figures 1 and 2)..

As an alternative, a parking space of 2 400 mm wide x 9 000 mm in length long along a sidewalk can be used, provided the sidewalk is at least 2 400 mm wide.

Where auxiliary movable ramps are used, even more space is needed; at least a 3 600 mm area beside the van and/or at the rear of the van. The van space in this case shall be 6 000 mm wide and 9 000 mm in length.

6.5 Signage

It is important that the locations of the designated parking spaces are clearly signposted at the entrance to the building site or car park with information providing direction to designated parking spaces and to other accessible facilities. Therefore, directional arrows combined with the international symbol of access (see figure 71 in section 41) shall be used.

Designated accessible parking spaces shall be marked both on the pavement with the International symbol of access (see figure 71) and with a vertical sign with the International symbol for accessible parking space (see figure 72) to indicate the location of the designated accessible parking. The vertical sign should be located so that it does not create a hazard.

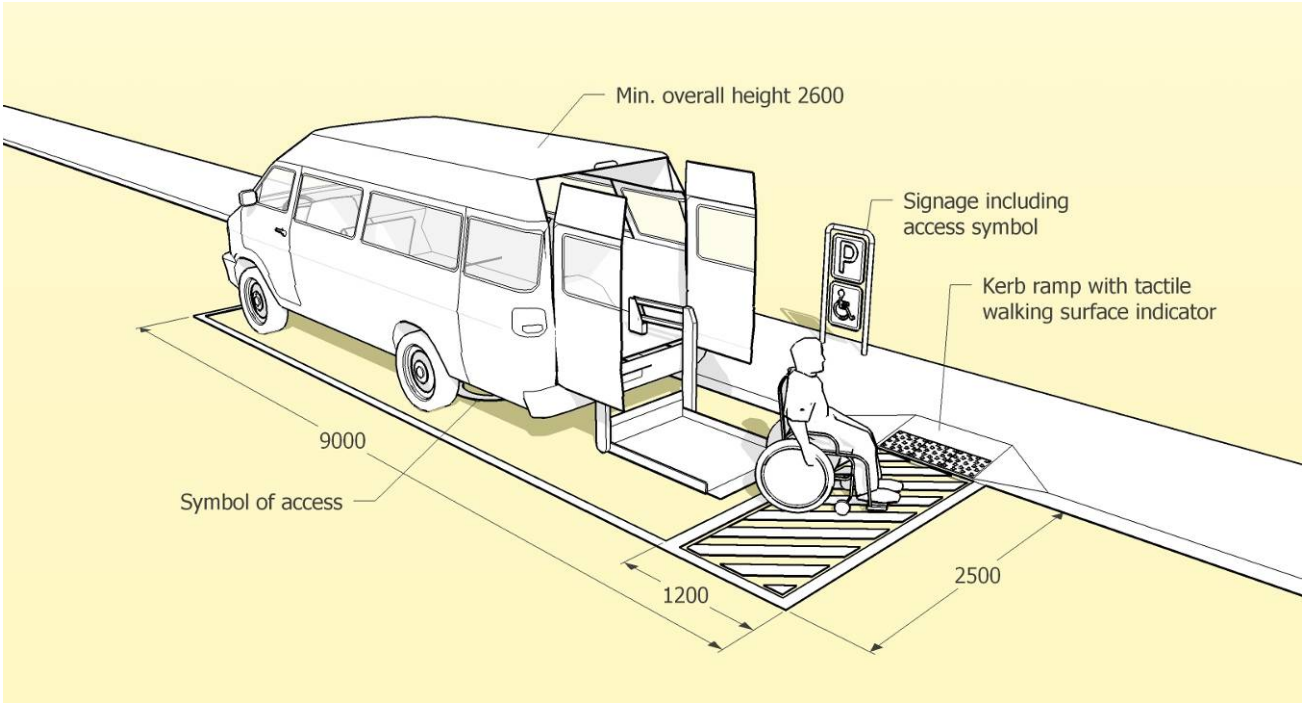


Figure 2 — Example of parking space along a sidewalk

6.6 Surface

The surface of a designated accessible parking space shall be even and stable with no variation of surface exceeding 5 mm, between paving, surface features and mix of different surfaces or finishes.

The designated accessible parking spaces shall be located on a gradient not greater, throughout its length and its width, than 1:50.

6.7 Kerb ramp from parking space to an adjacent higher pedestrian path

The kerb ramp should be located in close proximity to the designated accessible parking area connecting the accessible path of travel to the principal entrance.

The kerb ramp width should be a minimum of 1 000 mm. The gradient of the kerb ramp should consider the requrirements in 8 and comply with table 2.

The accessible path to the kerb ramp can be marked with hatching painted on the road surface to prevent people from parking in this area (see figure 1 and 2).

Kerb ramps shall have a slip-resistant surface.

Where a kerb ramp is located in the direct line of pedestrian travel, the dished area of the kerb shall be fitted with tactile warning surface indicator (attention pattern), see figure 3 and Annexe C.

6.8 Indoor parking

If no national requirements or regulations are available, the minimum requirements outlined in 6.1 – 6.4 also apply for indoor parking facilities.

If the indoor parking facility is not accessible, suitable warnings shall be given at the entrance and alternative designated accessible parking spaces shall be provided outside the building.

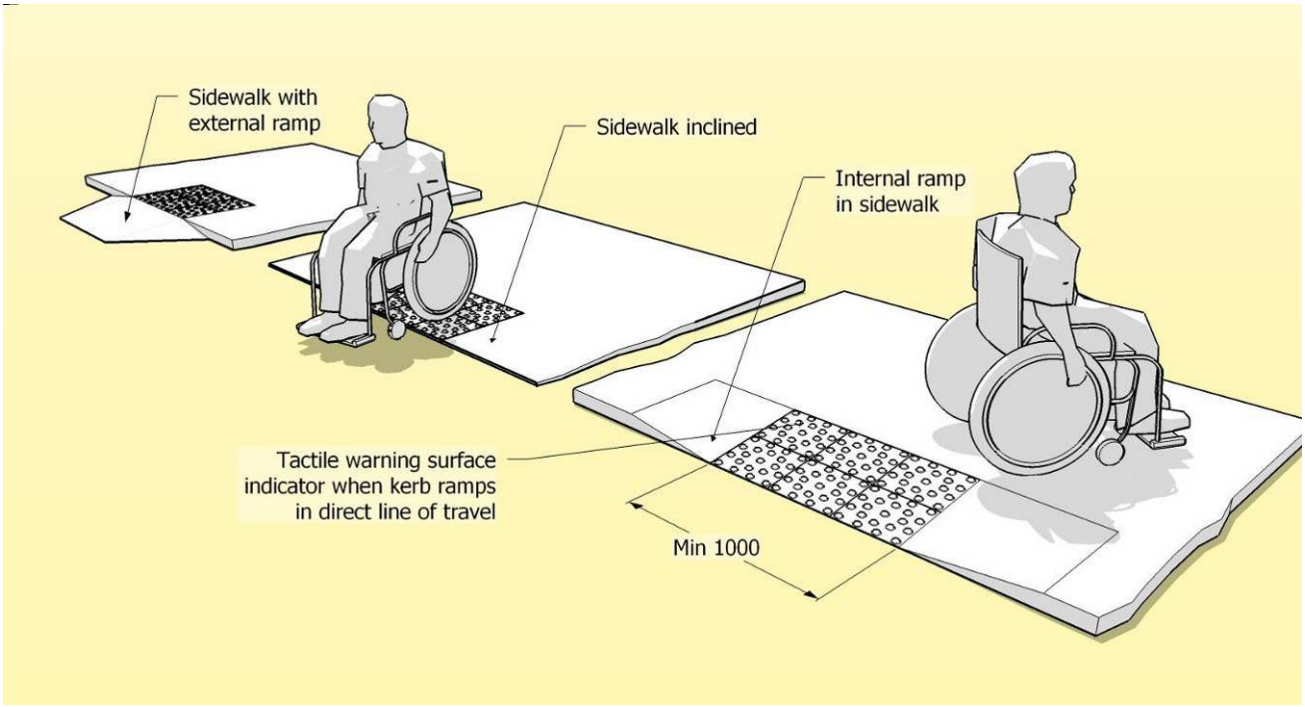


Figure 3 — Examples of kerb ramps

6.8.1 Signage at the entrance

Signage should be posted at the entrance to the parking facilty indicating the location of the designated accessible parking spaces.

Suitable indication shall be provided for the route from the accessible designated parking space to the building or buildings served by the car park, including to parking machines, passenger lifts, ramps and exits.

6.8.2 Location of designated accessible parking spaces

Designated accessible parking spaces shall preferably be located at the same level as the principal entrance to the building or buildings served by the car park.

Designated accessible parking spaces should be signposted and on every level.

A suitable passenger lift or separated pedestrian ramp shall be installed to facilitate suitable access from the parked vehicle to the principal entrance of the building or buildings served by the car park.

6.8.3 Height of clearance

The clear height at the entrance to parking facilities should be a minimum of 2 400 mm.

NOTE National building regulations may have other dimensions reflecting the height of local transportion vehicles.

6.9 Parking control

If a payment machine is provided it shall provide all controls at a height between 800 mm and 1 100 mm. Also consider section 41.

Access to the machine shall be level along an accessible route and easy to operate. The machine shall be located so that it does not create a hazard or barrier for people with vision impairments or people with mobility impairments.

7 Paths to the building

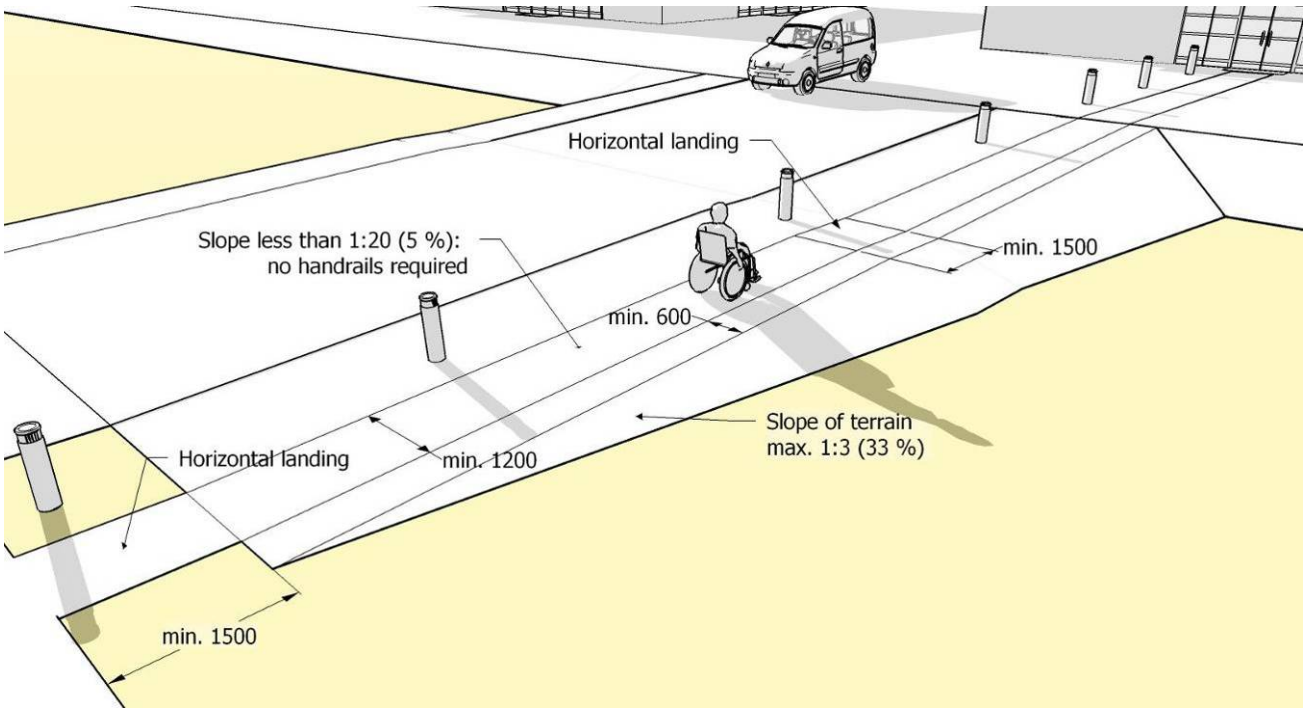


Figure 4 — Example of sloping path

The design of the path or route to the building from the boundary of the site or from the parking area should be designed and constructed to enable all people to approach, enter and exit the building. See figure 4.

Pedestrian paths or routes should be separated from routes used by cyclists and motor vehicles. Where necessary, crossing points should be provided with appropriate kerbs and TWSI.

Access between buildings shall also comply with this section.

7.1 Wayfinding, guided path and other physical support of information

Suitable provision shall be made at the entrance to the site and from any car parking within the site and at decision points within the site to indicate the location and nature of the path to the building.

In very complex sites visual, audible and tactile information should be provided to assist in orientation and wayfinding. Consider also requirements in section 38.

Orientation can be facilitated by differences in acoustics, surface material, light and colour. The design should indicate the use of the building elements, especially the location of the main entrance, making it clearly visible.

Additional illumination or luminance contrast and tactile information, such as a change in material or tactile walking surface indicators, shall be provided at key decision points to assist orientation and wayfinding.

To facilitate people with vision impairment who have some residual vision, routes to be followed shall have a minimum difference in luminance to the surroundings (see section 35).

Tactile walking surface indicators shall be used to indicate the directional orientation especially where no other clues indicate the path to the building. Across large or open areas people who are blind need a tactile route or guiding line to follow (see Annex C).

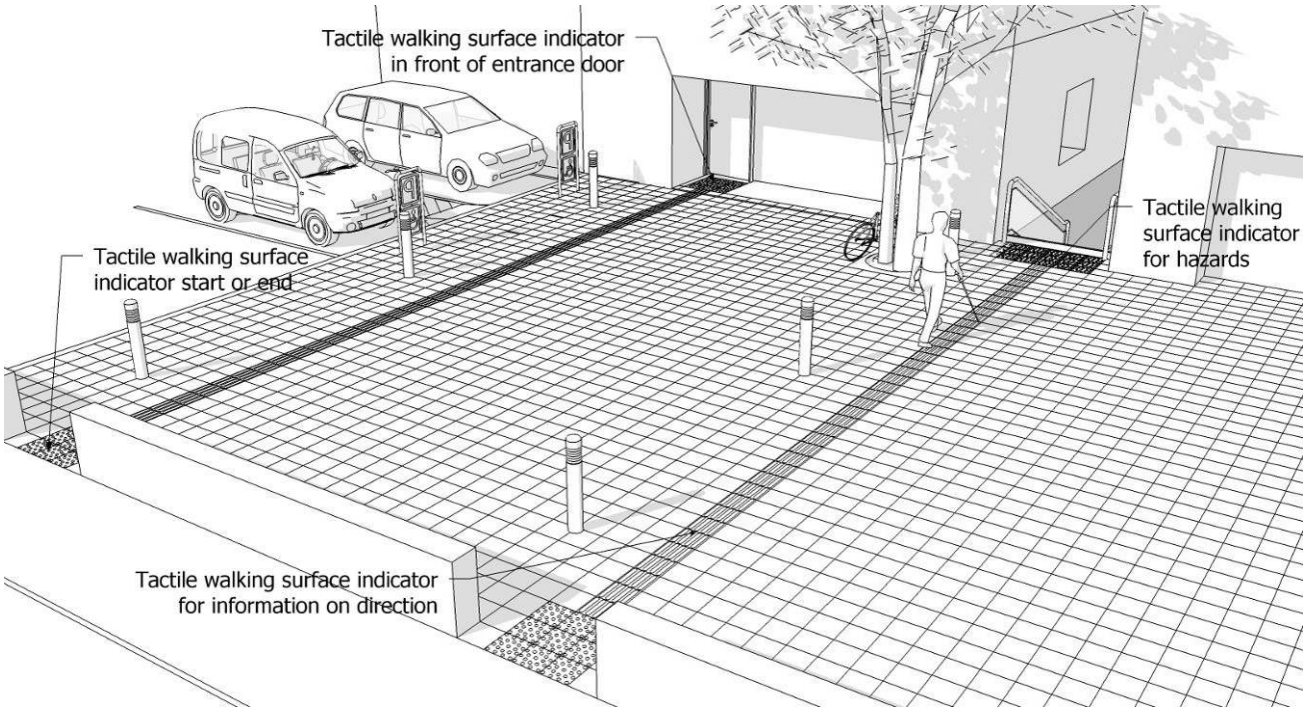


Figure 5 — Example of tactile walking surface indicators used in open area

Where hazards on the direct line of pedestrian travel such as stairs, escalators, moving walks and travelators or ramps with a slope of more than 1:16 can not be avoided, tactile warning indicators and visual markings shall be provided.

To assist orientation and way finding, consider also requirements in section 39.

NOTE 1 Tactile floor coverings or a runner as well as tactile walking surface indicators can help in locating entrance doors, counters, etc.

NOTE 2 Sound-producing objects (such as ticking wall clocks and fountains) may provide a good wayfinding aid for people who are blind or have vision impairment and may supplement tactile information. People with a combination of disabilities (vision/hearing impairment or frail older people) will particularly benefit from these provisions.

7.2 Path

The path to, around and between buildings should be level, stable and firm.

The cross fall gradient across an access route should not exceed 1:50 (2 mm pr m), except when associated with a dropped kerb.

If the slope of any part of a path exceeds 1:20, it shall be designed and constructed as a ramp (see section 8).

In exceptional circumstances, such as that associated with a kerb at the side of a road or an entrance to an existing building, it will be acceptable to provide a short slope with a maximum gradient of 1:8.

Obstacles, such as objects or signs mounted on walls, bollards, columns or free-standing supports along the walking path should be avoided. Unavoidable free standing posts or columns within access routes shall be clearly marked with visual indicators. Visual indicators at least 75 mm in height with a minimum visual

contrast of 30 points difference to the background shall be placed at a height between 900 mm – 1 000 mm and 1 500 mm – 1 600 mm above floor level.

Consider soltary obstacles in a path according 7.14.

7.3 Width of the path

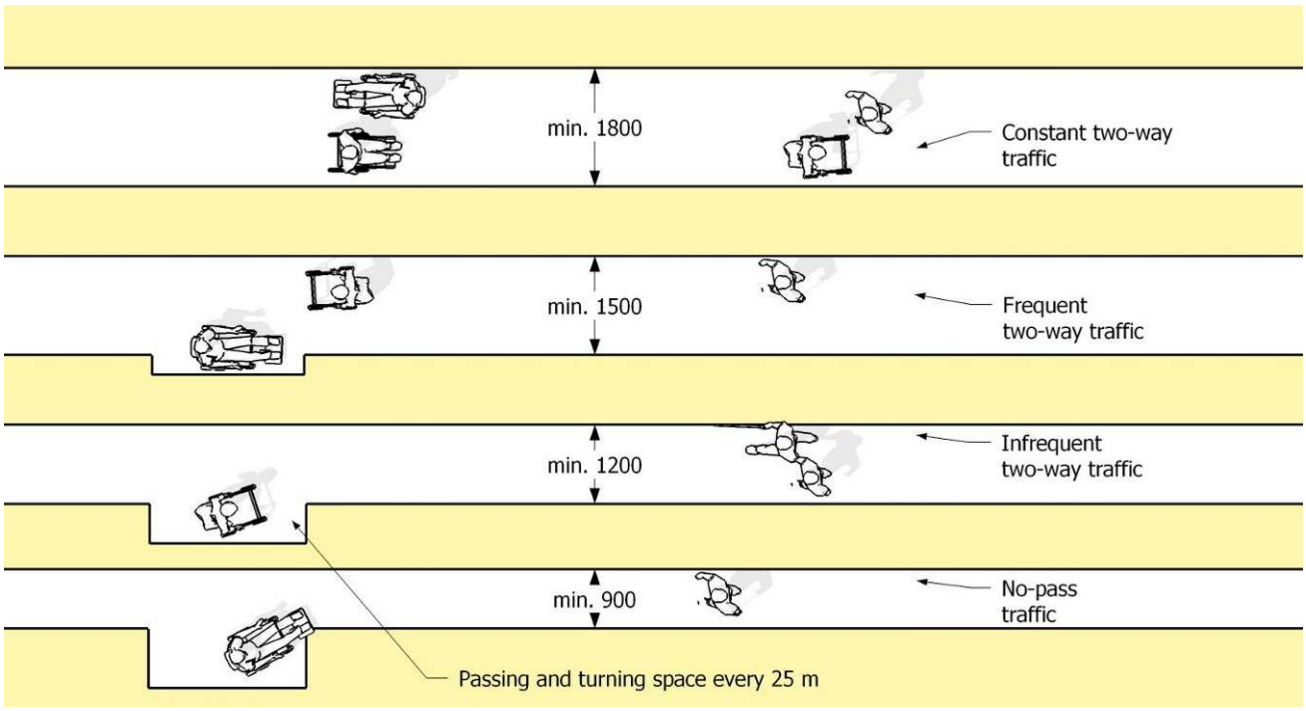


Figure 6 — Different surface widths of the path depending on frequency

The surface width of the path shall be (see figure 6):

a) not less than 1 800 mm for constant two-way traffic;

b) not less than 1 500 mm for frequent two-way traffic, provided that passing places are included at suitable intervals;

c) not less than 1 200 mm for infrequent two-way traffic; a passing and turning space of at least 1 800 mm x 2 000 mm should be provided for every 25 m (see 7.5.1)

d) not less than 900 mm when it is unlikely that people have to pass one another, a turning space of at least 1 500 mm x 1 500 mm should be provided for every 25 m (see 7.6).

7.4 Passing space

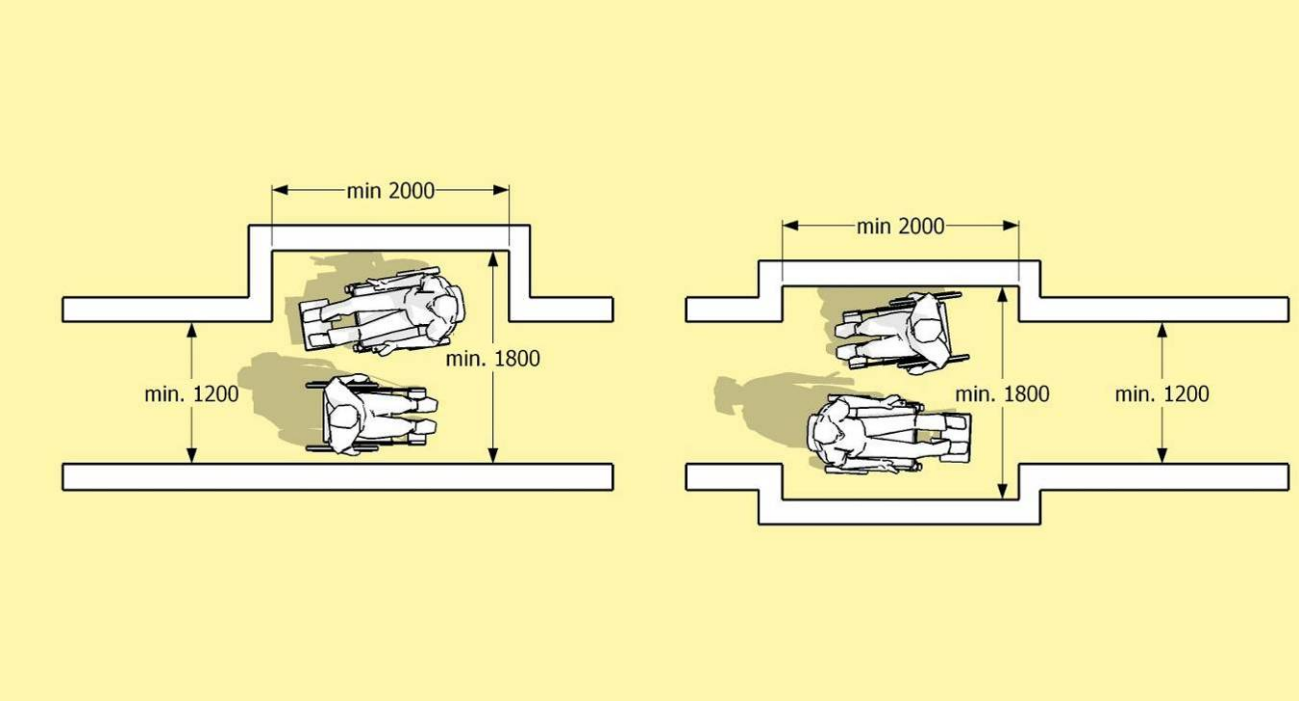


Figure 7 — Examples for passing spaces for wheelchairs

7.4.1 Passing space for wheelchairs

A path whose surface width is less than 1 800 mm (see 7.3 a) and whose overall length is more than 50 m, shall be provided with a passing place or places. Passing places should be a maximum of 25 m apart. This does not apply to a landing forming part of a sloped path, a ramp, steps or a stair.

Passing place for 2 people using wheelchairs shall be a minimum width of 1 800 mm for a minimum length of 2 000 mm. For example see figure 7.

NOTE Passage widening may be associated with intersections, turns and doorways so as to appear as integrated design features or enhancements.

7.5 Turning space for wheelchair on landings

For changes of direction of more than 45 ° on the landings of the path to the building, the manoeuvring space shall be at least 1 500 mm x 1 500 mm. See similar requirements within ramps in section 8.

If larger powered wheelchairs and scooters for outdoor use are to be considered the outer radius of a turning space should be larger. For changes of direction of more than 45 ° on the landings of the path to the building the radius of the outer circle of the way shall be at least 1 900 mm for powered wheelchairs and scooters.

7.6 Path construction

The path shall be rigid with an even and slip-resistant surface and free from drainage gratings.

Care must be taken to ensure that adjacent surface materials do not display different slip resistance characteristics, particularly, at the edges of changes of level or gradients.

7.7 Stepped path and stair

For ambulant people, a stepped path may provide a safer and more assuring means of access than a sloped path or a ramp.

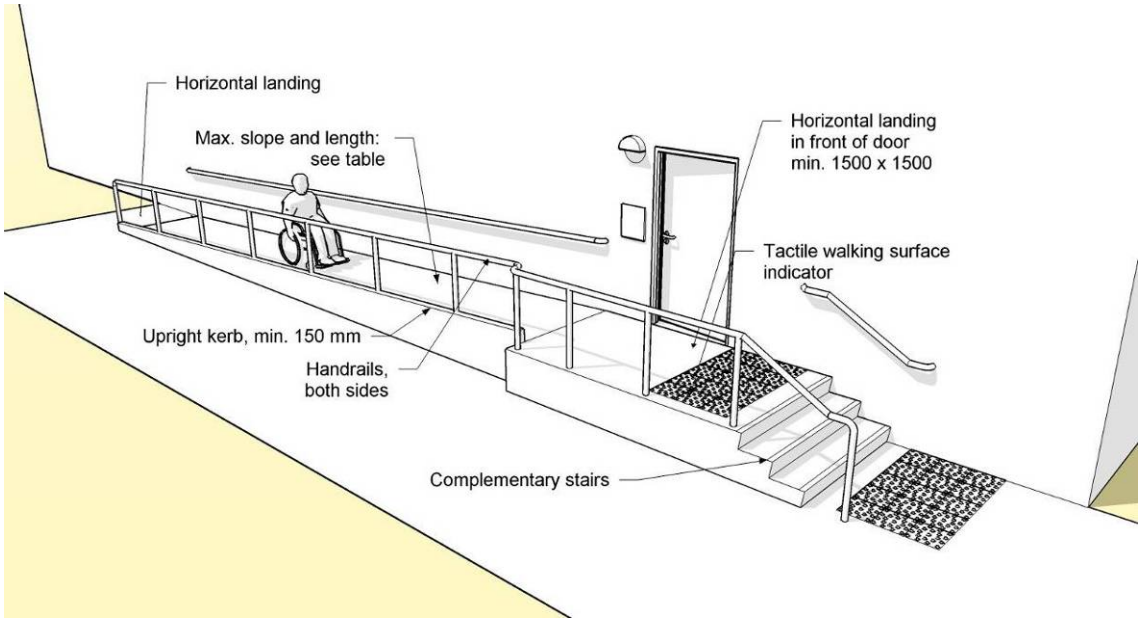


Figure 8 — Example of ramp with additional flight of steps

Wherever the rise of a ramp exceeds 500 mm, an additional flight of steps shall also be provided.

An isolated single step is not acceptable.

Consider detailed requirements for stairs according to section 13.

Where required on a continuous accessible path of travel, tactile warning indicators shall be located at both the top and bottom of stairways, ramps, escalators, moving walks, and travelators.

7.8 Width of stepped path and stair

The surface width of a stepped path and stair shall be not less than 1 200 mm. The clear unobstructed width of the flight of a single- or multi-channelled stepped path and stair shall be not less than 1 000 mm between handrails or any obstructions.

7.9 Landing of stepped path and stair

For requirements for landings consider also 13.3.

7.10 Landings of sloped paths

For landings at the foot and the head of a sloped path, consider also 8.3. If there is a door at the end of the landing of a sloped path the manoeuvring area, door opening area and access to the door handle should also be considered.

7.11 Support and guidance by a handrail on sloped and stepped paths

Support and guidance by a handrail should be provided on sloped and stepped paths:

– Consider the general requirements of handrails according to section 14.

– a handrail shall be provided on each side of a flight of steps that consists of 2 or more risers

– a handrail shall be provided on each side of a channel that may subdivide a flight of steps.

7.12 Drainage of path, sloped and stepped path, ramp or landing

The cross-fall of a level or sloped path, a stepped path, a ramp, or a landing, that is provided to permit drainage of surface water, shall not exceed 1:50.

A dished channel shall not be constructed within the boundaries of a path or ramp.

A drainage grating that is within the boundaries of a path or a ramp shall be set flush with the surface.

7.13 Solitary obstacles in a path

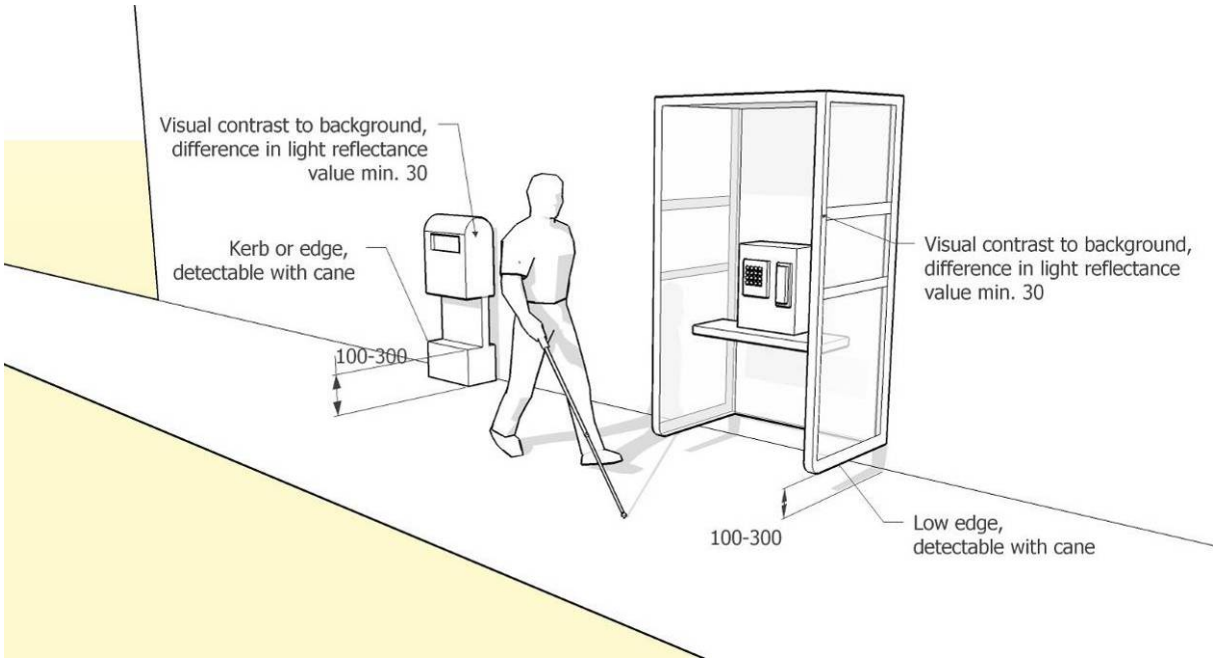


Figure 9 — Solitary obstacles

Objects with a height lower than 750 mm may create a hazard for blind or partially sighted people. Permanent equipment that cannot be located outside the boundaries of a path shall:

a) be designed to be easily seen with a minimum difference in LRVs of 30 points to the background, or

b) be shielded to protect against impact or

c) be accompanied by a feature that warns of the presence of a potential hazard and is detectable for a person using a white cane or stick, see figure 9.

The headroom along a path shall be maintained at a height of not less than 2 100 mm above the surface of the path.

Any objects projecting more than 100 mm between 300 mm and 2 100 mm above ground level into an access route should be clearly visible and needs to be detectable with a cane, see figure 9.

Protection on the ground can be made by a solid kerb or fixed element between 100 mm – 300 mm above floor level under the protruding obstacle. Wing walls, side partitions, alcoves or recesses are solutions for protruding elements where free space under the object is needed. Winged protection shall extend continuously between 300 mm and 1000 mm above the floor.

7.14 Guards against falling within a path

Consider requirements in 9.

8 Ramps

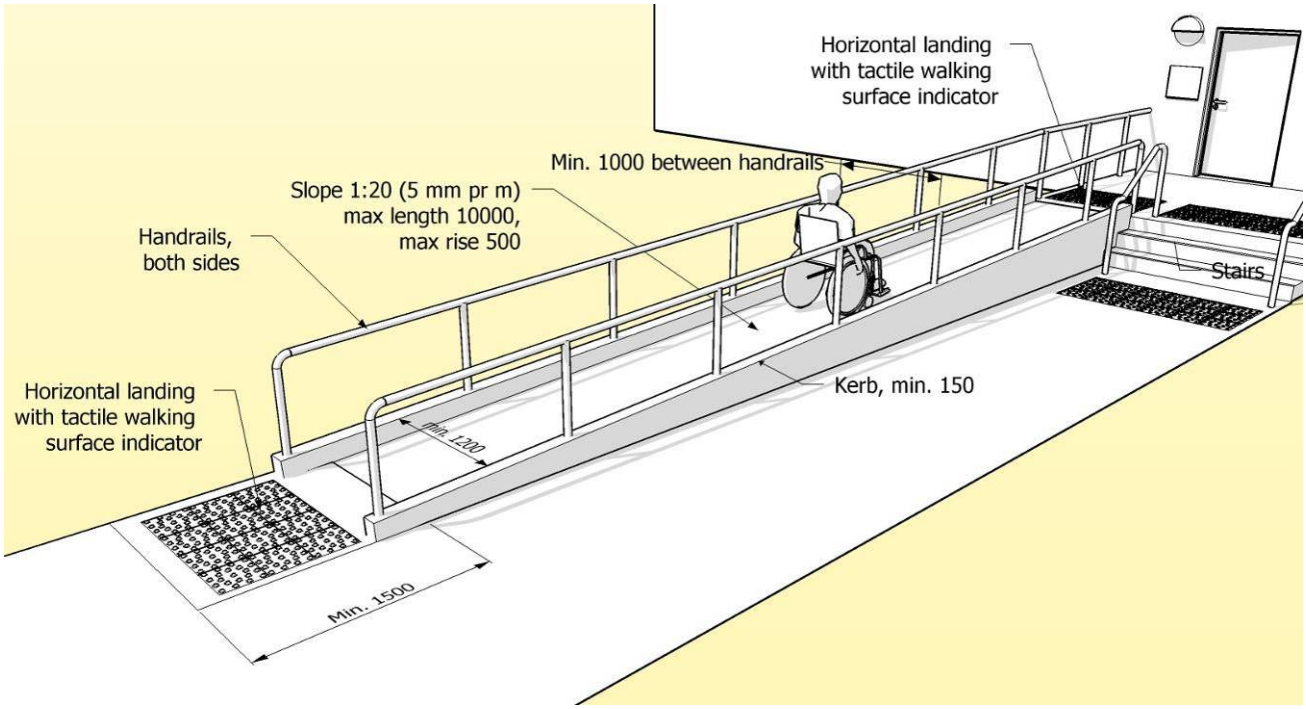


Figure 10 — Example of ramp with slope 1:20 and horizontal landings at beginning and end

Ramps provide an accessible route between changes of level. A ramp with the appropriate slope can provide accessibility without requiring reliance on a mechanical device.

NOTE Ramps may be the only practical solution for people who cannot use steps or stairs, but other people may prefer to use stairs.

In addition to a ramp, a flight of steps should be provided if the change in level is more than 500 mm. See figure 10.

In buildings of more than two storeys, a lift should be provided.

Where required on a continuous accessible path of travel, tactile warning indicators should be located at both the top and bottom of ramps. See further detailed measures in 13.5.

8.1 Slope and length

The slope shall not exceed the maximums set out in Tables 2 and 3.

Table 2 — Maximum slope and length of ramps

Max. rise, mm	Max. slope	Max. length, mm	Outdoor use	Indoor use
500	1:20 (50 mm pr m)	10 000	yes	yes
425	1:18 (56 mm pr m)	7 650	yes	yes
320	1.15 (67 mm pr m)	4 800	yes	yes
210	1:12 (83 mm pr m)	2 520	yes	not recommended
150	1:10 (100 mm pr m)	1 500	kerb ramps without handrails	not recommended
75	1:8 (125 mm pr m)	600	kerb ramps without handrails	thresholds only

The graph in figure 11 shows approximate rise and slope for values not mentioned in table 2.

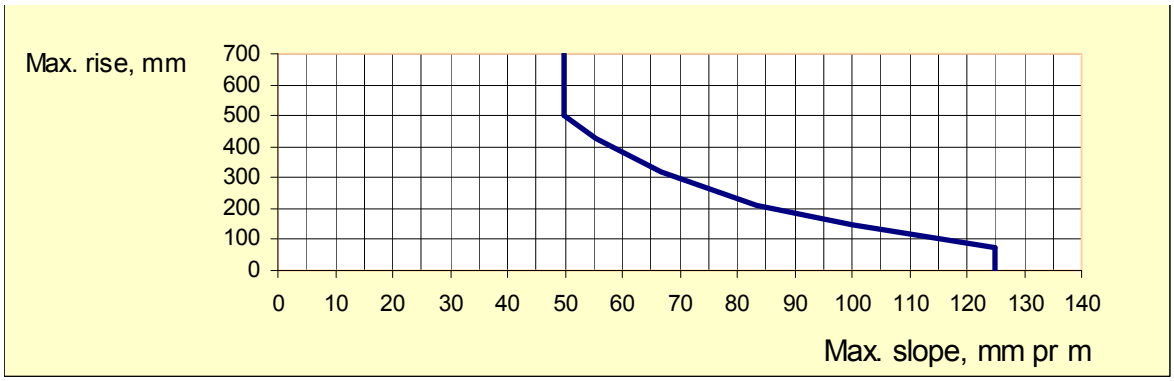


Figure 11 – Approximate graph of ramp slope and rise

Table 3 — Exceptional considerations in adaptation of urban areas or at the entrance of existing buildings

Max. rise, mm	Max. slope	Max. length, mm
1 250	1:12 (83 mm pr m)	15 000
1 000	1:10 (100 mm pr m)	7 650
375	1:8 (125 mm pr m)	3 000
35	threshold ramp: 1:8 (125 mm pr mm) without handrails	280

The graph in figure 12 shows approximate rise and slope for values not mentioned in table 3.

Ramps with a gradient greater than 1:12 (83 mm pr m) should only be used in existing environments under special circumstances decided at a national level.

NOTE A ramp with a gradient greater than 1:12 (83 mm pr m) is difficult to use and may create the risk of an accident, especially for frail older people and people in wheelchairs.

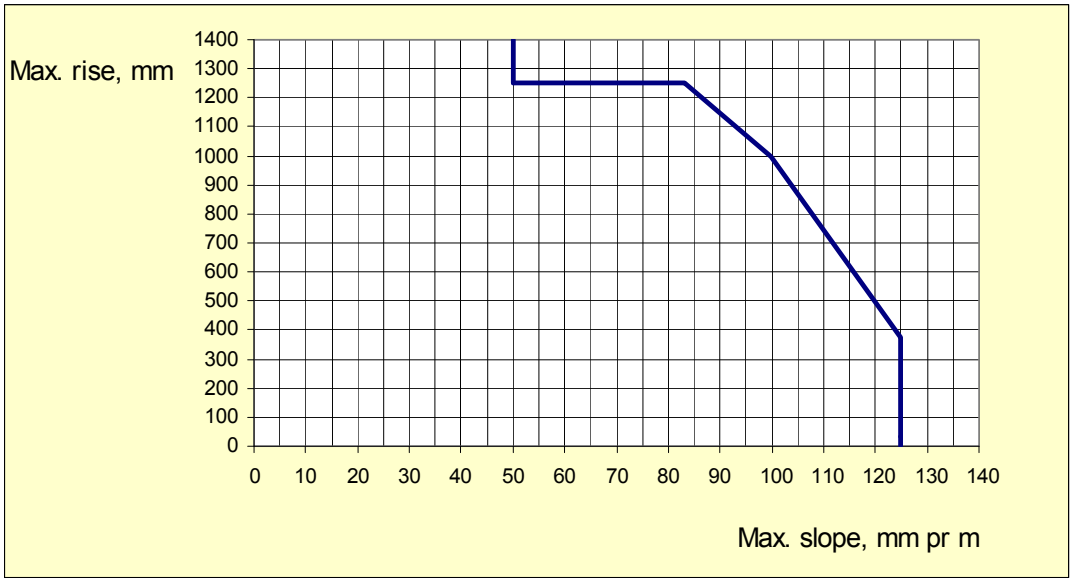


Figure 12 – Approximate graph of ramp slope and rise for exceptional considerations in adaptation of urban areas or at the entrance of existing buildings

8.2 Width of ramps

– The surface width of a ramp shall be not less than 1 200 mm.

– The clear width of a ramp shall be not less than 1 000 mm between the handrails or any obstructions.

"Exceptional considerations in adaptation of urban areas or at the entrance of existing buildings": The clear width of a ramp shall be not less than 900 mm.

8.3 Landings of ramps

An end landing shall be provided at the foot and the head of a sloped path, a stepped path, or a ramp. The area of an end landing may be a part of the continuing path, see figure 10.

The length of an end landing and an intermediate landing shall be not less than 1 500 mm

The length of an intermediate landing at any change in direction of more than 10 ° shall be at least 1 500 mm measured on the centre line. See figure 10.

"Exceptional considerations for existing buildings": The clear space at the beginning and at the end of the ramp shall be at least 1 200 mm at surface level. Intermediate landings shall also be at least 1 200 mm.

The area of a landing shall be clear of any obstruction including the path of swing, onto it, of a door or gate.

8.4 Support and guidance by handrail on ramps

Consider general requirements of handrails according to 12.3 and the following:

– a handrail shall be provided on at least one side of a ramp when the length of the ramp is 2 000 mm or less and there is an alternative stepped access.

– a handrail shall be provided on each side of a ramp if the ramp exceeds 2 000 mm in length.

The minimum distance between handrails shall be 1 000 mm.

8.5 Drainage of ramp

Consider the general requirements in 7.13.

8.6 Surface materials

Surface materials shall be rigid with a plain and slip resistant surface, in both wet and dry conditions.

9 Guards along paths and ramps

Providing protection at the side of the path protects people who use wheelchairs and ambulant people from injuring themselves as the result of a fall. Examples of protection against falling see figure 13.

– if a level or sloped path is bounded on one or both sides by terrain that slopes downwards by up to 30 ° from the horizontal, a firm and level margin of at least 600 mm shall be provided at the relevant side or sides.

– if a sloped path or ramp is bounded on one or both sides by terrain that slopes downwards by 30 ° or more, an upright kerb of a minimum 150 mm shall be provided at the relevant side or sides. Kerbs shall have a minimum difference in LRV of 30 points to the ramp.

– if a path, or a sloping path, stepped path, ramp, terrace or other unfenced platform rises more than 600 mm above the adjacent ground, it shall be provided with guarding from that point onwards.

Guarding shall be designed to discourage a user, particularly a child from climbing on it.

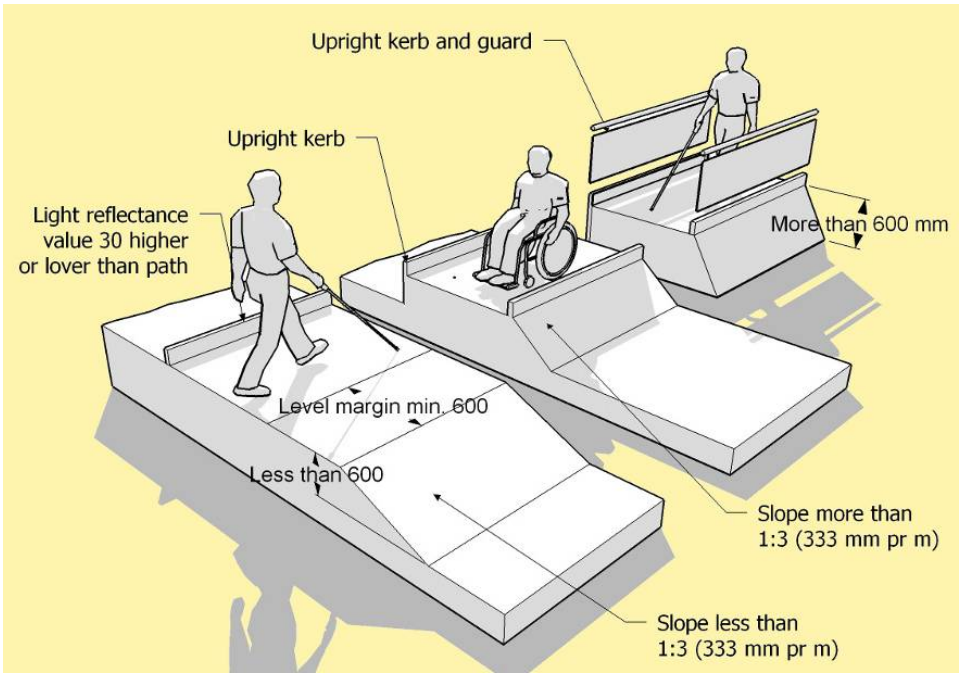


Figure 13 — Examples of protection against falling

10 Building entrances and final fire exits

The entrance(s) including final fire exits, to a building should be easy to locate, safe and convenient to use and have limited exposure to rain and snow. Entrance doors should be sufficiently high and wide, and easy and intuitive to operate (see 18.1).

Information concerning fire safety and fire evacuation procedures should be conveniently located at all entrances and final fire exits. Tactile information plans should be provided for blind persons.

Entrance doors which swing or revolve should be capable of resisting the forces of prevailing winds without opening unexpectedly. Conventional swing doors should always be located adjacent to revolving doors for the purposes of unhindered access and fire evacuation.

These requirements shall be met at the principal entrance to the building.

10.1 Identification

The principal entrance to a building shall be identifiable from the boundary of the site and from any designated accessible parking spaces the site. If the entrance cannot be easily located, suitable means of visual and tactile wayfinding shall be provided.

10.2 Floor level at the entrance

Entrances into the building shall be free from any change in floor level. Any raised threshold should not exceed 15 mm.

Where a raised threshold is necessary, it shall have maximum height of 15 mm, be bevelled down to a height of 10 mm, and have a minimum difference in LRV of 30 points compared to the floor.

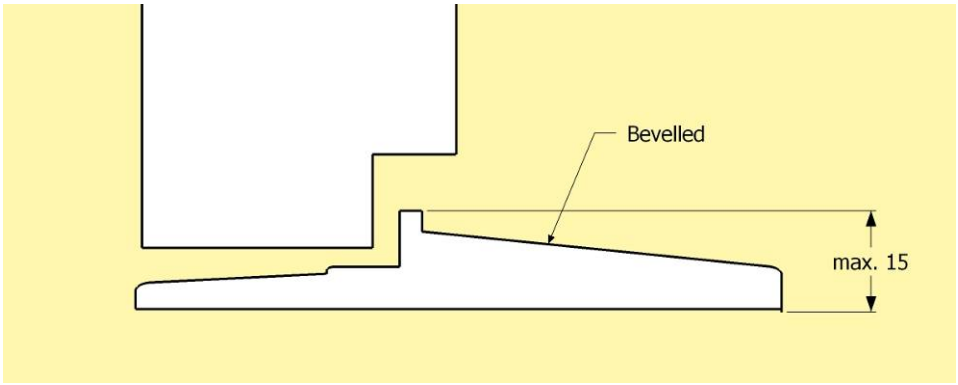


Figure 14 – Bevelled threshold

If the level of the entrance storey is above that of the surrounding ground, a suitable sloped or ramped approach and landing shall be provided immediately outside the principal entrance.

The surface of any permanent or temporary feature, provided at floor level to limit incoming dirt or water, should be set flush with the remainder of the floor.

10.3 Principal entrance doorway

Detailed requirements for doors are specified in section 18.

10.4 Passage width

The minimum clear passage width of an entrance doorway shall be not less than 800 mm; 850 mm or more is recommended as more space may be required for a person using a powered wheelchair.

NOTE Many building regulations require a minimum width of 900 mm for an entrance door.

10.5 Passage height of a doorway

The minimum clear passage height of a doorway shall be not less than 2 000 mm.

10.6 Circulation space

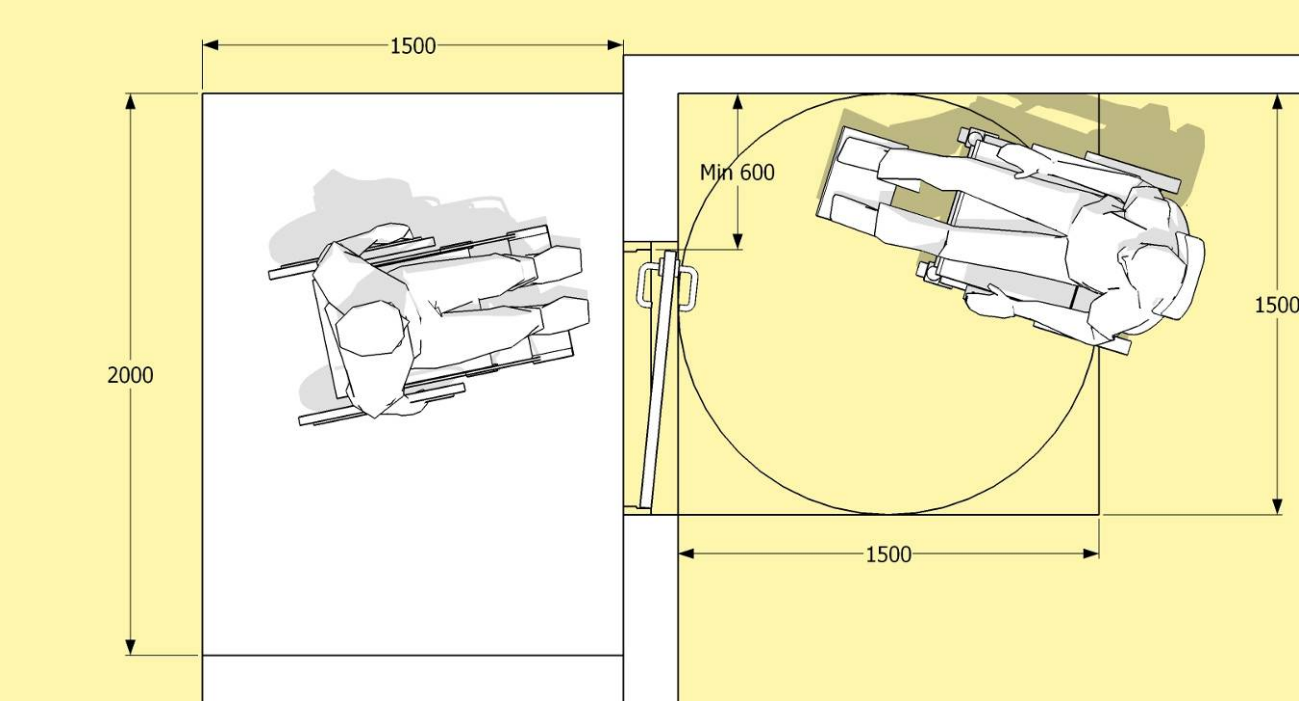


Figure 15 — Circulation space inwards and outwards of a swinging door

In front of the door opening into the building, there should be a minimum horizontal manoeuvring space of 1 500 mm by 1 500 mm. Where doors open outwards, there shall be minimum 1 500 mm by 2 000 mm. A clear space of 600 mm (700 mm recommended) at the side of the door is required to allow someone to operate the door handle; see figure 15.

For alternative openings and constructions consider A.7.

10.7 Lobbies

Lobbies should allow people to enter the built environment without any hindrance or barriers. Consideration shall be given to the requirements for doors according to 18.1.

10.7.1 Unobstructed manoeuvring space

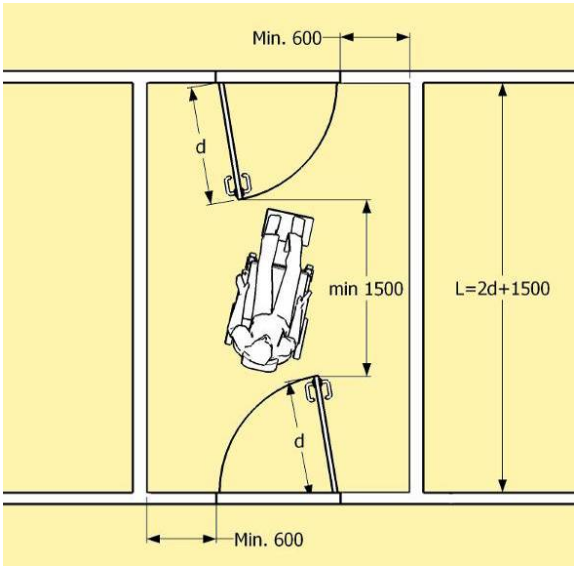


Figure 16 — Minimum dimensions of lobbies with single leaf single swing doors

The minimum unobstructed manoeuvring space between doors in an entrance lobby shall be not less than 1 500 mm free of the door swing (2d + 1 500 mm – see figure 16).

For buildings where a person with a mobility impairment might be assisted in entering the premises, these minimum dimensions must be increased.

In single swing doors, in the lobby, the door shall swing outwards.

10.8 Visual awareness of an entrance door

Except when necessary to maintain security or privacy, an entrance door shall be designed to permit visual awareness of the layout of the building immediately beyond.

Consider also requirements for viewing panels in 18.1.5 and for visual contrast in 18.1.6.

11 Horizontal circulation

The main horizontal circulation design shall be level on each storey in order to ensure that the building is accessible to all people. Horizontal circulation shall be without steps. Where differences in level cannot be avoided, ramps, lifts or platform lifts shall be provided, see 8, 15 and 16.

Buildings should be designed, constructed and managed so that the internal layout is accessible and easily understood. All aspects of horizontal circulation, including corridors, should be designed to facilitate ease of movement for all people.

In order to avoid a tripping hazard (especially during a fire evacuation), where a raised threshold is necessary at a door opening, its maximum height shall be 15 mm, be bevelled, and have a minimum difference in LRV of 30 points compared to the floor.

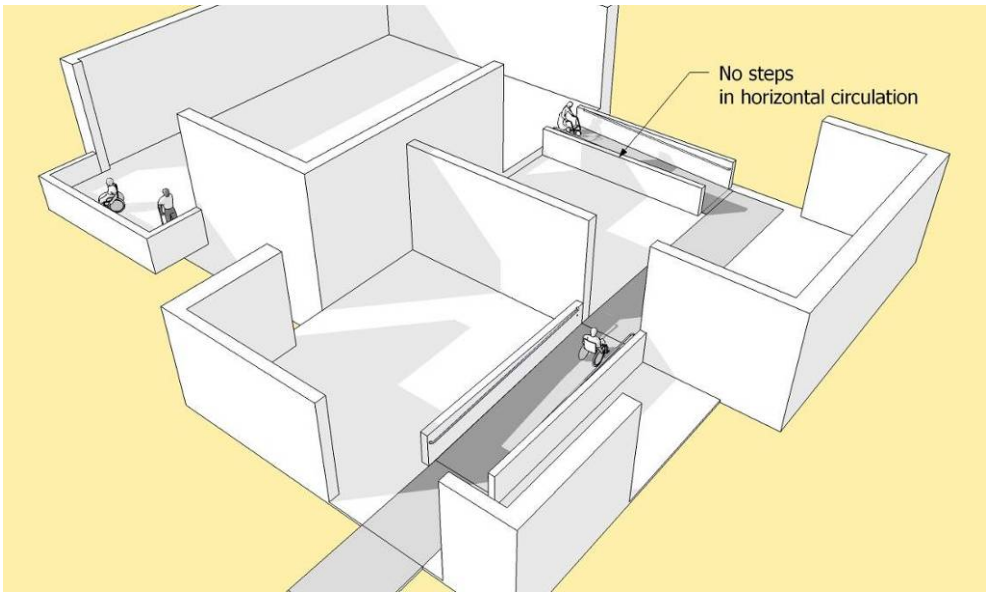


Figure 17 — Horizontal circulation without steps

Routes should preferably intersect at right angles to each other and be easy to follow. To facilitate people with visual impairments routes should have detectable delimitations and different luminance from the surroundings. For orientation and way finding in very complex buildings and across large areas, guidance can be provided by tactile walking surface indicators and visual, audible and tactile information, see section 38.

NOTE Handrails can provide support for persons with impaired mobility, guidance for vision impaired and blind persons and for can also support Braille Information or tactile letters in relief for blind persons.

11.1 Internal passages

The minimum clear width of passages shall be 1 200 mm. This dimension shall be exclusive of handrails and any other projections, e.g. portable fire extinguishers, notice boards, coat hooks, etc.

"Exceptional considerations for existing buildings in developing countries": In some member states where shorter and smaller wheelchairs are generally used and due to market situations, the internal passages may be reduced to a width of 900 mm for short straight passages of maximum 2 000 mm length. Wherever possible this internal passage width should be increased to 1 200 mm.

Adequate circulation space, where a doorway exists, shall be provided, consider Annex E.

Intensity in use of the corridor shall be a criterion when establishing the minimum width and length of the corridor (see figure 18).

NOTE In some countries the width of passage used for escape is defined by other criteria (e.g. number of people, surface of premises) see also Annex A.

Junctions within a corridor shall have a turning circle with a diameter of 1 800 mm or more, clear of any obstructions, see figure 19.

The minimum clear height of corridors shall be 2 100 mm.

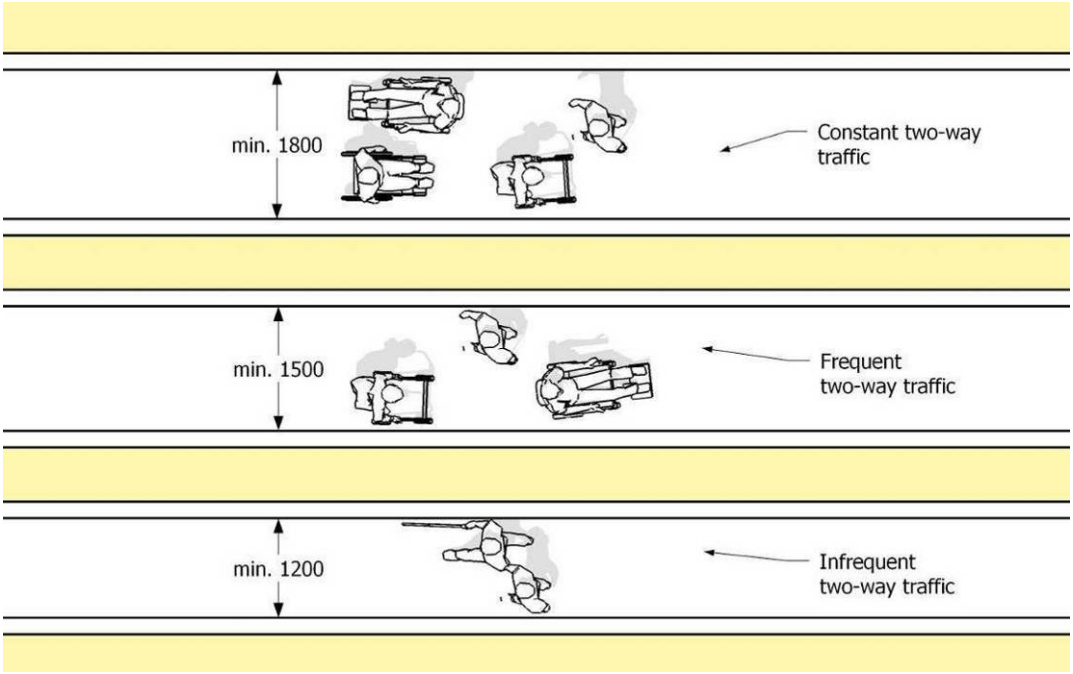


Figure 18 — Different corridor widths determined by intensity of use

Hanging objects on walls should be avoided, except when they comply with 7.14. The minimum clear width shall remain 900 mm.

11.2 Turning space for 90 ° turn of a wheelchair in corridors

The manoeuvring zone required for a wheelchair to make a 90 ° turn shall be designed according to figure 19:

It shall have:

— a gradient no steeper than 1:40

— be not be less than 1 200 mm wide and 1 200 mm long in the direction of travel.

If one corridor has a dead end the solution in figure 20 has to be considered.

A corridor 1 500 mm long in the direction of travel is recommended for ease of turning.

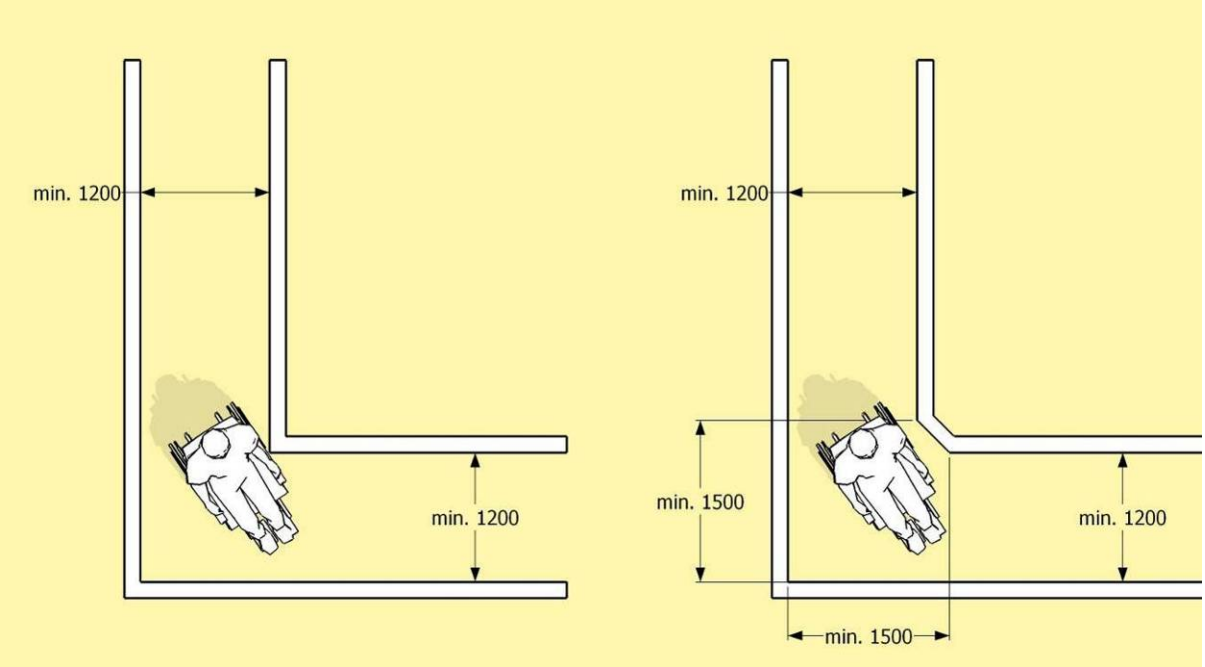


Figure 19 — Minimum and recommended space required for a 90 ° turn

11.3 Circulation space for 180 ° wheelchair turn

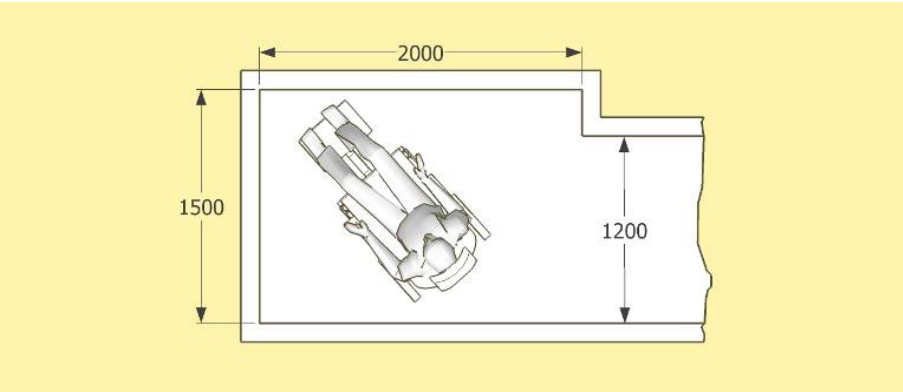


Figure 20 — Space required for a 180 ° turn in a corridor

The space required for a wheelchair to make a 180 ° turn shall be not less than 2 000 mm in the direction of travel and not less than 1 500 mm wide (see figure 15).

For landing dimensions, see 13.3.

12 Vertical circulation

Vertical circulation within buildings should be designed, contructed and managed so that it can easily be understood and used by people. Vertical circulation includes the provision of stairs, lifts and ramps, as well as escalators, travelators and platform lifts.

12.1 Ramps in buildings

General requirements for ramps are set out in 8. Internal ramps should, if possible, be avoided. Where required internal ramps shall be designed in accordance with the following additional criteria:

— no series of ramps should rise more than 2 000 mm in total. If this is the case, an alternative should be provided, e.g. a lift;

— in order to avoid trips and falls during a fire evacuation, a gradient of 1:15 (6.6 cm pr m) should be the maximum permissible gradient within a building

An internal ramp should have the lowest practical gradient.

The minimum illumination at the top and bottom of the ramp should be 200 lux and 150 lux in between the bottom and top. See lighting requirements in section 33.

13 Stairs

13.1 Rise and going of steps

The rise and tread of steps within flights shall be uniform.

For the purpose of safe assisted fire evacuation of people, the rise of a step should not have a height greater than 150 mm, and the going of a step should be not less than 300 mm. The minimum going of the tread shall be 260 mm, and the the maximum rise shall be 180 mm.

The sum of the going and twice the rise of a step shall be not less than 600 mm and not more than 660 mm.

The rise of a step shall not be open.

The projection of a step nosing over the tread below shall be avoided but, if necessary, not more than 25 mm.The nosing shall provide an uninterrupted transmission between riser and tread, see figure 21.

A flight of steps should not contain more than 12 risers. However, in circumstances where the plan area is restricted, a flight of a stairs shall contain no more than 16 risers. Successive flights should contain the same number of risers.

The minimum illumination at the top and bottom of the flight should be 200 lux and 150 lux along the stairs. See lighting requirements in section 33.

13.2 Minimum width of stair flights

The minimum width of a flight of stairs shall be 1 200 mm.

The minimum width between handrails shall be 1 000 mm. The width between handrails should not be more than 1 700 mm.

To allow sufficient space to safely carry an occupied wheelchair downwards while providing space for the purpose of accommodating contraflow, i.e. emergency access by firefighters rescue teams entering a building and towards a fire, while people are still evacuating from the building, the clear unobstructed width, exclusive of handrails and any other projections, e.g. portable fire extinguishers, notice boards, etc. of the flight of a single- or multi-channelled stairs should be not less than 1 500 mm. The surface width of a flight of stairs should not be less than 1 700 mm.

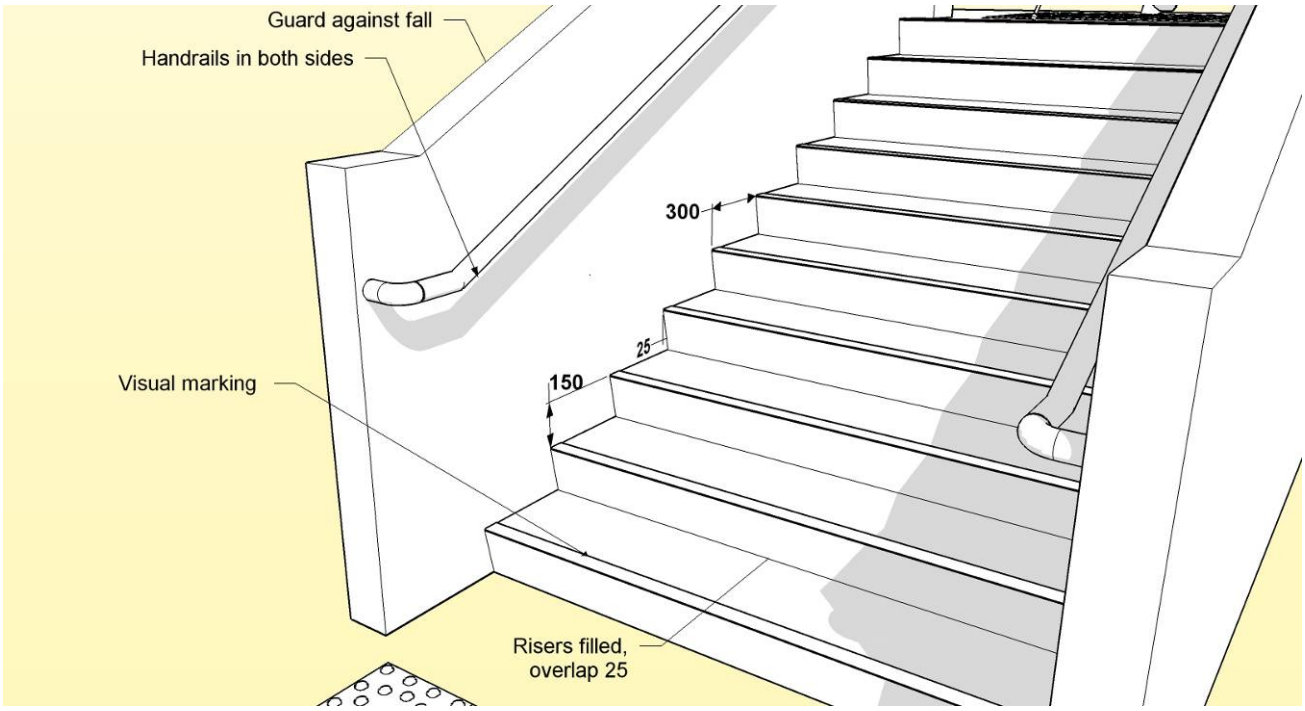


Figure 21 — Recommended going and rise of steps with riser overlap

13.3 Staircase landings

The area of a landing shall be clear of any obstruction including the path of the swing of a door or gate. Where there is a half landing or a 180 ° turn, it shall never be less than 1 500 mm wide in order to facilitate carrying a person on a stretcher.

If the stepped path is multi-channelled, the length of an intermediate landing shall not be less than the clear width of the widest channel.

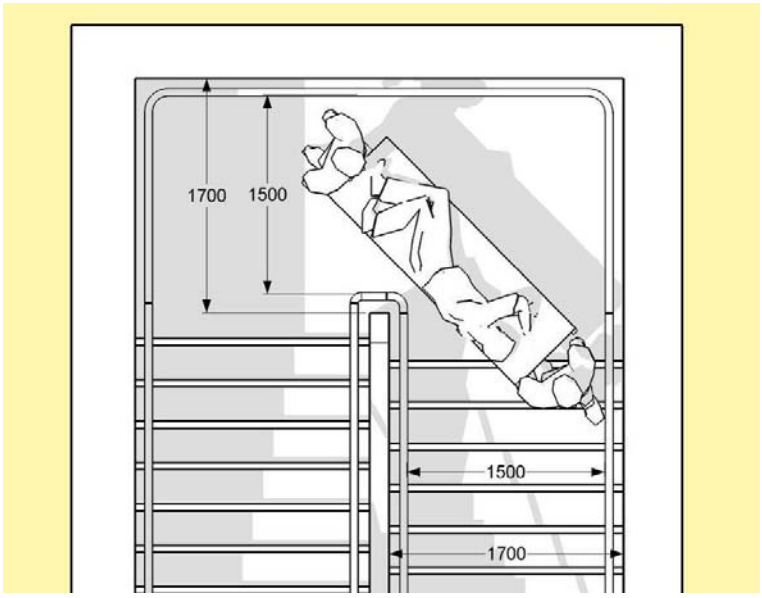


Figure 22 — Example of stair and 180 ° landing for emergency access

13.4 Head clearance

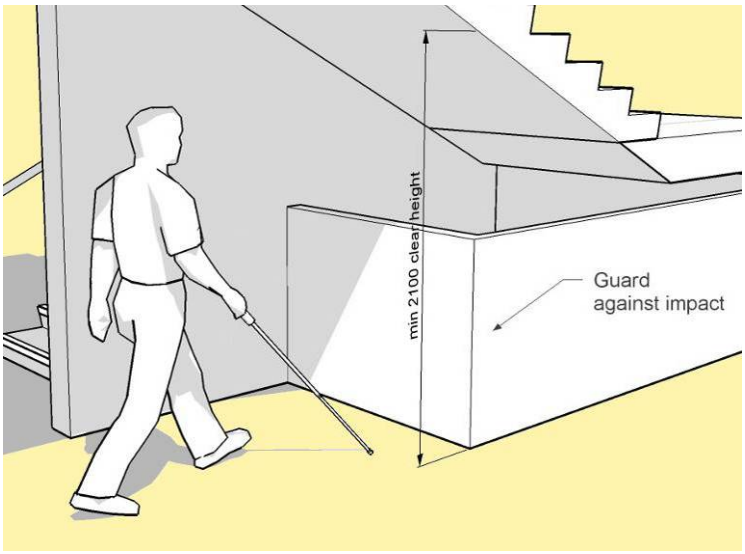


Figure 23 — Clear height under stairs

Clear accessible height under stairs shall be a minimum of 2 100 mm or greater. If the clear height is less than 2100 mm a guard or other element shall be provided to shield against impact. See figure 23.

Head clearance on the stair shall be minimum 2 100 mm.

13.5 Visual and tactile warnings

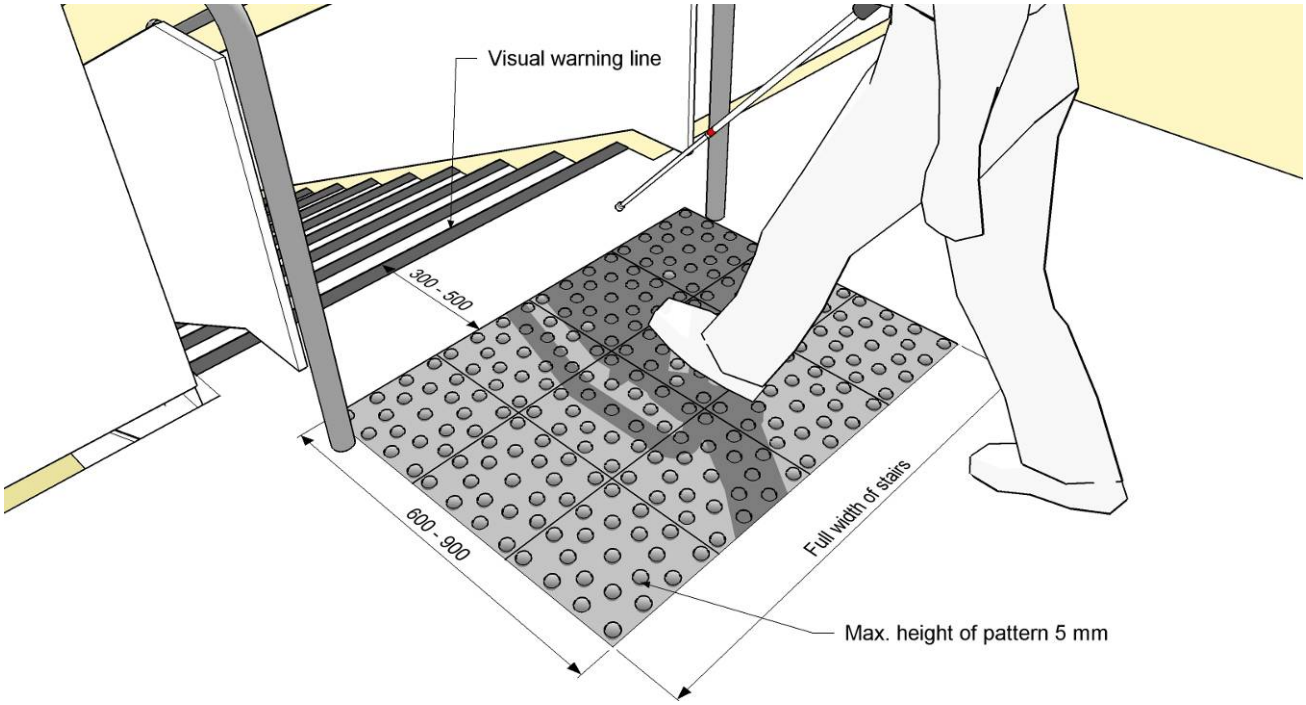


Figure 24 — Tactile walking surface indicator (TWSI) and visual indicator

There shall be a visual contrast between landings and the top and bottom step of a flight of stairs. Preferably, a visual warning line of 40 mm to 50 mm shall be provided on the front edge of the going of each step with a minimum difference in LRV of 60 points. As an alternative solution a visual warning line with a width between 50 mm and 100 mm shall be provided on the going of the first and the last step of the flight.

Where a stair is on the direct line of travel or in an open area, a tactile attention pattern shall be provided. National regulations may require the systematic use of tactile warning at any stair.

Where tactile attention patterns are used, they should be provided on the landings at top and bottom of every flight of stairs across the whole width of the stair. The tactile attention pattern should have a depth of between 600 mm and 900 mm ending 300 mm to 500 mm before the front edge of the first down going step. For dimensions of attention patterns see Annexe C.

Where tactile attention patterns are used at the top and bottom of stairs the attention pattern shall not reduce visual detection of the first and the last step of the flight.

13.6 Guards along stairs

Consider 9.

Handrail requirments are specified in section 14.

14 Handrails

A handrail provides a means of support, stability and guidance for the user. The presence of a handrail will assist most people in climbing or descending a flight of steps or a ramp. However, a handrail will also provide an essential means of support, stability and guidance for all building users during a fire evacuation.

Handrails shall be provided for stepped and sloped paths, ramps and stairs and lift cars according to the following requirements.

14.1 Provision of handrails

See specific requirements concerning handrails for paths in 7.12 and for ramps in 8.4**.**

– a handrail shall be provided on both sides of all flights of stairs,

– a central handrail should be provided when the clear width of the stairs exceeds 2 700 mm; provided that a clear width of at least 1 500 mm is provided on one side. Consider also ISO/DIS 12055.

“Exceptional considerations for existing buildings”: a handrail should be provided, at least, at one side of the flight (principal difficulties arise in relation to heritage buildings).

14.2 Profile of a handrail

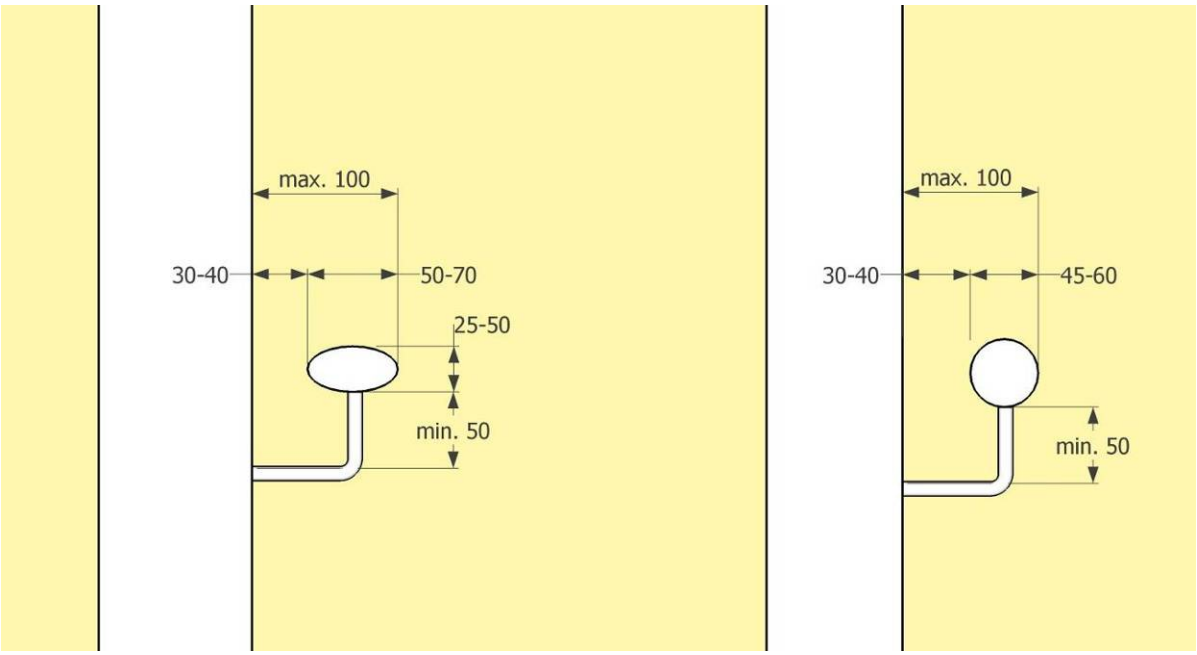


Figure 25 — Elliptical and round handrail profile

A handrail shall:

a) have an elliptical profile of 50 mm – 70 mm wide and 25 mm – 50 mm deep, or have a circular profile of not less than 45 mm or not more than 60 mm in diameter, as shown in figure 25;

b) be located to provide a clear space between 30 mm to 40 mm from an adjacent wall or other obstruction;

c) be supported centrally from below, with not less than 50 mm between the underside of the handrail and the top surface of the support;

d) have a surface that is slip resistant.

NOTE A wide and relatively flat-topped surface on a handrail provides better support than does a regularly curved one. Graspability is better on a handrail that does not require significant hand and finger joint movement. For these reasons, the use of a handrail that is elliptical is preferred.

14.3 Continuity of a handrail

Handrails should be continuous throughout the flight of a ramp, stair, stepped path and intermediate landing, except where they intercept with a doorway or path of travel.

14.4 Height of a handrail

The height to the top of a handrail shall be between 850 mm and 1 000 mm above the surface of a ramp, stair, landing or stepped path.

If a second handrail is provided, it should be between 600 mm and 750 mm in height.

If a stair rises more than 600 mm above the adjacent ground, it shall be provided with guards from that point on; see section 9.

14.5 Horizontal extension of a handrail

A handrail on a stepped path, stair or ramp shall have a horizontal extension of not less than 300 mm beyond the first and last nosing of each flight.

A handrail shall not project into a transverse circulation path unless it is continuous and intended to form part of the guidance along that path.

The end of the horizontal extension should be turned towards the wall on the closed side of the ramp or stairs, or be turned down and terminate at the floor or ground level.

NOTE This provision supports people with mobility impairment and limits the risk of clothing being caught.

14.6 Visual and tactile information

The minimum visual contrast of a handrail to the adjacent background (e.g. wall) shall comply with the requirements outlined in 35.

Tactile symbols or raised text shall be unobtrusively and permanently fitted or fixed to handrails as an important source of information for people who have a vision impairment, e.g. indication of floor number, direction of fire evacuation, location of final fire exits, etc.

Visual and tactile information should be provided according to 7.1, 33, 35, 38 and 40.

14.7 Mechanical resistance

Handrails shall be securely fixed and rigid. The fastenings and the materials shall be able to withstand a minimum load, both vertical and horizontal of 1.2 kN.

15 Lifts (Elevators)

15.1 General comments

All levels of a building should be accessible with ramps or lifts (elevators). Lifts shall be accessible for all persons, including those with disabilities.

NOTE Requirements for the minimum size and numbers of lift cars are a matter of national building regulation.

Where national regulations do not require a lift in a mulit-storey building, a space for an accessible lift with a minimal car size of 1 100 mm x 1 400 mm should be provided for later adaptation.

Requirements concerning the size of the lifts are stated in ISO 4190-1 as lifts *“accessible for wheelchairs”* in two categories:

– "*accessible lift cars for wheelchairs*" which fulfil minimum accessible requirements,

– “*accessible lift cars for wheelchairs*” for full manoeuvrability of a wheelchair within the lift car.

The requirements of ISO 4190-1 give dimensions for a wide range of accessible lifts. Different classes are defined:

– Class I, Residential lifts,

– Class I, General–purpose lifts,

– Class III, Health–care lifts,

– Class VI, Intensive–use lifts,

– Lifts for specific local markets,

All technical requirements for accessible lifts shall comply with ISO 4190-1.

All control devices, signals and additional fittings shall comply mainly with ISO 4190-5:2006, except when in some clauses of this lift section other requirements are specified, especially where particular requirements for easy access for disabled persons are mentioned.

NOTE EN 81-40 for chair lifts and inclined platform lifts and EN 81-41 for vertical platform lifts are relevant standards in Europe.

The following accessibility requirements shall apply.

15.2 Car dimensions

Accessible lift car sizes have to be chosen according to ISO 4190-1:1999, marked with the wheelchair symbol which fulfil minimum accessible requirements. For full manoeuvrability of a wheelchair, the lift car sizes with the wheelchair symbol shall be chosen.

The minimum size of an accessible lift car which can be used by persons with wheelchair or walking aids and an accompanaying person is 1 100 mm x 1 400 mm. The entrance door with a minimum clear opening of 800 mm shall be provided on the narrow side of the car. Recommended clear width of door opening is 900 mm. Conisder ISO 4190-1:1999, Class I – General-purpose Lifts, Series A with 800 mm entrance, 630 kg, car size 1 100 mm x 1 400 mm:

If a trolley with a strechter is considered necessary a car size 1 100 mm x 2 100 mm has to be used. The door with a minimum clear width of 900 mm has to be provided on the narrow side of the car. Conisder ISO 4190-1:1999, Class I – General-purpose Lifts, Serie B with 900 mm entrance, 1 000 kg, car size 1 100 mm x 2 100 mm.

If a door is provided on two adjacent sides the minimum car size is 1 600 mm x 1 400 mm with 1 100 mm entrance. Consider e.g. ISO/4190.1:1999, Lift Class I – Serie C with 1 100 mm entrance., 1 000 kg, car size 1 600 mm x 1 400 mm

In ISO 4190-1:1999 many additional accessible lift cars e.g. to facilitate transporting a stretcher or bed are described and clearly marked with the wheelchair or bed symbol. All these accessible lifts allow full manoeuvrability for people with wheelchair and walking aids.

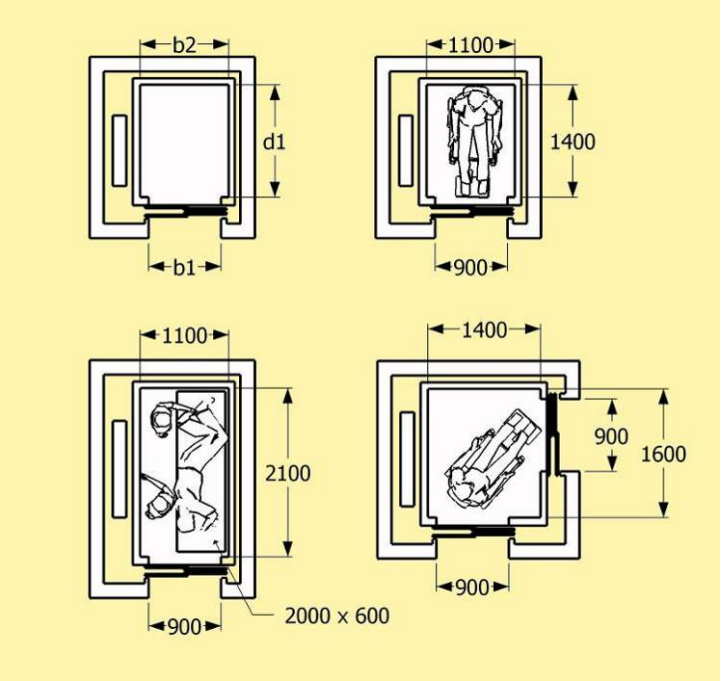


Figure 26 — Examples of lifts accommodating one person in a wheelchair, a person on a stretcher and a person performing a 90 ° turn between two adjacent lift doors

15.3 Entrances – door opening

Accessibility of the landing is required on all eligible floors.

The entrance clear door opening shall be at least 800 mm.

NOTE National regulations can require more than 800 mm (see Introduction)

For series B lifts a clear entrance door opening of 900 mm should be provided. For series C lifts the clear entrance door opening of 1 100 mm is specified in ISO 4190-1:1999, table 1.

The car and landing doors shall be constructed as automatic power operated horizontally sliding doors.

The colour and tone of the doors should contrast with the surrounding wall finish to assist with the location of the doors; see section 35.

The control system shall allow for the door open time to be adjustable to suit the conditions where the lift is installed (normally between 2 s and 20 s). A mechanism to reduce this time shall be installed e.g. by using a door close button in the car. The means of the adjustment shall not be accessible to users.

A presence sensor device shall cover the opening over the distance between at least 25 mm and 1 800 mm above the car door sill (e.g. light curtain). The device shall be a sensor which prevents physical contact between the user and the leading edges of the closing door panel(s).

Sufficient manoeuvring space outside the car door shall be provided according to 19.3 and B.8.1. If a stair is situated opposite the car door the distance to the stair shall be at least 2 000 mm to allow for safe manoeuvring (see figure 27). The manoeuvring area shall be adequately lit with a minimum illumination of 100 lux.

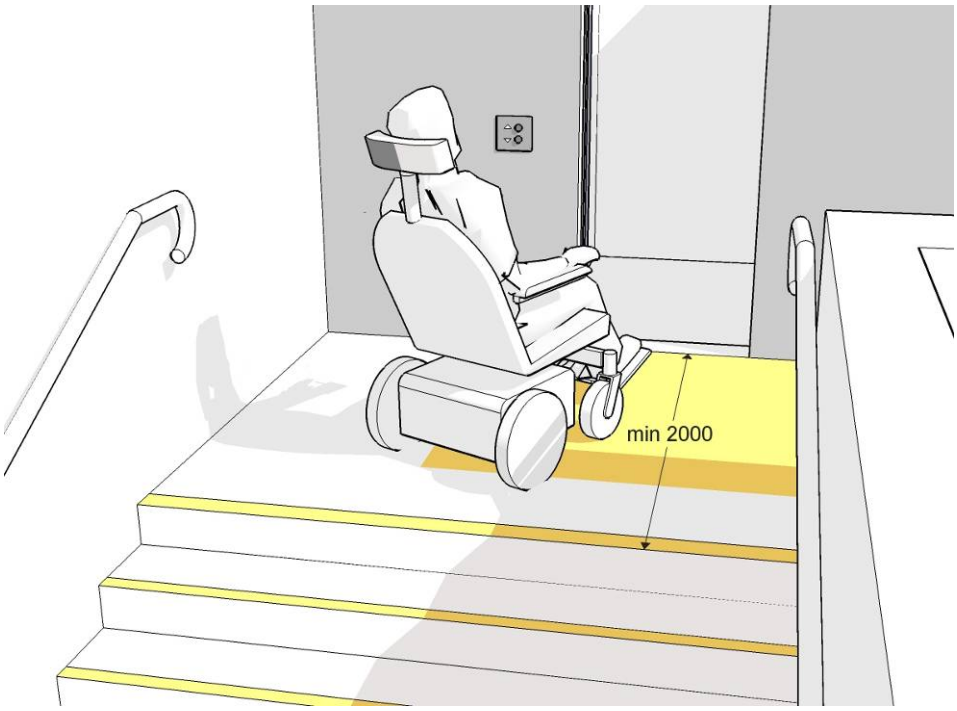


Figure 27 — Manoeuvring space outside the car door opposite a stair

A distinguishable floor surface, approximately 1 500 mm x 1 500 mm outside the doors, will aid in location. This could be a change of colour or floor finish. Changes in floor finish should be flush.

15.4 Equipment in the car

15.4.1 Handrail

At least one handrail shall be provided in the car and shall be fixed horizontally on the same side as the car operating panel; recommended one handrail on all sides except across the door. Handrails shall comply with the requirements according ISO 4190-5:2006, Annex B, B.5.

The gripping part of the handrail shall

— be between 30 – 45 mm in diameter,

— be located between 55 mm and 70 mm from the car panel.

— have no sharp edges.

The handrail shall be fixed at a height from the floor at 850 mm ± 10 mm.

The free space between the wall and the gripping part shall be between 35 mm and 45 mm.

The handrail shall be interrupted where the car operating panel is located on the same wall, in order to avoid obstructing buttons or controls.

The projecting ends of the handrails shall be closed and turned towards the wall to minimise the risk of injury.

15.4.2 Seat

Where a fold-up seat is provided, it shall have:

— a seat height from the floor: (500 ± 20) mm;

— a depth of 300 - 400 mm;

— a width of 400 - 500 mm;

— an ability to support a load of 100 kg.

15.4.3 Mirror or mirrored wall within the car

In case of a car size of 1 100 mm x 1 400 mm where a wheelchair user cannot turn around, a device (e.g. a small mirror) shall be installed to enable the user to observe obstacles behind when moving backwards out of the car. Where a glass mirror is used it shall be safety glass.

Where any wall of the car is substantially mirrored or covered with a reflective surface, measures shall be taken to avoid creating optical confusion (e.g. decorated glass, or a minimum vertical distance of 300 mm between the floor and the bottom edge of the mirror, etc.).

15.4.4 Floor and wall surfaces of the car

Internal walls shall have a non-reflective, matte finish in a colour and tone contrasting with the floor.

The car floor shall be rigid, slip-resistant and have a non-reflective, matte finish.

The floor of the car should have a similar surface characteristic to the landing floor. The control buttons should protrude slightly from the car wall.

15.4.5 Allergic materials

Surface materials that a user may be allergic to include nickel, chromium, cobalt and natural or synthetic rubber; these materials should be avoided in buttons, controls, handles or handrails. See Annex B. 11.

15.4.6 Lighting

Internal car lighting should provide a minimal level of illumination of 100 lux at floor level, uniformly distributed, and avoiding the use of spotlights.

15.4.7 Emergency warnings

Emergency warnings shall comply with requirements in ISO 4190-5:2006.

The car shall have an alarm device (two-way communication system) permanently connected to a safety organization according to the following:

a) The device shall ensure voice communication in both directions with an organization in charge of passenger rescue or the person in charge of the safety of the building.

   NOTE As an aid to communication, an induction loop can assist people with impaired hearing. In this case, the availability of the induction loop is shown in the car by the symbol “induction loop” — audio frequency induction loop system (AFILS).

b) A minimal operating force shall not be used to send the alarm.

c) The device shall provide visual and audible information feedback for passengers confirming

- the alarm has been sent, using a “bell” symbol, and
- the alarm has been received, voice communication established, using the “communication established” symbol.

15.4.8 Stopping/Levelling accuracy

The stopping accuracy of the car shall be ± 10 mm and a levelling accuracy of ± 20 mm shall be maintained.

15.5 Control devices and signals

Landing and car control devices shall be applied to suit all customers including persons with disabilities and/or to meet national regulations for lifts specifically designed to increase accessibility for persons with disabilities – particularly those in wheelchairs, blind persons and persons with vision impairments.

Landing and car control devices and signals – applicable to a nominal load ≥ 630 kg for passenger lifts – shall comply with ISO 4190-5:2006; especially those recommended for ensuring the ease of use and access for disabled persons which are specified in ISO 4190-5:2006, Annexes A, B and C.

If keypad systems and destination oriented lifts are provided they shall be designed according ISO 4190-5:2006, Annex A.

On landings the control devices shall fulfil the requirements according ISO 4190-5:2006, Annex B, B.2.

In the car horizontal control devices according ISO 4190-5:2006, Annex B, B.3 shall be provided; see figure 28, 29 and 30. For additioinal vertical car operating panel the requirements are specified in ISO 4190-5:2006, 3.2.2.2 a), b), g) and h).

All representative symbols to be used shall be applied according ISO 4190-5:2006, Annex C.

For passenger lifts accessible to wheelchair users, the lateral distance between the centreline of any button to any corner of adjacent walls, shall be minimum 600 mm (700 mm recommended) unlike the requirement in ISO 4190-5:2006.

In order to maximise the visibility, visual contrasts in colour, or, more importantly, tone, can be used to help identify objects and avoid hazards. Proper lighting is essential in conjunction with colours. Blind people need tactile Information with contrasting raised letters and Braille and audible announcements on each level to be able to function independently. Tactile figures are both visual and tactile. They should have a good visual contrast according section 35 to help people with impaired vision.

A black number or letter on a white background is easiest to perceive, and if lit, the contrast should be the other way round in order to avoid glare. Tactile figures, in order to be easy to perceive, should not be smaller than 15 mm high. The profile of the relief figure should be shaped as a rounded upside-down turned letter V with the height of at least 0,8 mm.

Braille can be used as a complementary and independent feature to tactile figures and is useful where large texts are necessary.

The lift call button should be colour and tone contrasted with the surrounding finishes. This can be achieved using a contrasting panel, or a contrasting border around the button panel.

For passenger lifts accessible to wheelchair users, the buttons shall be accessible by parallel approach of the wheelchair travel. The recommended distance to the centre line of any of the buttons from any wall or door at right angles is 500 mm minimum.

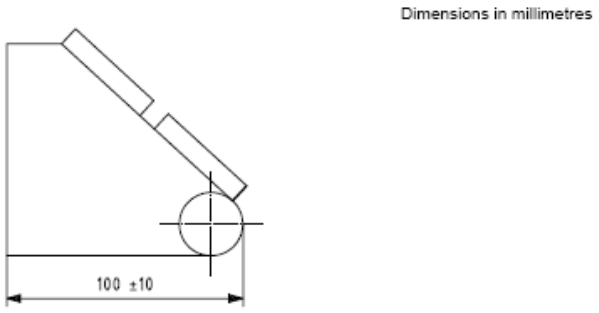


Figure 28 — Horizontal car controls, XL type - Side view, example (ISO 4109-5:2006)

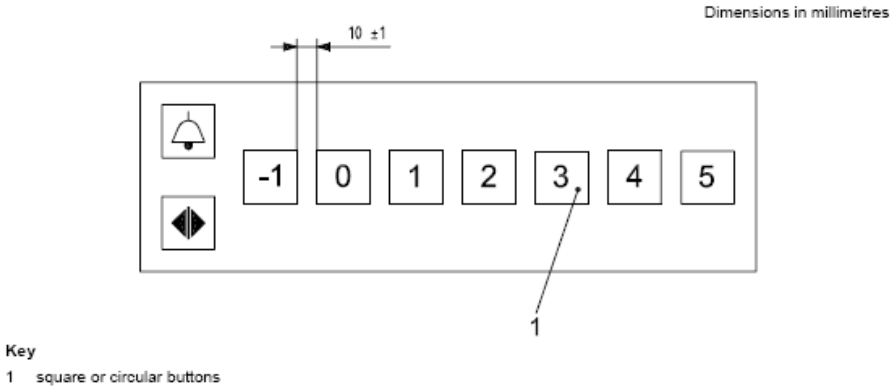


Figure 29 — Example of arrangement of one row of square push buttons (50 mm x 50 mm) (ISO 4109-5:2006)

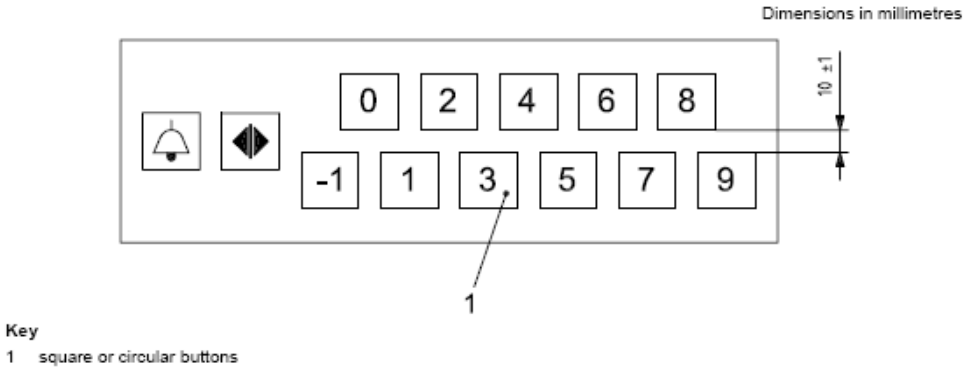


Figure 30 — Example of arrangement of two rows of square push buttons (50 mm x 50 mm) (ISO 4109-5:2006)

15.6 Use of lifts (elevators) for fire evacuation

It is a fundamental principle of fire engineering design for evacuation that there must be alternative, safe and intuitive evacuation routes away from the scene of a fire, which can occur at any time and in any part of a building; these evacuation routes must be available to all building users.

Manual handling of occupied wheelchairs in a fire evacuation staircase, even with adequate training for everyone directly and indirectly involved, is hazardous for the person in the wheelchair and those people -

minimum three - giving assistance. The weight of an average unoccupied powered wheelchair, alone, makes manual handling impractical.

All lifts/elevators in new buildings should, therefore, be capable of being used for evacuation in a fire situation. Lifts/elevators in existing buildings, when being replaced or undergoing a major overhaul, should then be made capable of use for this purpose.

It is essential that any lift/elevator used for evacuation can continue to operate effectively and safely, under strict management, for a specified time during a fire.

Firefighting lifts/elevators may be used for the evacuation of building users up until the time that firefighters arrive at the building and take control of the lifts/elevators. Prior liaison and pre-planning is always necessary with local fire authorities to agree suitable procedures with regard to this use of the lifts/elevators.

All lifts/elevators used for evacuation should be accessible, clearly identified and have adequate structural, fire and electrical protection to meet the project-specific fire engineering design objectives which have been developed by a fire engineer or other suitably qualified and experienced person. In order to adequately protect people with disabilities, however, the scope of these fire engineering design objectives will, typically, extend beyond the scope of the fire safety objectives in national codes and regulations.

The location of lifts/elevators in a building, preferably outside a central position on plan, should always be considered in relation to their supporting fire evacuation staircases, with associated areas of rescue assistance, and direct protected access to final fire exits leading to places of safety remote from the building.

See also section 38.

16 Vertical platform lifts and platform lifts on an inclined plane

16.1 General application

“Exceptional considerations for existing buildings”: vertical platform lifts and platform lifts on an inclined plane shall be provided in existing buildings only where no accessible lift according section 15 is possible:

— vertical platform lifts shall comply with ISO 9386-1, ISO 9386-2.

— stair lifts shall comply with ISO 9386-1, ISO 9386-2.

16.2 Height for platform lifts

The height for platform lifts shall be less than 4 000 mm.

16.3 Platform dimensions

The minimum dimension of the platform shall comply with 1 100 mm x 1 400 mm for the use of manual and powered wheelchairs with assistance.

For existing buildings, with minor public importance and less frequency of persons, where sufficient space is not available, other dimensions may be considered as e.g. 900 mm x 1 400 mm or 800 mm x 1 250 mm. Local building regulations should be observed.

16.4 Platform lifts on an inclined plane

The platform shall be able to withstand the application of a force of 300 N.

16.5 Vertical platform lifts

Vertical parts of the platform shall be able to withstand the application of a force of 385 N, acting at right angles at any point over an area of 5 cm^2 of round or square shape, without elastic deformation exceeding 10 mm and without any permanent deformation.

Where the driving, guiding or lifting mechanisms present hazards at the sides of a platform, the mechanisms shall be guarded to protect the users. The guarding shall be smooth, hard and continuous.

17 Escalators and travelators (Moving walkways)

Escalators and moving walks are very common in public buildings. They can greatly facilitate circulation for all building users in large, extensive and complex modern building types.

However, the location of escalators and travelators should always be considered in relation to the position of adjacent fire protected lift/elevator shafts and lobbies, Staircases and their associated areas of rescue assistance.

During normal periods of maintenance and servicing, escalators and travelators will not be operational.

In the event of a fire emergency, building users attempting to evacuate will typically tend to re-trace their routes of entry, whatever the nature of the hazard and wherever it is located. It should be assumed that the electrical supply to escalators and travelators will be terminated or turned off during such emergencies.

For important reasons of safety, therefore, inclined travelators should comply with the requirements for ramps in buildings (see 8.1).

For important reasons of safety, escalators in public buildings should comply with the requirements for the rise and going of steps (see 13.1). Special warning notices and indicators shall be provided at the top and bottom of escalators where step rises reduce suddenly and dramatically when not operational.

Some individuals, in particular older people, might have more than one impairment. Some individuals are not able to use an escalator or moving walk independently and rely on assistance/support being provided by a companion.

The most important issue to take into account during selection and installation of escalators and moving walks is their safe use by all persons.

Lifts are the preferred method of vertical travel for most people with disabilities and in particular wheelchair users and persons with assistance dogs.

Persons with a wheelchair can generally use horizontal moving walks and moving walks with an inclination up to 6 °. Moving walks with inclinations greater than 6 ° and escalators are not considered suitable for persons with wheelchairs.

Warnings about the presence of escalators or moving walks to inform people, including blind people and to avoid that they try to use it in wrong direction (e.g. audible signal or tactile signalisation as TWSI on the ground) shall be provided.

NOTE Different solutions are available worldwide due to the different design concepts and building regulations and are not harmonised. These specialised details need to be integrated with the whole design of the building. Refer to National Standards.

Signs should be provided to indicate the location of other facilities, such as lifts and these facilities should be in close proximity to the escalators and moving walks and easy to find.

Moving walkways shall be free of protruding objects and obstacles up to a height of 2 100 mm.

A minimum level of illumination of 100 lux shall be provided on moving walkways.

18 Doors and windows

18.1 Doors and door furniture

General requirements for entrance doorways see 10.3.

Doorways shall be designed in accordance with the following additional criteria:

— clear width of doors shall be minimum 800 mm, 850 mm or more is recommended,

— clear height of doors shall be at least 2 000 mm (compare with 10.5),

— a level threshold is recommended for internal and external doors,

— where a raised threshold is/exists/provided/necessary, it shall have a maximum height of 15 mm, be bevelled when higher than 5 mm and have visual contrast,

— a level manoeuvring area on either side of a door (see figure 15 and 16)

— If any door is opening towards a descending stair, the minimum safe distance for manoeuvring should be 2 000 mm to minimize the risk for wheelchair users. See also 13.3 landings.

18.1.1 Clear opening of doorways

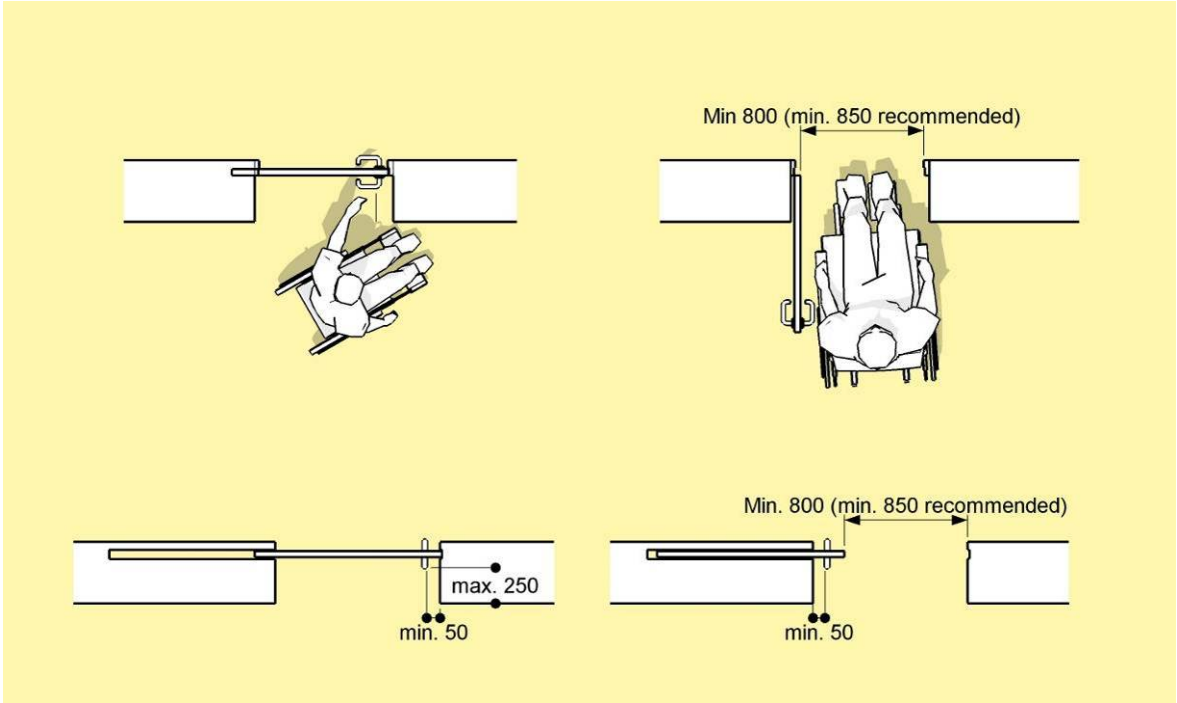


Figure 31 — Clear opening of swinging and sliding doors

The minimum clear opening of a doorway on a continuous accessible path of travel shall be 800 mm when measured from the face of the door (see Figure 31). 850 mm or more is recommended. Consider detailed information and alternatives in A.7.

The maximum distance from the handle of the door leaf to the wall surface shall not exceed 250 mm.

18.1.2 Position of a door

A manoeuvring space of not less than 600 mm shall be provided between the leading edge of a door and a wall that is perpendicular to the doorway. 700 mm or more is recommended. This space is necessary to permit opening of the door by a wheelchair user or a walking frame user (see Figure 31). This requirement does not apply where automatic doors are provided.

18.1.3 Operating force

When the operating force needed to open the door is greater than 30 N at 0 ° and 20 N at 30 ° opening, an automatic opening door is recommended.

People with impaired mobility often experience difficulties when using self-closing doors. The force required to open doors should be adjusted to less than 30 N at 0 ° and 20 N at 30 ° opening

Buildings for public use should preferably have sliding automatic doors with dual powered controlled door opening and closing and a hold-open device.

18.1.4 Glazed doors and glazed areas

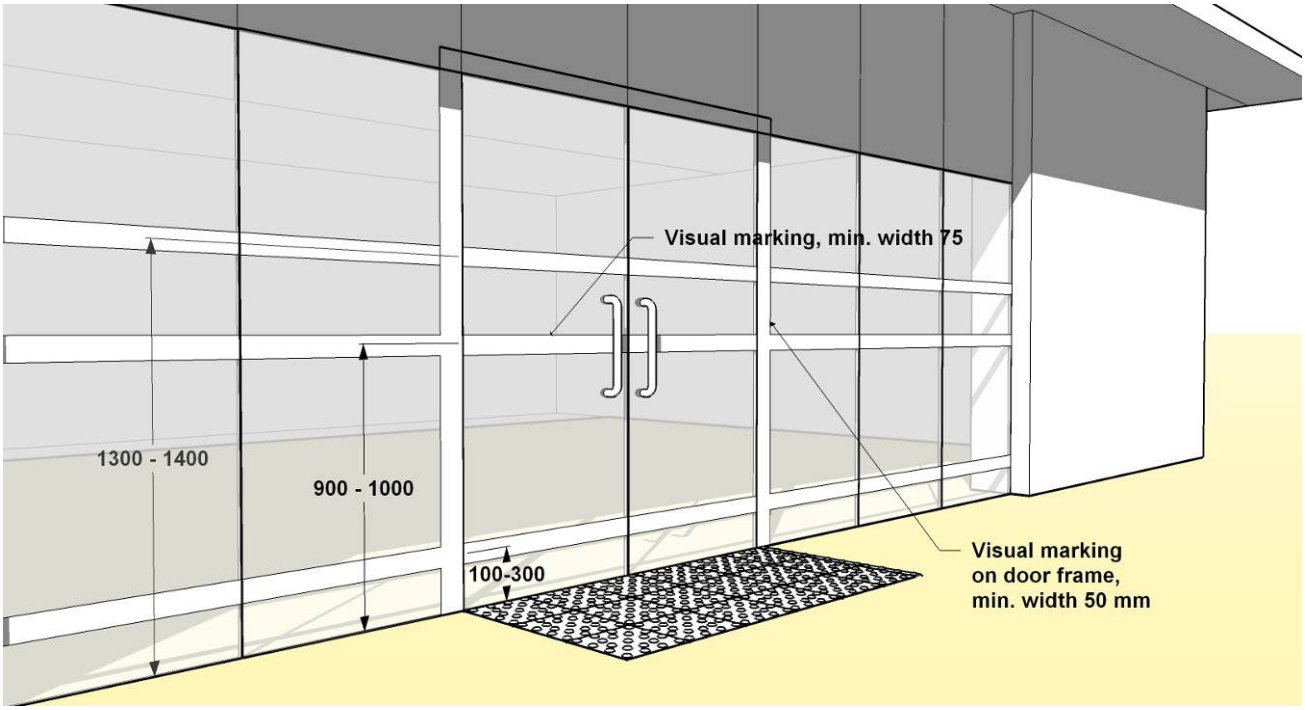


Figure 32 — Markings on glazed doors

Glazed (glass) walls and fully glazed doors shall be clearly marked with visual indicators. Large glazed areas close to circulation spaces could be mistaken for openings.

Uninterrupted visual indicators of at least 75 mm height with a difference in light reflectance values of minimum 60 to the background shall be placed at a height of 900 mm – 1 000 mm and 1 300 – 1 400 above floor level. An additional visual indicator placed at a height of 100 mm – 300 mm is recommended. See figure 32. Visual indicators made consisting of two separate colors with a minimum differerence in LRV of 30 points are recommended, if varying lighting conditions and backgrounds are to be taken into account.

NOTE People who have vision impairment may have a depth of field limitation, which results in them looking down at an angle of 45 ° – 50 °. This also allows them to choose a safe path of travel. When they are within 1 000 – 1 500 mm from a fully glazed door or sidelight, they will be able to detect the visual barrier at a height of 900 mm – 1 000 mm, provided the visual contrast criteria has been applied to the background. The background in all cases will be the circulation space on the opposite side of the door.

18.1.5 Viewing panels in doors

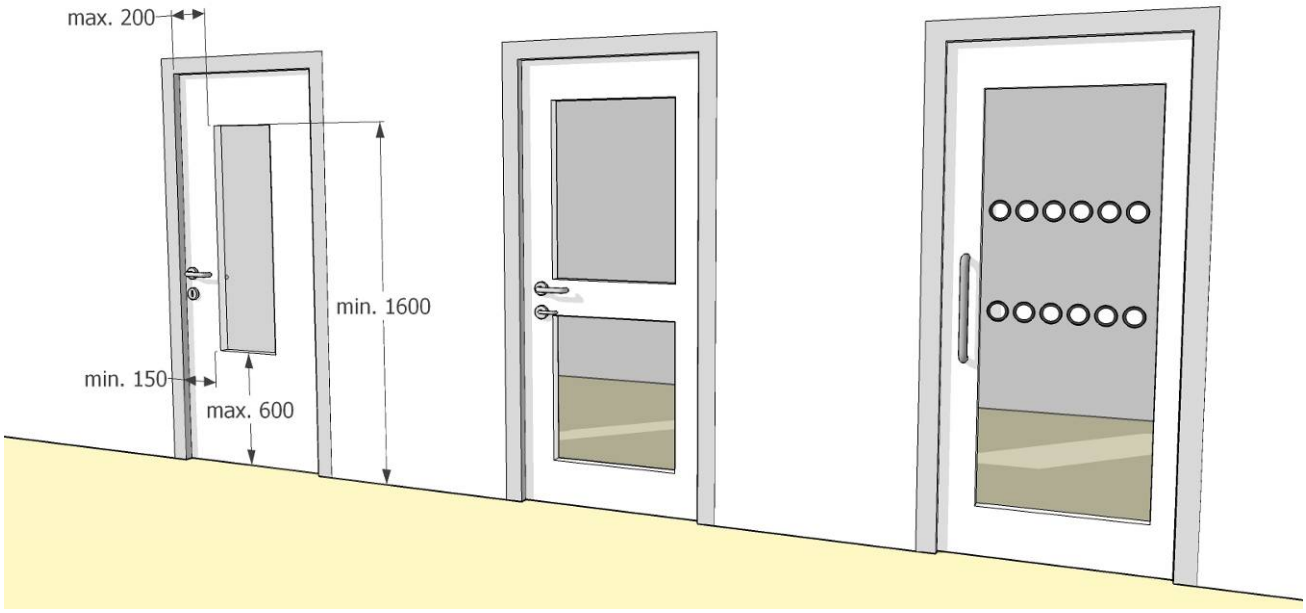


Figure 33 — Examples of doors with glazing viewing panels

If viewing panels are provided, they shall comply with the following requirements (see also figure 33):

— the lower edge of the glazed panel shall be not more than 1 000 mm above the finished floor,

— the upper edge of the glazed panel shall be not less than 1 600 mm above the finished floor,

— in width, the glazed panel shall start not more than 200 mm from the latch edge of the door, and the glazing be not less than 150 mm wide,

— the glazed panel may be subdivided by narrow construction cross sections, if sight is not restricted.

18.1.6 Visual contrast of doors and door furniture to the wall

Doors forming part of an accessible path of travel shall have a difference in light reflectance value to doorframe and the surrounding wall, of not less than 30 points, as described in section 35.

The minimum width of the area of visual contrast shall be 50 mm.

If this is not possible to achieve, at least a marking of 50 mm width (e.g. around the frame of the door), with a different visual contrast from the wall – with a minimum difference in LRV of not less than 30 points – shall surround all the perimeter of the door (see figures 32 and 35).

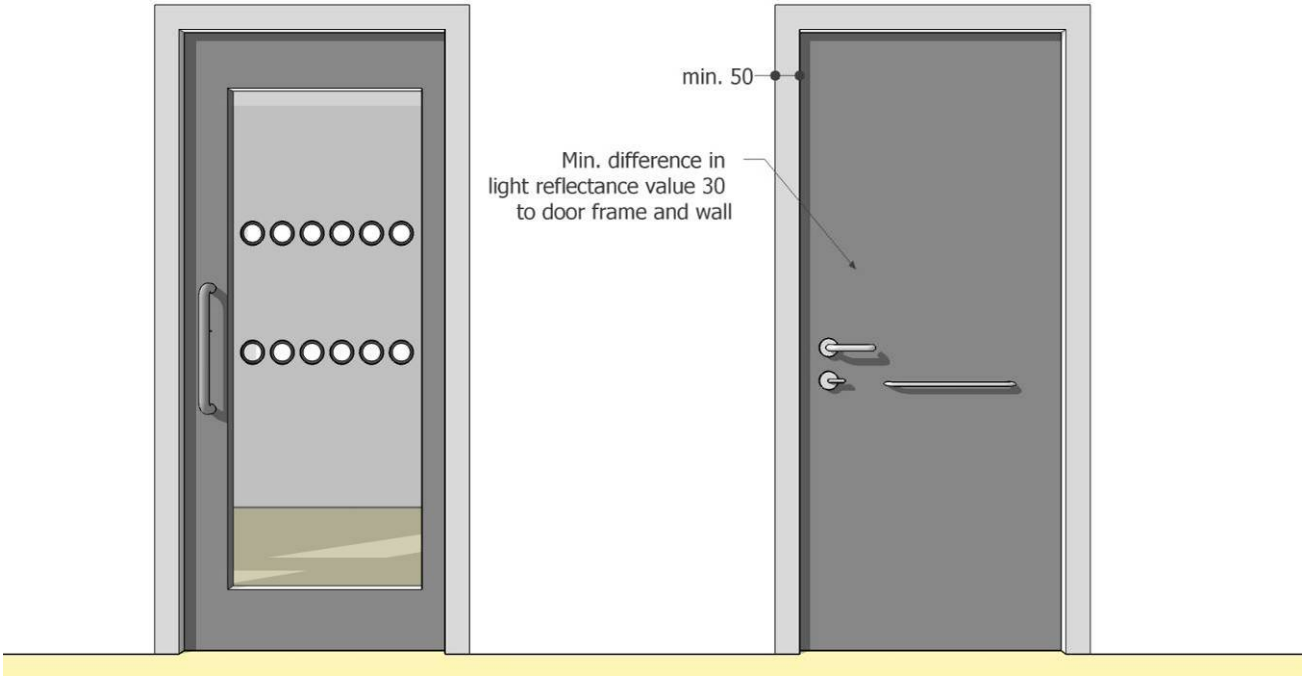


Figure 34 — Door with sufficient visual contrast

18.1.7 Automatic opening doors

The minimum width shall be at least 800 mm, with 850 mm as a recommended value. In narrow spaces sliding doors may be preferable. All automatic doors should be capable of remaining totally open (at least 90 ° in the case of hinged doors) without manual support.

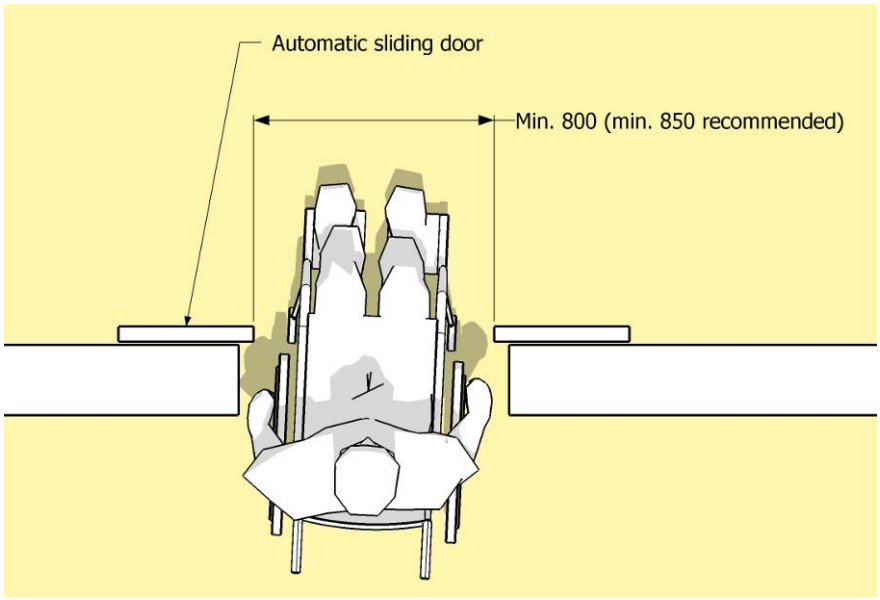


Figure 35 — Automatic sliding door

18.1.8 Powered swing door

A powered swing door shall be:

— provided with a suitable detection device that is set to ensure that a person approaching or leaving the door will not come into contact with the door during the opening and closing phases;

— fitted with a return delay mechanism that allows sufficient time for safe passage and for detecting the presence of a person laying on the floor within the door closing area;

— capable of being used manually in the event of electrical or mechanical failure.

18.1.9 Revolving door

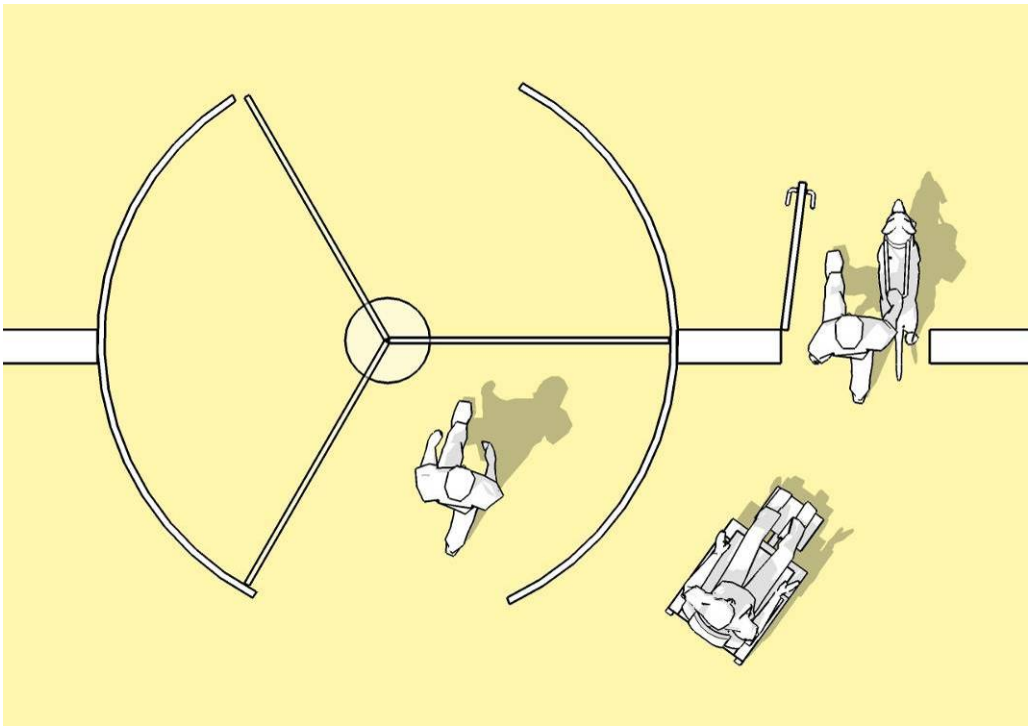


Figure 36 — Revolving door accompanied by door suitable for people who walk slowly, use a wheelchair or have impaired sight

Where a revolving door or turnstile is installed, a hinged or sliding door shall be provided as an alternative alongside.

NOTE Unless of a significant size and power-operated, revolving doors are not suitable for use by people who can only walk slowly, use a wheelchair or have impaired sight.

A revolving door shall be large enough to allow safe passage and accommodation for a wheelchair user and a companion (see figure 36).

An automatic revolving door shall be equipped with a means to slow it or to stop it if it is subjected to pressure or resistance.

18.1.10 Automatic sliding or folding door

An automatic sliding or folding door shall be equipped with a mechanism to prevent its colliding with a user and anything that is being pushed pulled or, otherwise, being transported through the doorway.

Doors should not obstruct the flow of people or create a collision hazard. The door shall never obstruct the escape route.

18.1.11 Door hardware

Door locks or other devices to open the doors shall be reachable and operable. Door hardware shall be located between 800 mm and 1 000 mm in height. (Consider also B.8.1).

Adequate clear passage spaces shall be available on either side of the doors to enable people in wheelchairs to access the door controls and pass through. Consider 18.1.1 and Figures 15 and 16.

18.1.12 Glazed walls and screens

Glazed walls and glazed screens should be marked as stated in 18.1.4.

18.2 Fire resisting doorsets

Special consideration should be given to the choice of closing device for a fire resisting doorset. The door leaf should always be easy, intuitive and obvious for everyone to open, whatever its configuration, dimensions or ironmongery.

See 13.1 for the detailed requirements and recommendations concerning any doorset in a building.

18.3 Windows and window hardware

18.3.1 Restriction opening

Opening windows shall not project into pedestrian areas below a height of 2 100 mm.

18.3.2 Manoeuvrability of hardware and shutters

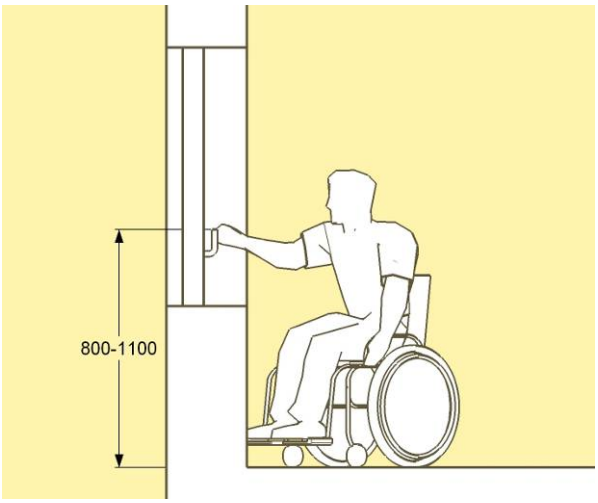


Figure 37 — Heights of hardware and shutters

Windows should be easy to open and close. It should be possible to open and close the windows with only one hand.

Hardware shutters and switches for remote control should be placed between 800 mm and 1 000 mm above the floor (see figure 37).

18.3.3 Height of the window

To enable wheelchair users to see through a window, the glazing should be no higher than 1 100 mm from the floor.

18.3.4 Visual indication of glazed areas

Consider the requirements stated in 18.1.4 and 35.

19 Reception areas, counters, desks and ticket offices

19.1 Hearing and lip-reading

Reception areas, counters, ticket offices, especially in noisy environments or those equipped with a separating security screen shall have at least one position fitted with a hearing enhancement system (e.g. induction loop system) to assist hearing-aid users, as described in 32, and be clearly marked with the appropriate symbol. See section 30.

Avoid positioning service counters in front of windows where bright sunshine will cause the user's face to be in shadow and hence difficult to lip-read. Service counters equipped with a service screens are particularly difficult. Reflections and glare should be avoided.

19.2 Location

Counters and reception desks should be located and clearly identified that they are easily recognisable from a building entrance. Information reception areas should be positioned near the main entrance. Consider also wayfinding specified in 7.1 and orientation specified in 38.

NOTE Carpets or entrance flooring systems or tactile walking surface indicators can help in locating reception counters for people who have vision impairment. Such products should be designed to reduce trip & slip hazards.

General design requirements for colour and visual contrast should be considered (see 35).

19.3 Space to manoeuvre

Counters, desks and ticket offices should be accessible to wheelchair users on both the service side and the server side. At least 1 500 mm by 1 500 mm clear manoeuvring space shall be provided in front of the counter on the service side and the server side, 1 800 mm is preferred.

19.4 Height

The counter level shall be between 740 mm – 800 mm from the floor. Clear knee space underneath shall be minimum 700 mm. See also Figure 38.

Reception desks where writing is done by the visitor (for example receptions at hotels) should allow frontal approach by wheelchair users with space to provide clearance for wheelchair user's knees. At least a part of the desk should also be at a height suitable as a writing place for standing people, see Figure 38. Where desks are for communication purposes, it shall have a maximum height of 900 mm.

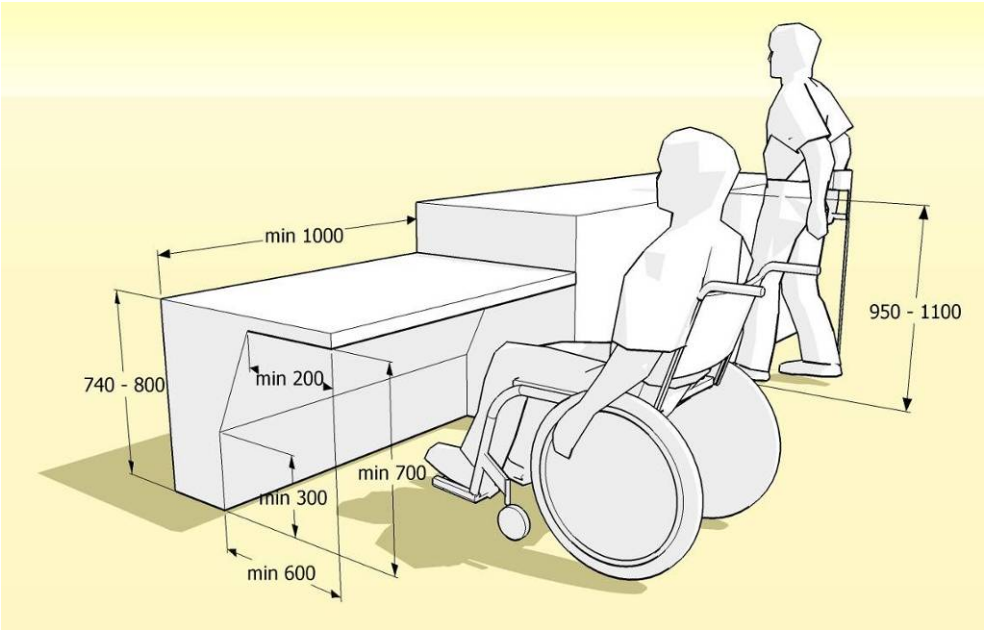


Figure 38 — Heights of counters suitable for wheelchair users

19.5 Lighting

To facilitate lip reading, lighting should provide even illumination.

The reading and writing surfaces at counters, desks and ticket offices shall be illuminated to a level of at least 200 lux in the room, and on the desk in a range of 350 lux– 450 lux.

19.6 Ticket systems

If a queue number ticket system is used, it shall be suitably designed to be accessible. All control devices shall be located according to 30 and B.8. All necessary information shall be given in simple wording, with sufficient visual contrast (with a minimum difference in LRV of 30 points) and based on the two-sense-principle (consider 32 , 35 and 36). The ticket machine and the calling system shall provide visual and audible output.

Some seats should be located so that a guide or assistance dog can accompany its owner and rest in front of, or under, the seat.

20 Cloak-room

A mirror should be usable from a standing or a sitting position.

A chair with armrests is required for people who need to sit down to put shoes on (reference to seating).

Coat hooks should be set at different heights: some at 850 mm and some at 1 100 mm; the other hangers at 1 800 mm.

21 Auditoriums, concert halls, sports arenas and similar seating

21.1 Hearing enhancement systems

A hearing enhancement system shall be provided. The system shall also be provided on the stage/platform. Consider requirements in 32.

21.2 Lighting for sign language interpretation

Adequate provisions should be made to facilitate sign language and lip-reading. Lighting on the faces and hands of presenters and people signing will need to be provided at an angle of 45 ° – 50 ° from horizontal at ceiling level for people with a hearing impairment to read the presenter's lips and the signer's lips and hands. A suitable contrasting backdrop must also be provided, to assist in reading the presenter's lips and hands.

21.3 Designated seating for wheelchair user

At least 1 % of seats shall be designated for wheelchairs users (with a minimum of 2). These spaces should be integrated among other seats and allow two wheelchair users to stay together. It is recommended that the armrest on the seats at the end of the row lift-up to allow people to transfer from the wheelchair onto a seat.

21.4 Access to stage and backstage

Access to the stage and to the backstage area shall be provided in new buildings. Adequate provisions should be made to direct the user to the designated spaces.

21.5 Row and seat numbers

The row and seat numbers should be legible to people have a vision impairment with tactile, adequate size and visual contrast; consider requirements in 35 and 40.

21.6 Accessible Changing rooms

The minimum number of accessible changing rooms may be subject to national requirements or regulations, depending on the type and use of the building.

In the event that changing rooms are provided alongside a toilet area, these should comply with the specifications indicated in 26.

A fixed bench should be set at a height of 400 mm – 480 mm above floor level. The bench should be no less than 500 mm wide x 2 000 mm in length, and be provided with a grab rail at a height of 750 mm with a clearance of between 45 mm and 65 mm from the wall.

A clear space of 1 500 mm x 1 500 mm shall be beside the bench.

Coat hooks should be set at different heights: 850 mm – 1 100 mm, additionally at least one hook at 1 800 mm.

Provision of call bell may be provided in accordance with section 41.

Changing rooms shall have a minimum area of 4 m^2.

22 Conference rooms, meeting rooms

Consider the requirements for accessible sanitary facilities in 26 and sufficient acoustic provisions in 32. A sound augmentation system should be provided.

NOTE Reverberation time for speech, music etc. should be given by national provisions.

All equipment in conference rooms shall be usable by people chairing or participating in the meeting and shall be at a height between 800 mm -1 100 mm. Consider also 30.1.

23 Viewing spaces in assembly areas

23.1 Floor area

The floor area for a wheelchair viewing spaces shall be connected to an accessible path of travel and shall meet the following requirements:

— at least 900 mm x 1 400 mm

— the depth of the row shall be minimum 2 400 mm

— clear and level surface,

— sufficient manoeuvring space.

— multiple wheelchair spaces shall be located beside regular seating rows especially for the accompanying person.

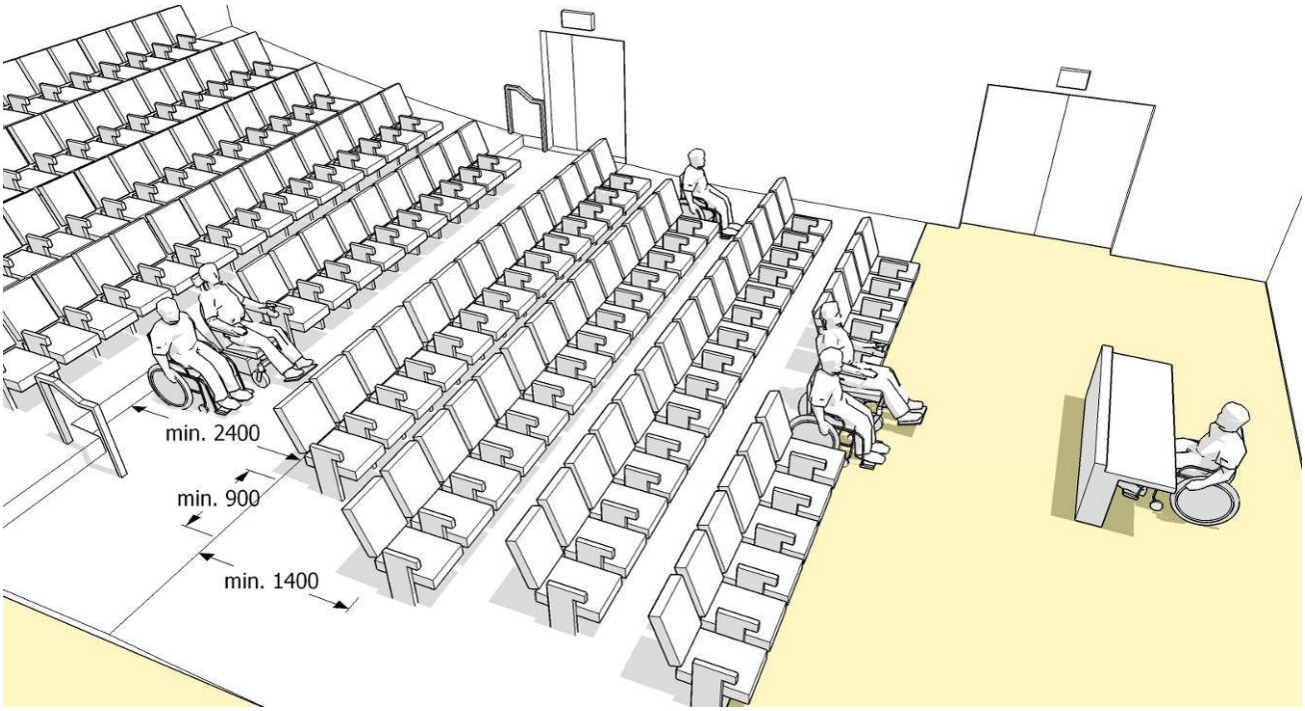


Figure 39 — Examples of viewing spaces for wheelchair users

23.2 Sight lines

Wheelchair user viewing spaces shall provide viewing spaces that are:

— comparable to those for all viewing positions with a minimum unobstructed eye level up to 1 200 mm

— not reduced or obstructed by standing members of the audience.

Row and seat number identification signs shall be legible to persons who are visually impaired (consider 40.5).

24 Bars, pubs, restaurants etc.

Sufficient space for internal passages and manoeuvring space between tables and the route to the accessible sanitary facilities shall be provided (consider 4, 10, 18.1, 26, 30 and B.8.1).

A hearing enhancement system should be installed at the counter e.g. induction loop system. Consider the acoustic recommendations in 32.

The general design requirements for colour and visual contrast should also be considered, as described in 35.

25 Terraces, verandas and balconies

Terraces, verandas and balconies shall be accessible to all people, including people with mobility impairments, in accordance with 10.6 and 30.

Parts of these facilities should be covered with a canopy/pergola, to give shelter against the weather (sun/rain/snow).

Walking surfaces should be slip resistant.

26 Toilet rooms and sanitary rooms

The requirements contained in this section apply to buildings in use by the public, for example hotels, work places, public buildings and buildings used for sport and recreation activities.

Sanitary facilities shall be able to accommodate a variety of users, including children and parents with children.

There are a variety of approaches in providing wheelchair accessible toilet rooms, the selection shall be carefully selected to meet the needs in each country.

If no other national requirements or regulations are available, the following will apply:

— at least one wheelchair accessible toilet room shall be provided,

— the wheelchair accessible toilet room shall always contain a washbasin.

National provisions may give the number and type of toilet rooms (lateral transfer from two sides or corner toilet), taking into consideration the type and use of the building and circumstances in which unisex or single sex provision would be acceptable.

Accessible toilets that can be used by both sexes allow the greatest flexibility for people who require assistance.

Consider signage and wheelchair symbol for indication of accessible toilet room speciefied in section 40 and 41.

26.1 Toilet rooms for ambulant people

Ambulant toilet rooms meet the needs of ambulant people who require support. This toilet room design is not for the majority of people who use wheelchairs.

Characteristics:

— toilet seat height, depth and distance to wall should comply with 21.5

— clear manoeuvring space in front of the toilet should be minimum 900 mm x 900 mm

— door should open outwards

— grab rails on both sides of toilet

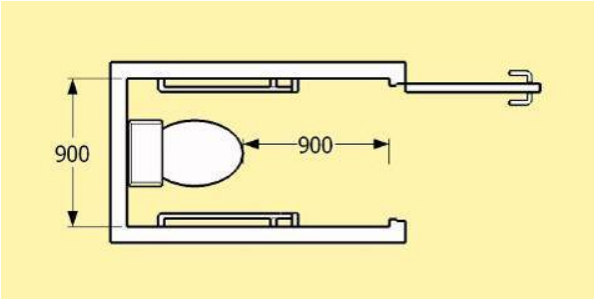


Figure 40 — Ambulant toilet

26.2 Wheelchair accessible toilet rooms

Fixtures and fittings in sanitary facilities should visually contrast with the items and surface on which they are positioned.

The minimum illumination measured at 800 mm above floor level shall be 200 lux in the area of the washbasin.

The floor surface shall be slip resistant, anti-glare and firm.

Light switches should be fixed inside all accessible toilet cubicles or the light should automatically switch on when someone enters the room. Timed light switches should not be installed or used.

26.3 Dimensions for wheelchair accessible toilet rooms

The dimensions for wheelchair accessible toilet rooms depend on the functions they have to reply to. This standard gives the characteristics and requirements for the three types (A, B, C) of toilets most commonly used in the world.

National regulations shall decide on the priority of the functions to be met and recommend which type of toilet room is to apply for different building types and which type is acceptable for existing buildings.

26.3.1 Type ‘A’ toilet room with lateral transfer from both sides

Characteristics:

— lateral transfer from both sides,

— manoeuvring space uninterrupted by wash basin and pan,

— independent water supply beside toilet seat,

— only horizontal grab rail beside the toilet seat,

— toilet paper dispensers on both folding grab rails.

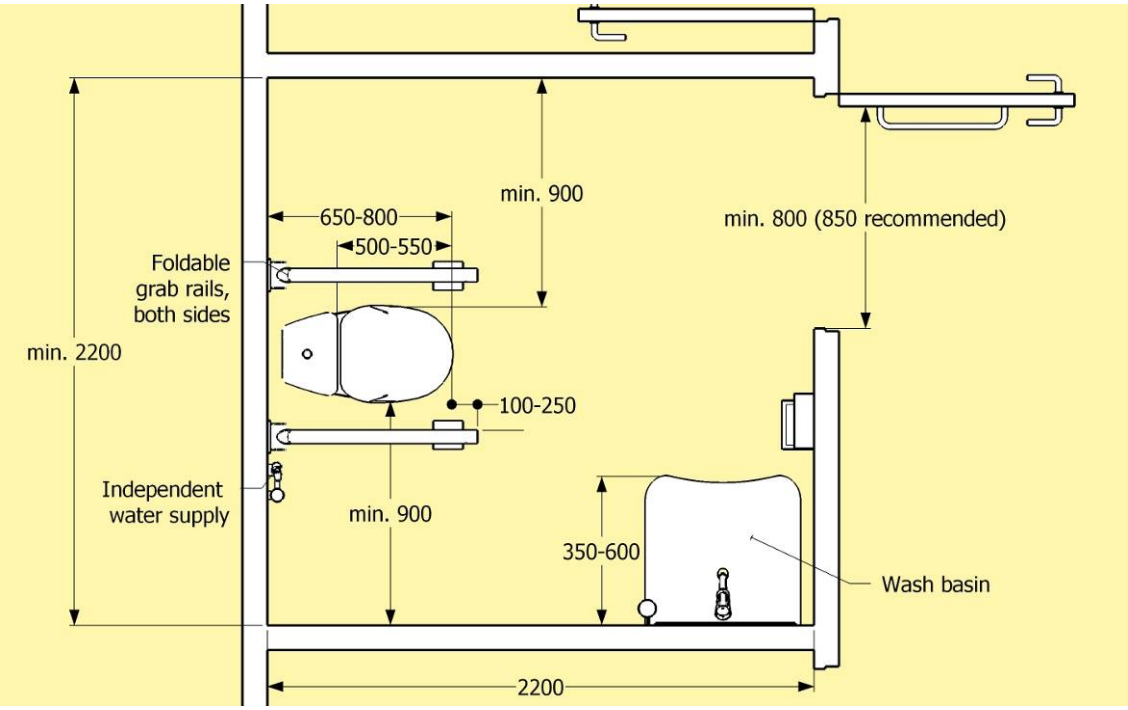


Figure 41 — Example of type A toilet room, lateral transfer from both sides

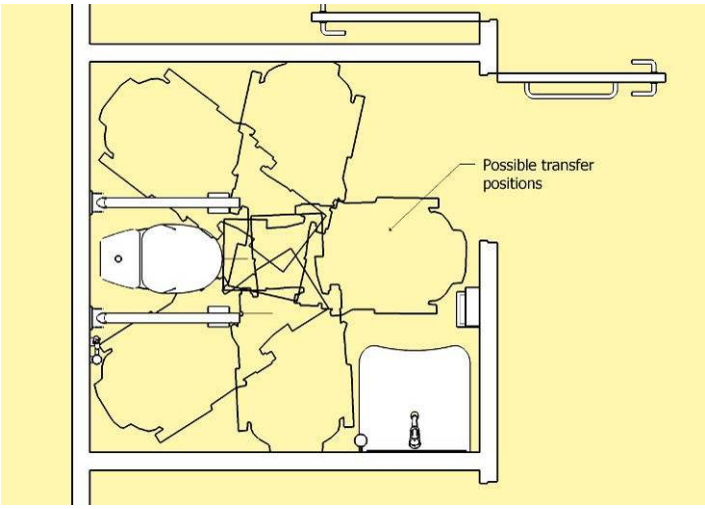


Figure 42 — Type A toilet room transfer options

26.3.2 Type 'B' corner toilet room

Characteristics:

— lateral transfer only from one side,

— manoeuvring space uninterrupted by wash basin and pan,

— independent water supply beside toilet seat,

— vertical grab rail beside the toilet seat for getting up and sitting down,

— toilet paper dispenser fixed on the wall beside the toilet seat.

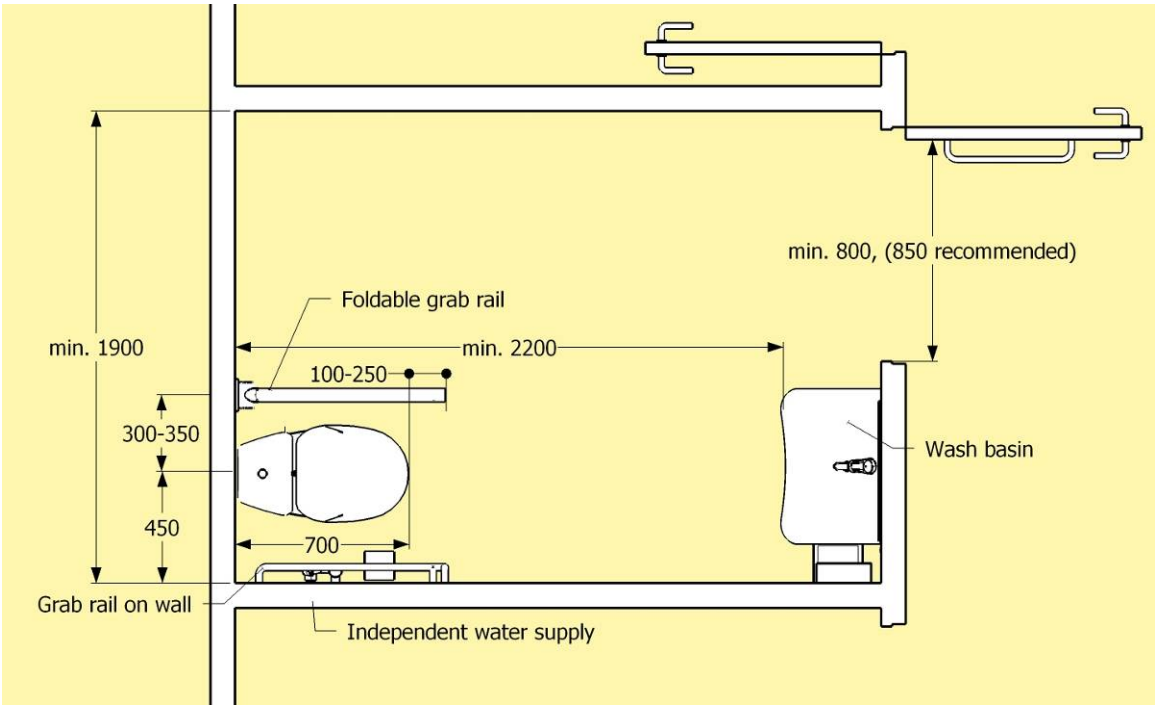


Figure 43 — Example of type B large corner toilet room

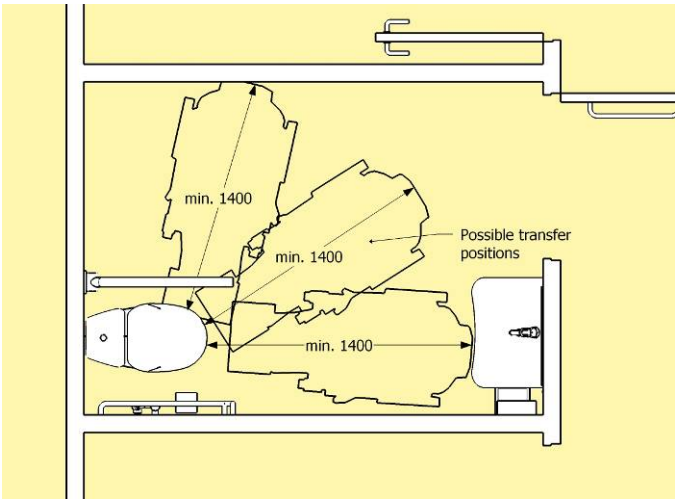


Figure 44 — Type B toilet room transfer options

26.3.3 Type 'C' toilet room

Characteristics:

— lateral transfer only from one side,

— manoeuvring space reduced by wash basin,

— independent water supply beside toilet seat,

— possibility of reaching water basin when sitting on the toilet seat,

— vertical grab rail beside the toilet seat for getting up and sitting down,

— toilet paper dispenser fixed on the wall beside the toilet seat.

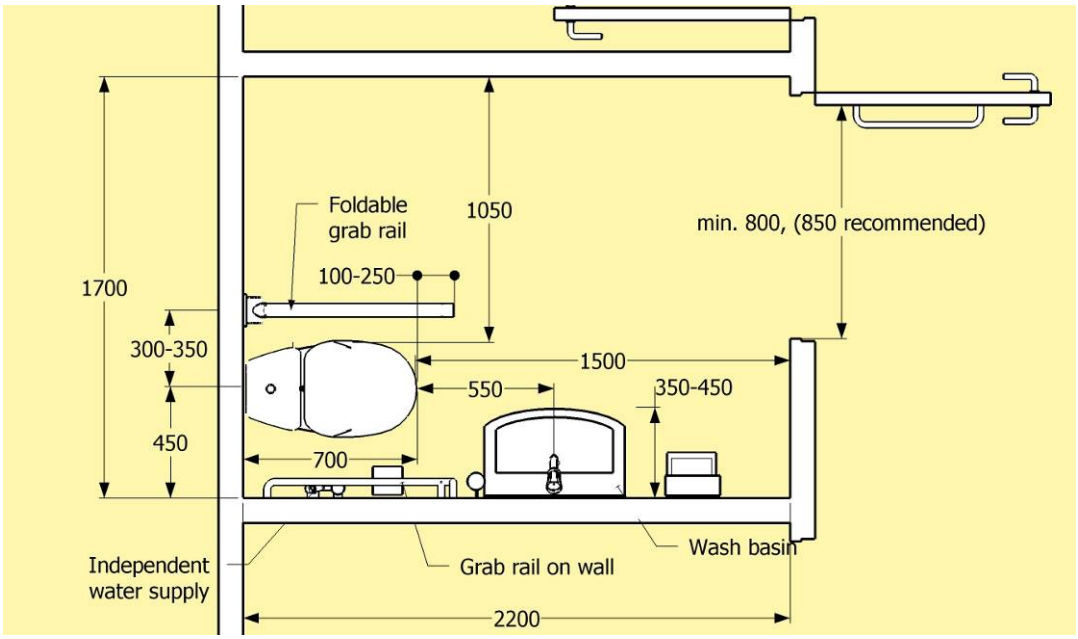


Figure 45 — Example of type C small corner toilet room

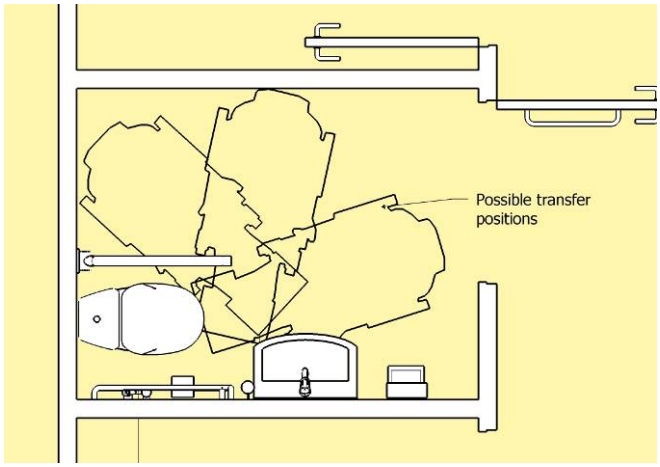


Figure 46 — Type C toilet room transfer options

26.3.4 General requirements for all types of wheelchair accessible toilet rooms

Layout of wheelchair accessible toilet rooms should provide toilets usable for both sexes separated from toilets for men and women.

The clear manoeuvring space of the toilet room shall allow frontal, oblique and lateral transfer.

The clear manoeuvring space at floor level in front of the toilet seat and the washbasin shall be 1 500 mm x 1 500 mm, except for type C where 300 mm under the wash basin is accepted as part of the total manoeuvring space.

The minimum free clearance beside the toilet seat shall be 900 mm, preferred 1 200 mm for lateral transfer and assistance.

NOTE Minimum clearance of 900 mm accommodates only 65 % of the wheelchair users, clearance of 1 200 mm accommodates 90 % of all wheelchair users especially also those who use powered wheelchairs.

Exceptional considerations in existing buildings: If the measures given above cannot be achieved due to technical reasons, the manoeuvring space at floor level may be reduced, but it should be recognised that such a reduction will limit the number of people who can use these toilet rooms.

When more than one accessible corner toilet type B or C is planned, a choice of layouts suitable for left hand and right hand transfer should be provided. The minimum measures for an accessible corner toiletroom are 1 700 mm width and 2 200 mm depth.

26.4 Toilet room doors

Toilet room doors should comply with the specifications indicated in 18.1.

The door shall have a clear width of at least 800 mm, with minimum 850 mm as a recommended value, and it shall be easy to open and close. The door should open outwards. If the door opens inwards, there must be the ability to open the door outwards or to remove it from the outside. There should be no openings under or above the door.

26.5 Sanitary fittings

26.6 Toilet seat

The top of the toilet seat shall be between 400 mm and 480 mm from the floor.

NOTE Toilet seats with a height of more than 460 mm may cause a problem of instability when sitting on the toilet seat. Toilet seats of less than 460 mm may cause a problem of transfer getting back to the wheelchair. The differences in stature of the population worldwide may require lower or higher heights of toilet seats. National regulations may give the most convenient and appropriate height for an accessible toilet seat at a national level.

The minimum distance from the edge of the toilet seat to the rear wall should be between 650 mm and 800 mm**,** see figures 38 and 40.

The minimum distance of a corner toilet from the pan to the adjacent wall should be 250 mm (see figure 43).

If a backrest is provided the distance from the seat to the backrest should range between 500 mm and 550 mm (see figure 43).

Toilets for children should have a distance from the center line to the adjacent wall between 305 mm – 380 mm. The toilet seat height shall be between 205 mm – 380 mm.

26.7 Grab rails

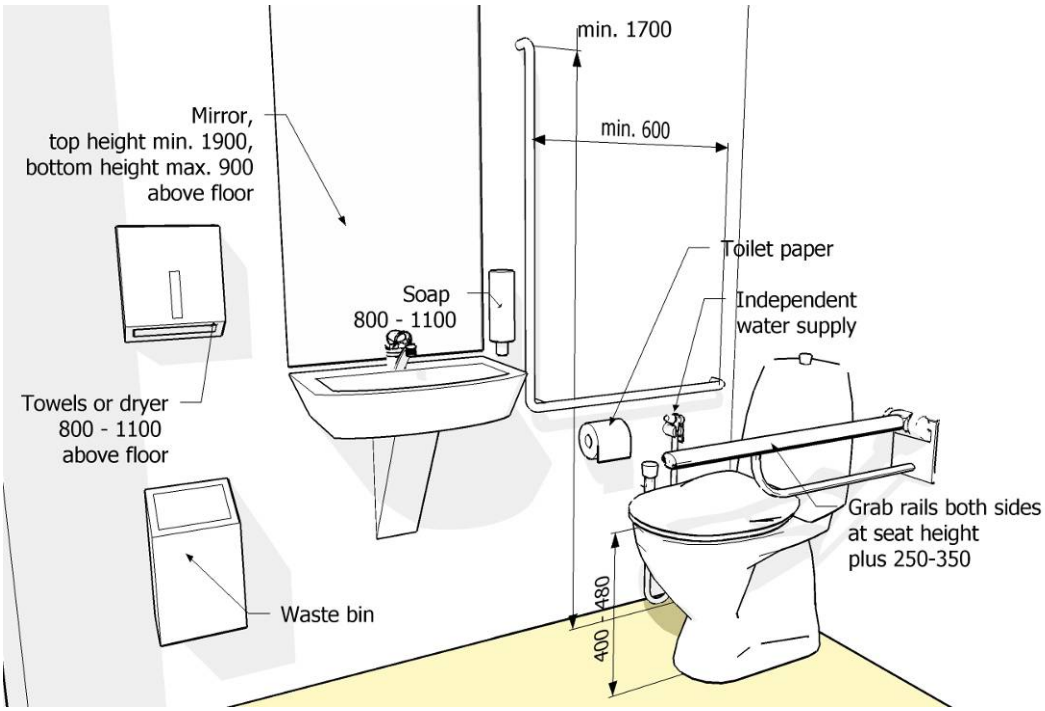


Figure 47 — Positioning of grab rails, water supply and toilet paper in type C corner toilet

On both sides of the toilet, a grab rail shall be provided at a distance between 300 mm to 350 mm from the centre of the toilet. Minimum distance from the wall should be 50 mm.

On the sides where a lateral transfer is possible, a foldable grab rail shall be provided at a height of 250 mm – 350 mm above the toilet seat. Grab rails shall withstand min. 1 kN force from any direction, with 1.7 kN as a recommendation. The length of the foldable grab rail should overlap the front edge of the toilet seat in between 100 mm – 250 mm.

Where a wall is beside the toilet, a horizontal grab rail shall be provided at a height of 250 mm – 350 mm above the toilet seat, and a vertical grab rail shall exceed from the horizontal grab rail to a height of 1 700 mm above floor level. The grab rail shall extend a distance of minimum 150 mm to the front edge of the toilet seat (see figure 47).

The horizontal grab rail shall be uninterrupted for its full length.

The grab rail height for toilets for children should be between 510 – 635 mm.

26.8 Toilet paper

Dispensers for toilet paper shall be reachable from the toilet seat, either under the grab rail or on the side-wall of a corner toilet at a height between 600 mm to 700 mm from the floor, see figure 47.

26.9 Washbasin

A washbasin shall be provided within an accessible toilet room.

The top of the washbasin should be located between 750 mm to 850 mm from the floor.

NOTE The differences in stature of the population worldwide may require lower or higher heights of washbasins. National regulations may give the most convenient and appropriate height for washbasins at a national level.

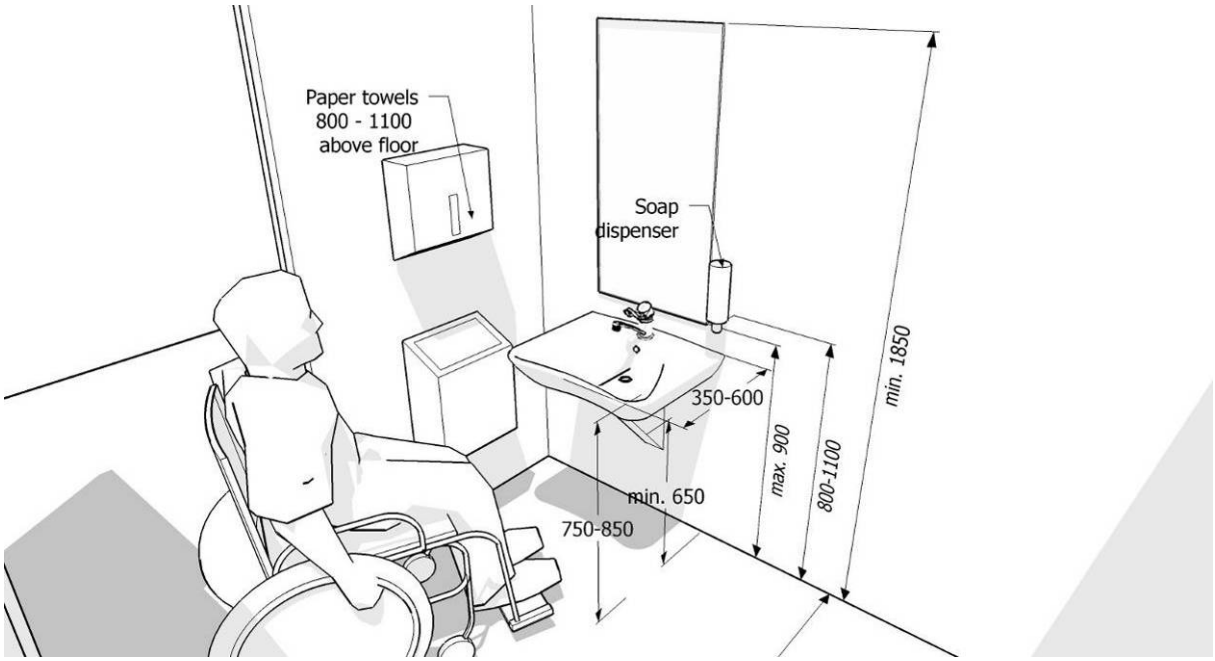


Figure 48 — Placement of washbasin and mirror above the washbasin with distance of sanitary appliance

The space under the washbasin shall be unobstructed with a knee clearance centred on the washbasin between 650 mm and 700 mm high and 200 mm deep. In addition, a toe clearance of minimally 300 mm high has to be provided (see figure 49).

In front of the washbasin, space should allow for a frontal or oblique approach by a wheelchair.

The washbasin should be located with a distance of 350 mm – 600 mm from the wall.

The reaching distance to the tap control shall be a maximum of 300 mm, according to figure 49.

The mirror above the washbasin shall be positioned at a maximum of 900 mm above the floor, up to a height of 1 850 mm, see Figure 48. If a second mirror is provided, the maximum height above the floor should be 600 mm, up to 1 850 mm.

A shelf with minimal dimensions of 200 mm x 400 mm shall be provided near the washbasin at a height of 850 mm, or combined with the washbasin.

In some countries a smaller washbasin (350 mm – 400 mm) is widely used, with a distance from the pan to the middle of the washbasin of 550 mm.

26.10 Water supply

An independent water supply (hand-held shower) should be provided next to the toilet needed for hygiene. An alternative can be a combination of bidet and pan/built-in –bidet.

26.11 Taps

Taps should be mixer, lever or sensor operated to aid operation. The tap controls should be set no more than 300 mm from the front of the washbasin.

It is recommended that a thermostat be installed to limit the temperature of the hot water to a maximum of 40° C in order to prevent scalding.

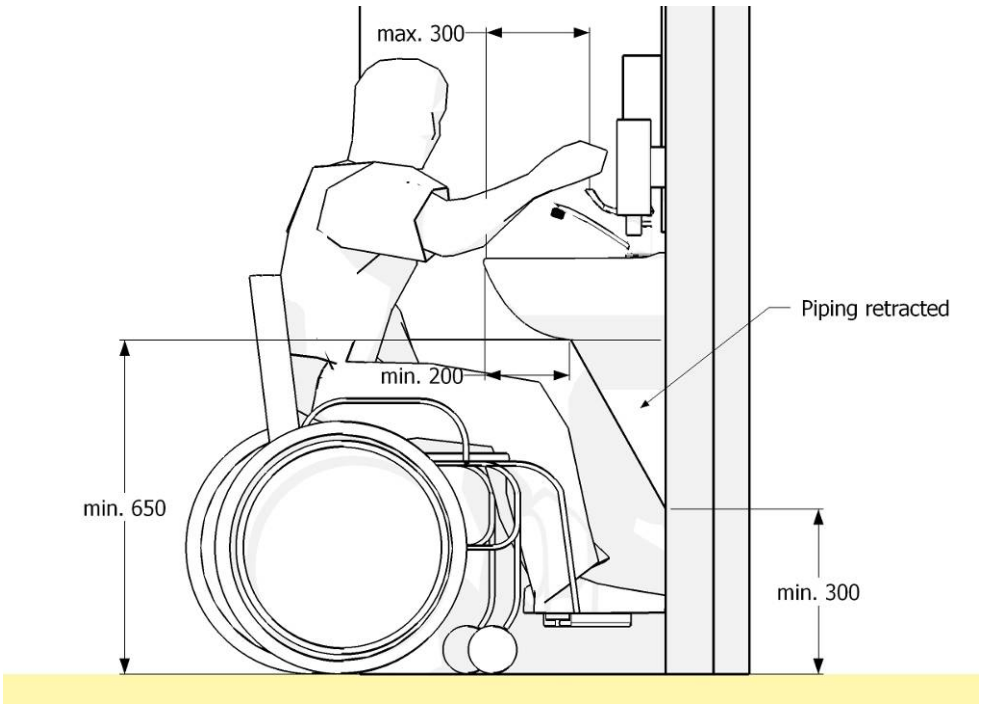


Figure 49 — Washbasin with knee / toe clearance

26.12 Urinals

When wall hung urinals are fitted in the washroom, at least one of these should be set at a height between 600 mm and 750 mm and equipped with a vertical grab rail.

This wall-hung urinal should be set clear above the floor level, without any raised access platform and with a clear floor area in front of the urinal of at least 750 mm wide and 1200 mm deep.

26.13 Other fittings

All other fittings like the coat hook, water tank, hand dryer, hand-held shower etc. should be set at a height between 800 mm – 1 000 mm (consider also 30.1).

Toilet doors should be easy to open and close and comply with the general specifications indicated for doors in 18. A horizontal pull handle on outward opening doors shall be provided at a height of 700 mm above floor.

Doors should preferably open outwards.

Light switches should be fixed inside all accessible toilet cubicles or the light automatically lit when someone enters the room. Timed light switches should not be installed or used.

26.14 Alarm

An alarm system shall be provided which can be activated from both sitting on the toilet or laying on the floor). This alarm system has to be connected with an emergency help desk.

A visual alarm shall be provided to alert people who are deaf or hard of hearing in the event of an emergency; consider 34.

26.15 Shower

The shower area shall have level entry and have no fixed elements that prevent front and side access.

The shower area should be 900 mm x 1 300 mm, with a transfer area of 900 mm x 1 300 mm.

The slope of the floor in the shower recess shall have a gradient between 1:50 and 1:60. The outside area of the shower floor shall have a gradient between 1:70 and 1:80 draining into the shower recess. Transition into the shower recess shall be level without a step down, a raised step kerb or hob at the entry to the recess.

The waste outlet should be centrally located and be a round type outlet and not the channel type, to ensure stability of the shower chair.

The shower should be fitted with an easily operable foldable seat that folds in an upward direction. If a foldable seat is provided, the minimum size shall be 450 mm x 450 mm, set between 400 mm – 480 mm above floor level and a maximum of 40 mm from the rear wall. The fastenings for grab rails and construction for the foldable seat shall be able to withstand a force of 1.1 kN applied at any position and in any direction.

NOTE Shower wheelchairs are sometimes used instead of shower seats. See Figure. 43.

The foldable seat shall have the following features:

— self-draining

— slip-resistant

— rounded front corners (radius 10 mm to 15 mm)

— rounded top edges (minimum radius of 2 mm to 3 mm)

— fold in a upwards direction; when folded, it shall not present a hazard and the grab rail shall be accessible from the foldable seat

Grab rails shall be set according to 26.6 and figure 50. The shower area shall be fitted with at least one vertical grab rail which may hold the flexible shower head. The length of the flexible shower hose shall be a minimum 1 200 mm. The handheld shower head should be provided between 1 000 mm and 1 800 mm above the finished floor. The shower hose fitting should be a minimum 1 300 mm above floor level.

Shower controls and folding seat shall be set according to figure 50.

If the shower is combined with an accessible toilet, the manoeuvring areas may overlap, as shown in figure 51.

If two or more shower recesses are provided, at least one shall have the seat on the opposite side.

26.16 Individual Shower room

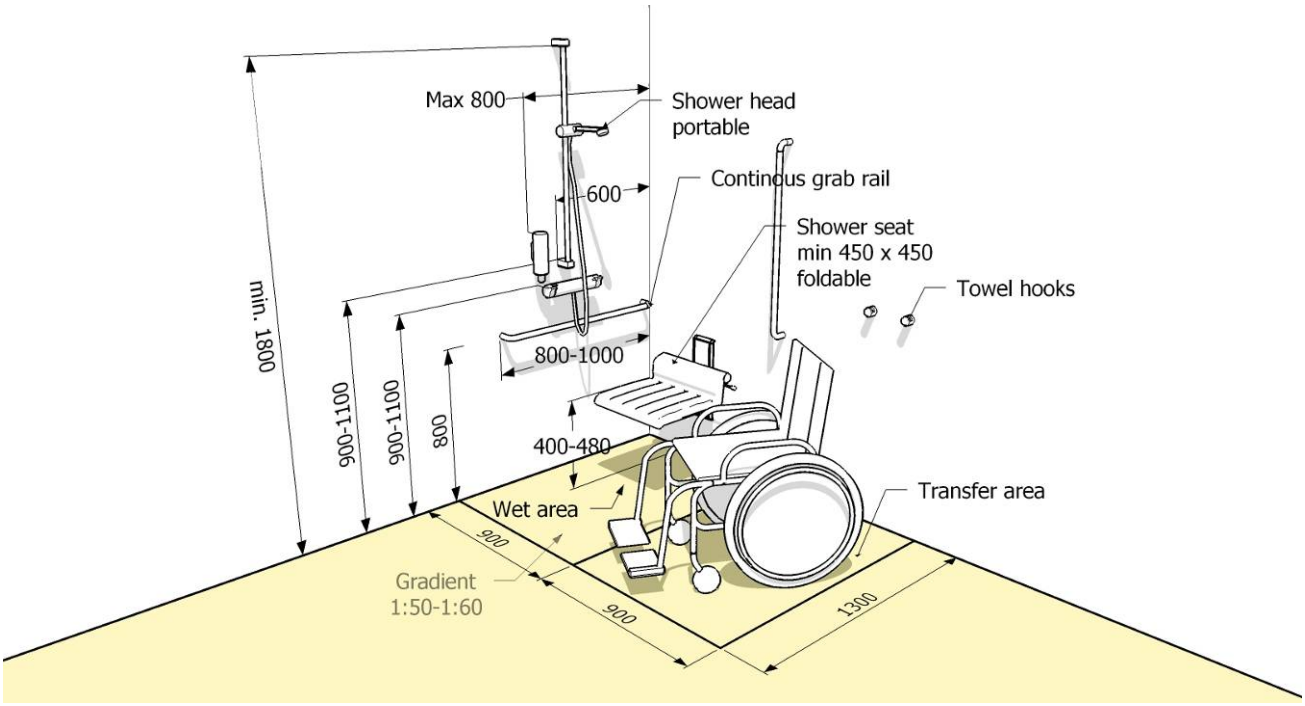


Figure 50 — Example of a shower place with grab rails, adjustable shower head and folding seat

A free space at least 1 300 mm x 900 mm shall be provided on the clear side of the foldable seat, to allow access from a wheelchair, in addition to the manoeuvring space of 1 500 mm.

The screening of a shower recess shall be either a curtain or a door system that maintains the required circulation and manoeuvring space and not interfere with the level entry.

A shower head support grab rail shall be fixed on the wall in the position shown in Figure 50.

A hand held shower head shall be provided with has a flexible hose of minimum length 1 200 mm, and able to reach within 100 mm of the shower floor.

An adjustable shower head holder shall be provided to support the shower head, which complies with the following:

— be installed on the shower head holder support grab rail as shown in Figure 50,

— allow the graspable portion of the shower head to be positioned at various angles and heights,

— allow the graspable portion of the shower head to be located at heights between 1 000 mm and 1 800 mm above the finished floor.

The fastenings, materials and construction of the seat shall withstand a force of 1.1 kN applied at any position and in any direction.

Grab rails shall be fixed on the walls in the positions shown in figures 43. All other devices, e.g. taps, soap holder, shall be situated in an accessible range between 900 mm to 1 100 mm.

26.17 Bathrooms

This section applies to buildings that provide bathing facilities, such as hotels, motels, hostels and sports buildings, where baths may be an alternative, or a supplement to showers.

If only one accessible bedroom for people with disabilities is provided, it should be connected to an accessible shower room, rather than a bathroom, since many disabled people can only use a shower due to their physical limitations. If more than one accessible bedroom is provided, a choice of shower or bath and a choice of right or left hand transfer to the toilet and shower or bath should be provided.

All accessible bathrooms should always contain an accessible toilet.

En suite facilities should be chosen as the preferred solution for accessible bedrooms, even when they are not provided generally for guests or residents in a hotel, motel or nursing home. If this is not possible, bathroom accommodation should be provided in close proximity to the accessible bedrooms.

The minimum overall dimensions of a bathroom intended principally for independent use, incorporating a corner toilet and a large basin, should be as shown in figures 44, 46 and 47.

In bathrooms with a toilet that is intended for independent use, the direction of transfer to both the bath and toilet should be consistent.

When more than one bathroom for independent use incorporating a corner toilet is planned, a choice of left hand and right hand transfer layouts should be provided.

Auxiliary grab rails should be set in accordance with the location of the bathtub.

Exceptional considerations in existing buildings: If the measures given above cannot be achieved due to technical reasons, the manoeuvring space at floor level may be reduced, but it should be recognised that such a reduction will limit the number of people who use wheelchairs.

NOTE To make a bathtub accessible for users of a bath lift or hoist, a free unobstructed space under the bathtub is needed.

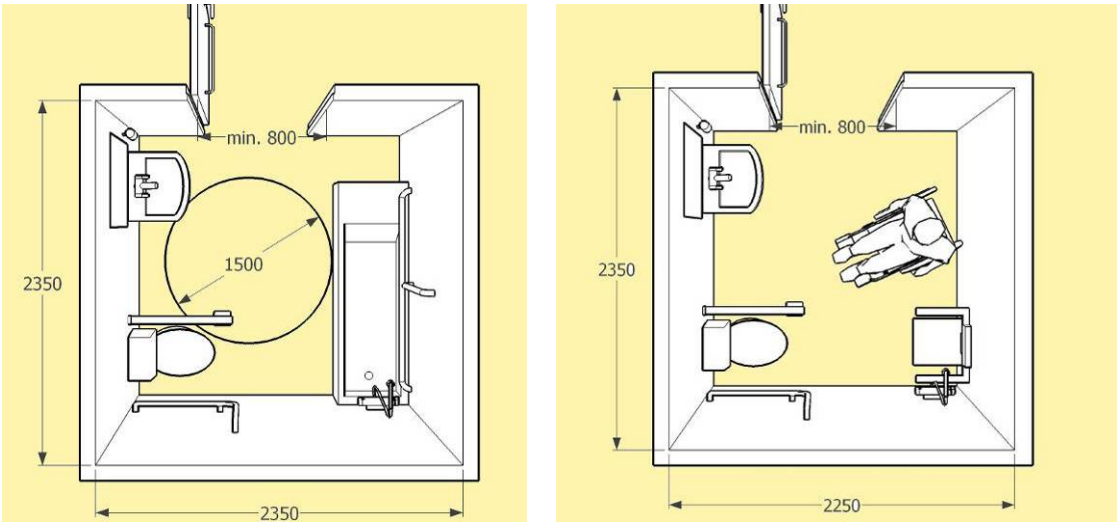


Figure 51 — Examples of a bathroom with bathtub and shower for independent use with a corner WC

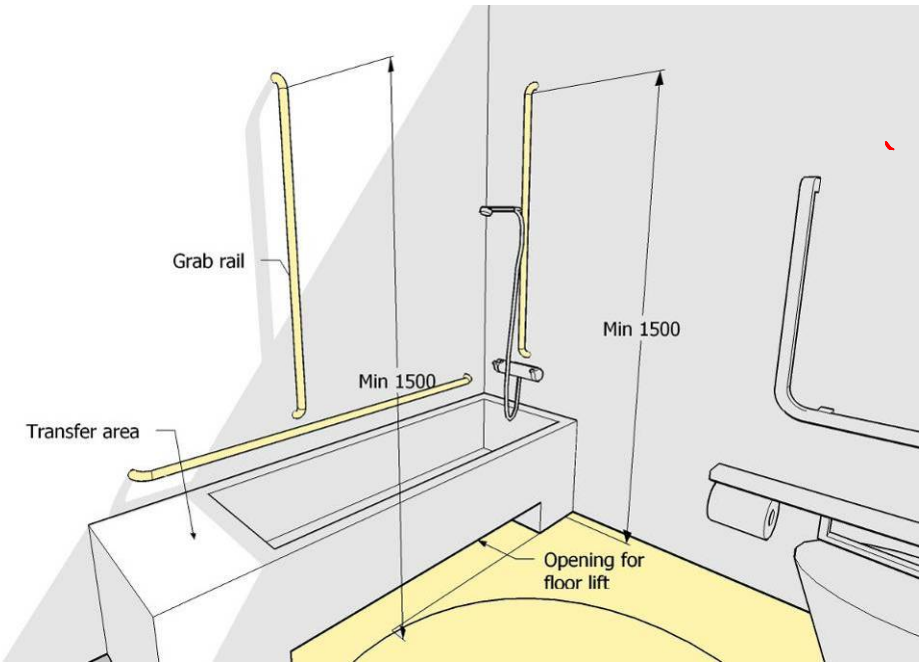


Figure 52 — Example of grab rails and transfer facilities surrounding the bathtub

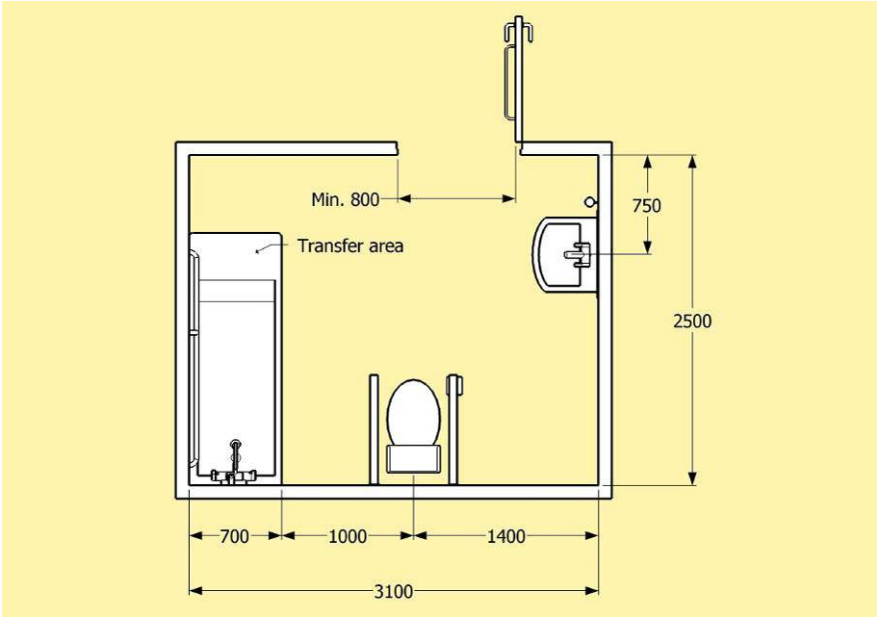


Figure 53 — Example of a bathroom for assisted use of bathtub and peninsular WC

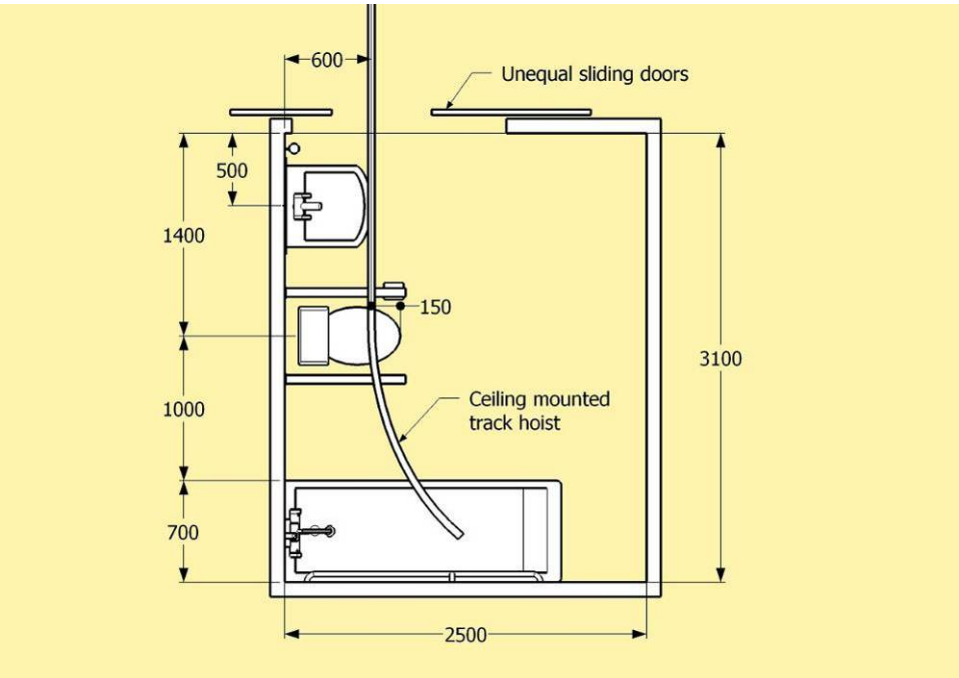


Figure 54 — Example of a bathroom with a ceiling mounted tracked hoist for independent or assisted use

27 Accessible bedroom in non-domestic buildings (hotels etc.)

Access to the accessible room shall comply with the requirements outlined in this standard, in particular with section 4 and 5. The minimum number of accessible bedrooms in a non-domestic building (hotel, guesthouse, etc.) may be subject to national requirements or regulations. At a minimum one accessible bedroom should be provided for every 20 standard bedrooms.

A wheelchair accessible room shall be designed for two beds. If a single bed room for wheelchair accessibility is provided a queensize bed is preferred, 1 500 mm width x 2 000 mm length.

The free space on at least one side of the bed should be 1 500 mm but shall not be less than 1 200 mm. On the short side of the bed, at least 1 200 mm is required.

An open space of at least 300 mm between the floor and the mattress should be provided to facilitate the use of a lifter or hoist.

Sufficient clear manoeuvring space is needed around the cupboard, doors and route to the sanitary facilities (toilet room).

There should be a bench for luggage at a height between 450 mm – 650 mm.

The minimum height of a bed shall be between 450 mm - 500 mm, when it is compressed under a 90 kg weight.

Communication for people with hearing, vision and cognitive limitations – consider 32 and Annex B.

Visual and audible alarm systems shall be accessible to warn people with visual and hearing impairments, consider 34 for fire emergency warnings.

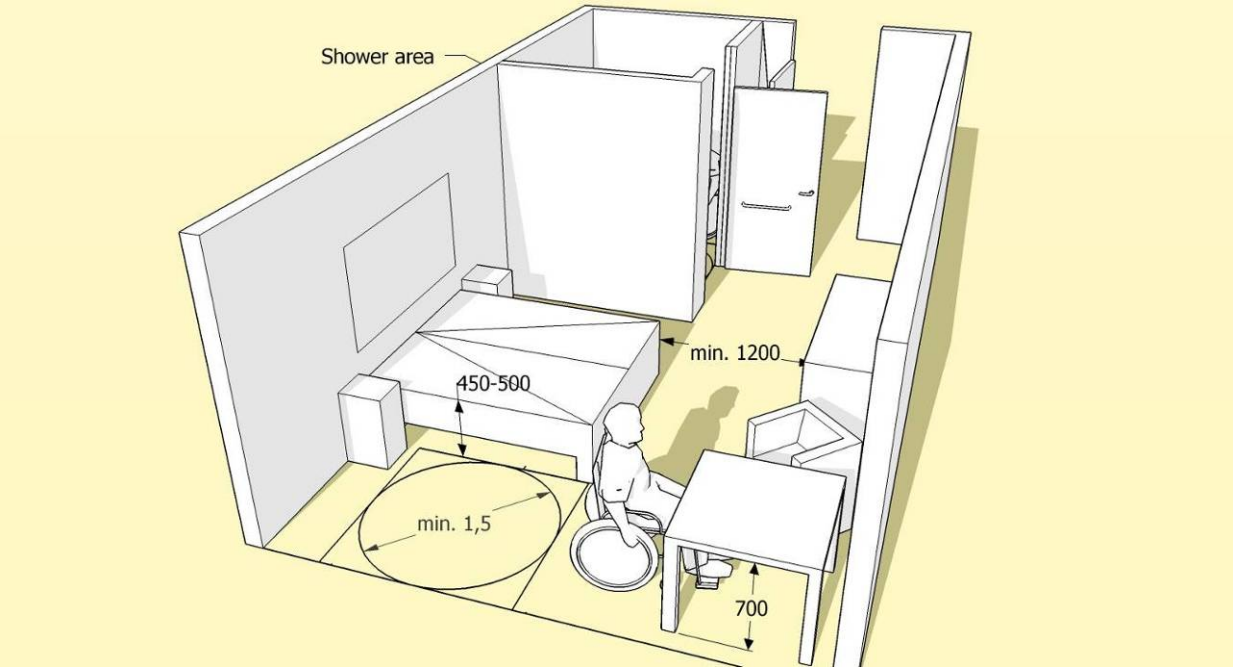


Figure 55 — Example for space allowances for accessible bedroom

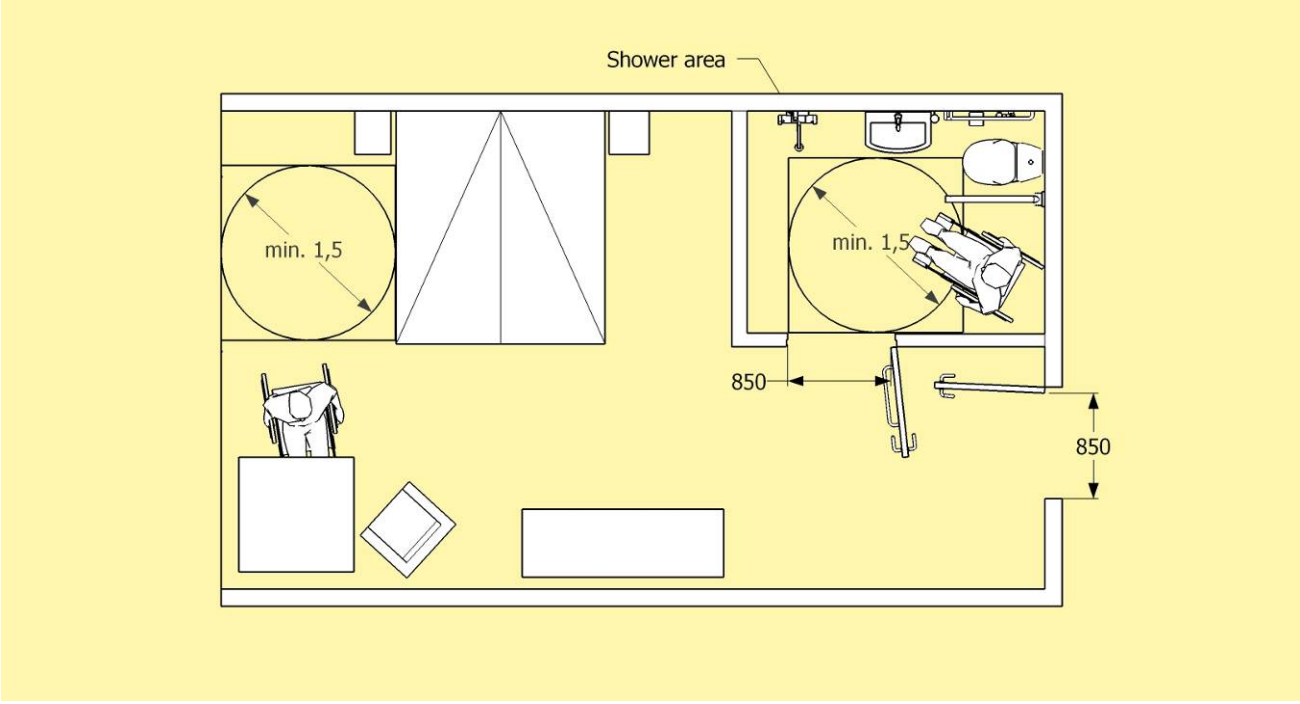


Figure 56 — Example for space allowances for accessible bedroom and bathroom

Consider figures 51 to 56 for details of an accessible bathroom. Manoeuvring space of a minimum 1 500 mm x 1 500 mm allows front facing or 45 ° oblique transfers by wheelchair users.

28 Kitchen areas

Kitchen areas shall take into account general design considerations in section 4, manoeuvring space (see B.8.1), slip resistant walking surface in 26 and accessible height of controls and devices (see 30.1).

Essential kitchen appliances (oven, refrigerator etc.) should be usable by persons both standing and sitting in a wheelchair, and a counter should be located beside all appliances.

A section of the shelves should be within reaching distance for a wheelchair user, between 500 mm and 1 100 mm above floor surface.

The sink taps should be reachable and easy to operate with one hand. Sink should be reachable for a wheelchair user and it is recommended to provide adequate space under the sink according to the user's needs or to provide adequate space beside the sink. If a knee recess is provided under a sink, its underside should be insulated.

29 Storage areas

The minimum manoeuvring space (see B.8.1) and reachability for wheelchair users (see B.8.3) should be taken into consideration when designing and constructing a storage area.

Part of the shelves should be within reaching distance for a wheelchair user, between 500 mm and 1 100 mm. above the floor.

If a door is provided, it should open outwards.

30 Facilities for guide dogs and other assistance dogs

In theatre and spectator facilities (also applies to waiting rooms/other seating areas) it is recommended that some seats should be located so that a guide or assistance dog can accompany its owner and rest in front of, or under the seat.

30.1 Relief facilities for guide dogs and assistance dogs

A relief facility for guide and assistance dogs should be provided near large buildings, such as shopping centres, leisure or entertainment complexes and transport other facilities, and any building where a guide or assistance dog owner is employed.

A secure area should be provided close to the building for use as a dog relief facility. The dog relief area should be at least 3 m x 4 m with a 1 200 mm high secure fence. The entrance gate to the enclosed area should have an easy to operate and secure catch. The surface area should be concrete with a smooth finish to assist in cleaning and a slight fall, of 3.5 %, to assist in drainage. It would be a good practice to provide a waste bin and a supply of plastic bags, close to the entrance. An accessible sign saying "For assistance dogs only" should be displayed. The area should be regularly cleaned and well maintained.

31 Floor and wall surfaces

Floor coverings shall be firm and slip-resistant in both dry and wet conditions.

Floor and wall surfaces should be anti-glare. Confusing reflections caused by the inappropriate use of floor and wall finishes and the placement of mirrors and glazing should be avoided.

For visual contrast consider 35.

The surfaces should contribute to an acoustic environment that helps in orientation; consider also 32 and 33.

32 Acoustic Environment

The acoustic environment in a building should be suitable for the intended function for all building users. This includes all hearing people especially the hard of hearing. For deaf people good lightening is essential to recognize the sign language interpreter and/or optical information devices.

Many people with some degree of hearing loss have assistive devices to amplify sound, such as hearing aids or cochlear implants.

However, if the acoustic environment is not supportive of these devices, they will not work effectively. In addition, many people who have a mild or temporary hearing loss and do not have assistive devices, may not be able to access information or communicate effectively.

Most people with hearing loss and people without hearing loss rely on sight to lip reading or interpretation of facial expressions; therefore suitable lighting, colour and visual contrast should be considered to benefit all building users where the acoustic environment is regarded as important.

Information normally conveyed in visual form may not be accessible to people who are blind or partially sighted. This information should also be conveyed audibly, the clarity (speech transmission index) of this information will be affected by the acoustic environment.

The following design considerations should be taken into account to maximize the functionality of the acoustic environment, and to support the use of assistive devices.

32.1 Acoustic requirements

People with hearing impairments have particular difficulty in comprehending sounds and words in noisy environments. Adequate sound insulation should minimise noise from both outside and inside the building. Noise can often be ‘mitagated’. for example, by not positioning a meeting room near noise from a busy road, by introducing a buffer zone between a meeting area and extraneous noise, or by partitioning a restaurant.

The acoustics in a room are essentially connected with its location in the building and with the acoustic insulation of the building elements. The distribution of noise from within the room itself and exterior sources depends on the sound absorption of the surrounding surfaces and furnishing of the room. The calculation of the absorption is significant in rooms where you need acoustic quality and also where noise reduction is required.

Good acoustics can be achieved by optimum reverberation time by considering the use/purpose of the room and by ensuring a low background noise level. The optimum reverberation time of a room should be determined by the volume and the intended purpose of the room.

The geometry and shape of the room, the distribution of sound absorbing and reflecting surfaces and the diffusion are important. Surfaces that absorb sound should be carefully selected, as well as surface that reflect it. To develop an effective acoustic environment, sound absorbent surfaces can be used on floors and ceilings.

The optimum reverberation times for communication, speech only or music performance are different and depending from the size and spape of the room; different values are given e.g. in DIN 18041.

32.2 Hearing enhancement systems

A hearing enhancement system fitted at an information point can significantly assist the communication of a person with a hearing impairment who uses a personal hearing aid, or has a cochlear implant. Hearing aids or cochlear implants may have a Telecoil (T-switch) which can reduce background noise.

NOTE Hearing enhancement systems amplify audible communication and can be helpful to people who have a hearing impairment. They include a direct wire system, an inductive loop system, an infrared system, or a radio frequency system. All of these systems transmit a signal. Special-purpose receivers are required for infrared and radio frequency systems,

while hearing aids equipped with a T-switch are capable of receiving the signal from an induction loop system. Receivers can be equipped to be compatible with hearing aids.

Hearing enhancement systems, for example induction loops and infrared signal transmitting systems, shall be provided in conference and meeting areas.

Min. 20 % of all seats should be covered by hearing enhancement systems like induction loops. Portable hearing enhancement systems can be an alternative.

Induction loops should fulfil the technical values according to IEC 60 118-4.

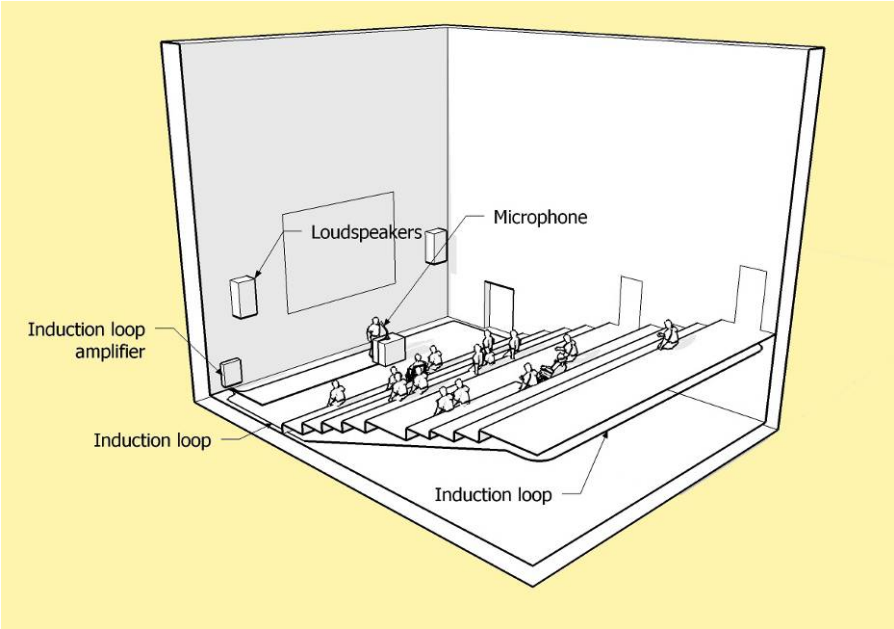


Figure 57 — Example of induction loop system in conference room

33 Lighting

The planning of artificial lighting should be co-ordinated with the planning of natural lighting, the choice of surfaces and colours. Lighting can be used to accentuate interior colour, tone and texture schemes, and to facilitate orientation, consider also section 39.

33.1 External lighting

The routes to and around a building shall have sufficient artificial lighting to facilitate awareness of changes of level or gradient. The positioning of lights should not cause glare, reflection or shadows. Ramps, entrances, steps, signage, etc. should be well lit artificially, with an illuminance of at least 100 lux.

33.2 Natural lighting

Light from windows should be possible to shade. Concerning location of windows consider 33.3 – 33.6 and 18.3.3.

33.3 Artificial lighting

Lighting should provide visual conditions relative to the visual task, orientation and safety. Key factors are:

— level of illumination of horizontal and vertical surfaces,

— limitation of glare from a light source or reflections,

— uniformity and luminance distribution,

— direction of lighting and shading,

— colour rendering.

Artificial lighting should give good colour rendering. Light sources with a colour rendering *Ra* of 80 are recommended.

NOTE 1 For safety colours see ISO 3846

NOTE 2 Good artificial lighting is crucial for everyone, ensuring that vision impaired people are able to use buildings safely and conveniently, and that people with hearing impairments will be able to lip-read.

33.4 Lighting to facilitate way finding

Lighting should facilitate wayfinding: building elements should be marked by extra illumination. The lighting in critical locations such as entrances, corridors, stairs, changes of level and workstations should facilitate their identification, consider also 33.3.

Time dependant switch devices shall have a progressive switch off to reach the next switch. Automatic switch on detection system shall cover the complete surface of ramps and stairs. Lighting shall provide sufficient time necessary for user to travel safely along ramps.

NOTE Switch off of lighting when people are still on ramps or stairs should be avoided. Ramps, stairs are the highest hazardous places for falls.

33.5 Controllable and adjustable lighting

All lighting, including natural light, should be controllable to avoid glare.

Artificial lighting may be adjustable to suit individual needs.

33.6 Light levels in different areas

Good light levels should be provided in hazardous areas such as stairs or changes in levels along a route, around doors and at communication or information systems.

A minimum light level should be provided according to the visual task, see table 4.

Table 4 – Minimum light level in different areas

different areas	Emin [lux]
Horizontal surfaces indoors	100
Stairs, ramps, escalators, travolators	150 – 200
Habitable spaces	300 – 500
Visual task with small details or low contrast	1 000

33.7 Lighting in auditoriums

Lighting conditions that support lip reading and sign language should be included. The environment should be designed to avoid reflection and glare, and it should be possible to adjust both natural and artificial light.

33.8 Glare and shadows

Lighting should not produce glare. Avoid glare and shadows by:

— protection of light sources by shielding or shading,

— use of indirect lighting,

— appropriate location of light source in relation to the direction of vision and to the object that is to be observed,

— uplighters, with light sources at floor or low level, should not be used,

— avoidance of windows at the end of corridors,

— avoidance of light sources against dark surfaces by choosing light colours for ceilings or walls,

— avoidance of abrupt transitions from light to dark spaces. Indoor and outdoor lighting around the doorway should be suitably adjusted to prevent dazzle when entering or leaving the building.

The United Glare Rate *UGRL* should not exceed 25 for circulation areas and 22 for habitable rooms.

NOTE 1 For determination of United Glare Rate, see methodology defined by CIE.

NOTE 2 Due to the increase of optical scatter in the eye, the effects of glare are exacerbated for the elderly and for individuals with some types of vision impairments (e.g., cataracts, corneal edema, and vitreous opacities). Glare can cause discomfort and interfere with task performance by decreasing the perceived contrast in visual displays (i.e., disability glare).

34 Fire emergency warning systems, signals and information

In all building types, a reliable and effective fire warning system is essential.

Available technologies now readily facilitate that warning information can be simultaneously communicated by sounder, light strobe, voice message and individual tactile sensation by vibration.

34.1 Light warning signals

Light strobes/beacons should be easily noticed. Light strobes should be located in washrooms and in other locations within buildings where people are apt to be alone and also in noisy environments.

A larger number of strobes/beacons with low output should be specified - never a small number of strobes/beacons with high output which will only lead to extreme glare causing confusion and disorientation among building users, or even panic attacks. Adapt light output of strobes/beacons to suit surroundings.

Light strobes/beacons - always ensure a slow rate of flash (e.g. once every 2 seconds) in order to avoid epileptic seizures. Most importantly, the flash of one strobe/beacon should be synchronized with the flashes of all other light strobes/beacons in view.

34.2 Acoustic warning systems

A larger number of sounders between 85 dB – 95 dB with low output should be specified - never a small number of sounders with high output which will only lead to confusion and disorientation among building users, or cause panic attacks.

Voice messages - a short message should contain appropriate warning information which is easily assimilated. The speaker must be distinct and easy to understand. In today's multi-cultural built environment, messages should be given in at least two or three different languages.

NOTE Children under ten years of age, who are asleep, are more difficult to wake than adults.

35 Visual contrast

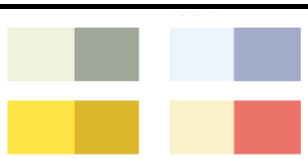
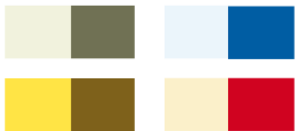
In order to facilitate orientation and to ensure safe use of an environment, adjacent surfaces, information and potential hazards shall provide a discernible visual contrast.

The minimum difference in light reflectance value (LRV) shall be provided in relation to the visual task. See table 5. And additionally one of the two surfaces should have light reflectance value of min. 6 points.

For lighting conditions lower than specified in this standard, the difference in LRV's should be higher. Refer to published recommended levels of illumination and to 33.4 for extra illumination to mark important areas or details.

NOTE 1 The *LRV,* sometimes also called the *luminance reflectance factor,* is expressed on a scale of 0 – 100, with a value of 0 points for pure black and a value of 100 points for pure white.

Table 5 – Minimum difference in light reflectance value (LRV) according to the visual task

Visual task	Difference on the LRV scale	Examples, approximate values
Large area surfaces (i.e. walls, floors, doors, ceiling), elements and components to facilitate orientation (i.e. handrails, switches and controls, tactile walking surface indicators)	≥ 30 points	
Potential hazards (i.e. steps, glass surfaces)	≥ 60 points	
Text information (i.e. signage)	≥ 60 points	

NOTE 2 The perception of visual contrast increases with better lighting conditions.

NOTE 3 Reflections and glare from shiny surfaces may reduce visual contrast and may confuse people with vision impairments.

Floor patterns should have a visual contrast of less than 20 points difference on the LRV scale.

NOTE 4 Highly contrasted floor patterns can be perceived as differences in floor level, which may confuse people with vision impairments or cognition capacity. Highly contrasted floor patterns may trigger an attack of vertigo.

Methods for the determination of visual contrast: see annexe B 9.2.

35.1 Choice of colours and patterns

Different colours should be used for identification of doors, different storeys or departments in a building to aid persons with impaired cognitive ability. The colours used to facilitate orientation shall also provide minimum difference in LRV according to 35. Combinations of red tones and green tones should be avoided.

The choice of colours should be co-ordinated with planning of lighting (see 33).

36 Equipment, controls and switches

The design and construction of the operating controls and devices should aim to ensure the independent and safe operation of controls and devices by all people.

Operating controls and devices include, but are not limited to:

— door handles and locks;

— lever, mixer or cross-head taps;

— activation devices;

— window openers and locks;

— electric outlets and switches.

The ease of operation should allow the possibility of hands-free operation and the use of an elbow, etc. Minimum manual effort should be required, such as for the opening and closing of doors.

36.1 Accessible location and height for devices, controls etc.

Devices, controls etc. shall be installed at an accessible height for reaching and operating, between 400 mm and 1 100 mm above floor level and shall be located a minimum of 600 mm from any internal corner, preferably 700 mm. For detailed requirements see also 4.3 and 4.8.

Sufficient lighting of the control devices and all relevant information should be provided, see 4.6, 4.7 and 4.8.

Round or oval type door knobs are not suitable for people with mobility impairment, for people of small stature or less strength, and for children.

All switches and controls should be located within reach of persons in wheelchairs. They should be easy to handle and it should be easy to understand.

36.2 Heights and distances

Control devices (radiator valves, fuse boxes, switches, push-buttons, intercoms, etc.) shall be installed between 800 mm – 1 100 mm, and they shall be located a minimum of 600 mm from any internal corner.

Landing controls and car controls in lifts see 15.3 and 15.4

Control devices combined with text or figures should be positioned with the text and figures or the whole control device placed at the angle of approximately 45 ° to the wall so that they are easier to read and operate. (for example a panel in an elevator).

Control devices placed on a horizontal surface should be placed at a height between 800 mm – 900 mm and within 300 mm from the edge of the surface.

Socket outlets, including those for telephone or TV, should be located not less than 400 mm from the floor.

Reading meters should be located between 1 200 mm and 1 400 mm from the floor.

NOTE Safety regulations related to electricity should be consulted in every country.

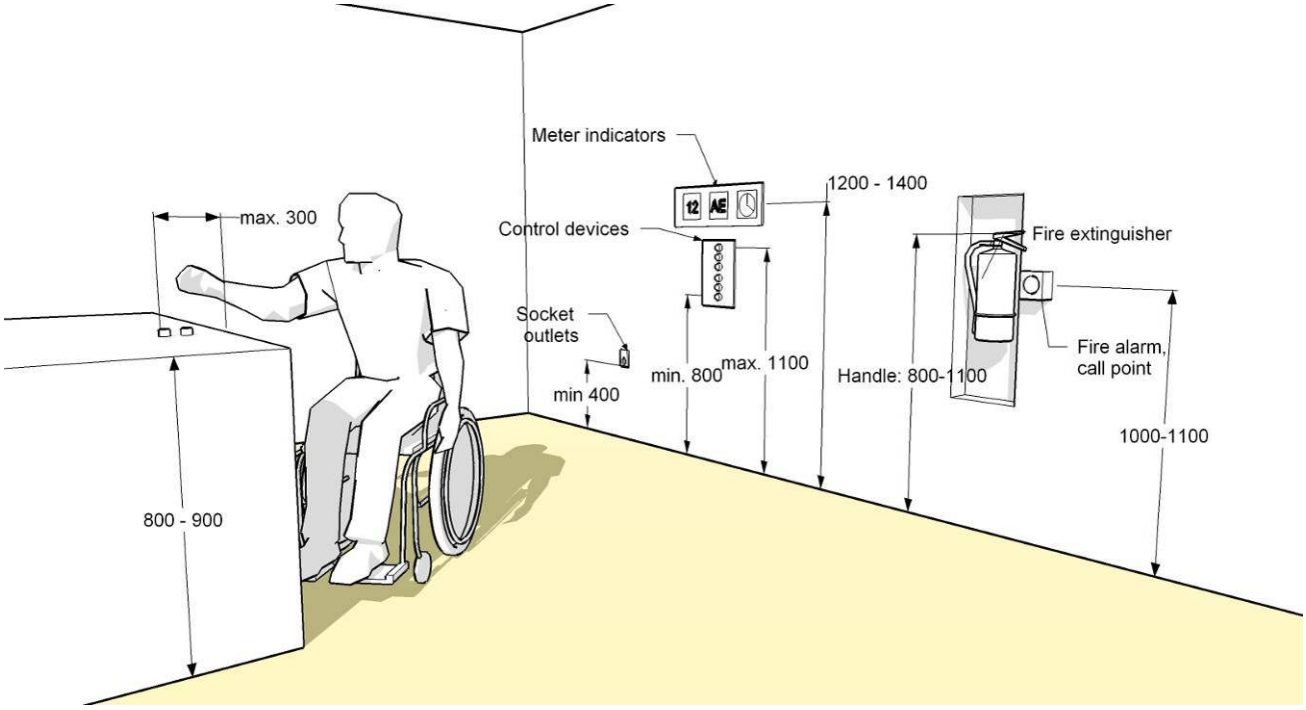


Figure 58 — Heights of switches, socket outlets, reading controls and controls on a horizontal surface

Door handles should be placed according to Figure 59. The upper figure shows the height of a handle for pushing or pulling the door, the middle figure shows a vertical door handle, and the figure on the right shows an example of a pull rail that might allow a wheelchair user to close the door behind him, for example, in a toilet

If fire and safety related, all controls should be intutitive and obvious to use. Fire extinguisher should have maximum wight of 5 kg or 6 litres or even less.

Fire alarm call point should be in a height of 1 000 and 1100 mm.

All important controls should have an integral Braille indication.

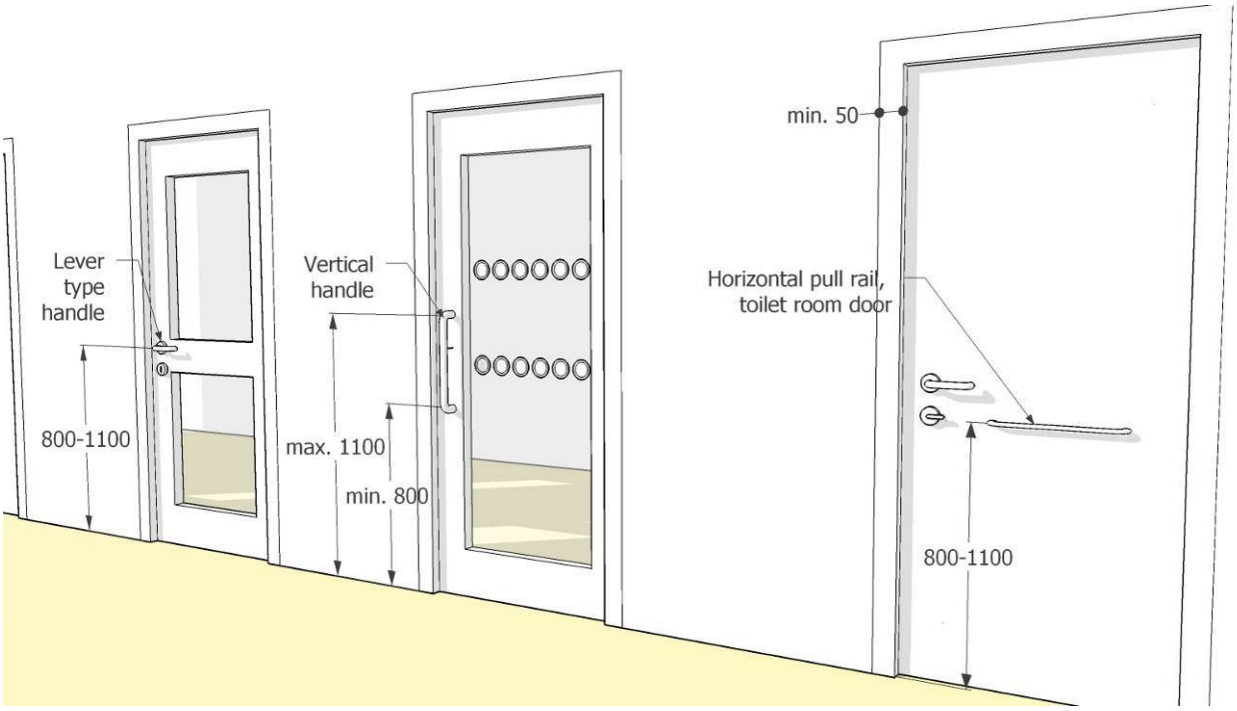


Figure 59 — Door handle types and heights

36.3 Distance from adjacent walls, internal corner, swing arc of an opening door

The minimum distance of the centre of switches and devices for controls of doors or windows etc. shall be 600 mm from any internal corner or any projecting element (see figure 60); recommended 700 mm.

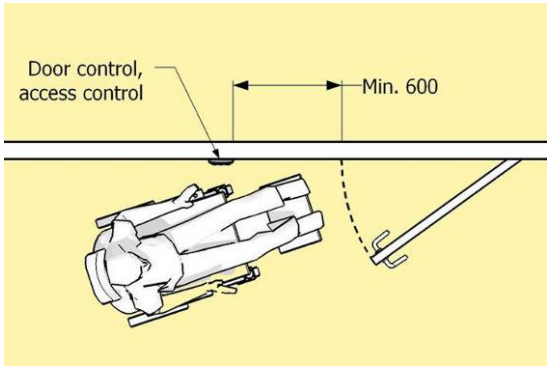


Figure 60 — Position of door and access controls

Controls for powered door openers to hinged doors should be located so that the doors do not conflict with wheelchairs, canes, walking aids, etc. Controls for powered door openers to hinged doors should be located a minimum of 1 000 mm from the swing of the arc of the door so that the door is clear of people in wheelchairs, scooters or other assistive devices (see figure 61). Opening time shall be sufficient for a person using wheelchair or assisting devices to safely pass through the door before it closes.

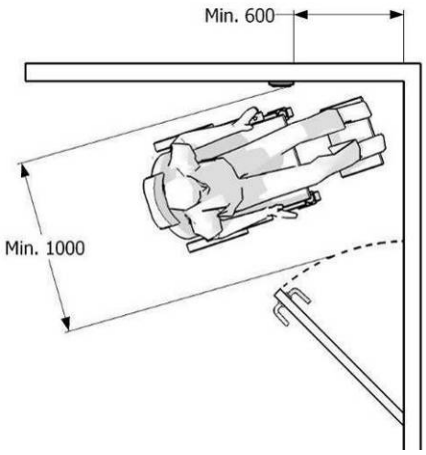


Figure 61 — Distance of controls for powered door openers

36.4 Operation

Consider requirements in 4.13.

To aid in operation by people with impaired coordination or vision impairments, switches, etc. should have large push plates.

Door, window and wall handles should be at least 100 mm long.

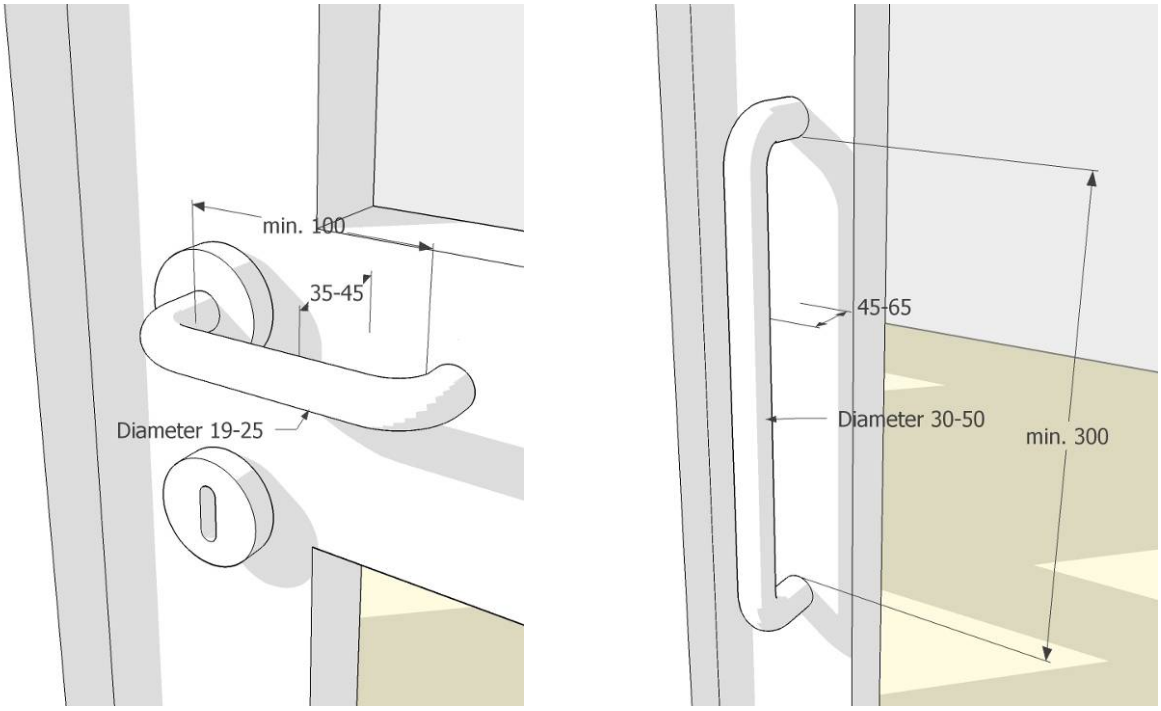


Figure 62 — Examples of D-lever and vertical door handles

Lever handles should be between 19 mm and 25 mm in diameter; “D-Lever” handles are preferred (see figure 62).

A vertical bar for sliding doors should be 30 mm – 50 mm in diameter. The clearance between the bar and the wall should be 45 mm – 65 mm.

Door locks and bolts should be set at least 50 mm from the edges of door leaves.

Consider general requirements for handrails in 14.

Suitable clearance should be provided between adjacent fixtures and fittings to prevent accidental operation.

Operating force on control buttons and push plates should be 2.5 N – 5.0 N.

36.5 Identification

Buttons and devices should be identified by visual contrast.

Information should be in raised tactile and Braille signage.

36.6 Usability

Control devices for different functions should be different. Hand control devices for similar functions should have a similar design and activation mechanism and be the same for identical functions throughout the facility.

36.7 Telephones

Telephones shall be on a clear accessible route with approach from the front or the side, consider B.8.1 and 4. All information should be in at least two senses, e.g. visual, aural and tactile. The telephone keypad shall have a tactile point on the number 5.

Public telephones should be located beside the access route and should be easily detected by people with vision impairments.

Control devices shall be at a maximum height of 1 100 mm. A clear space underneath shall be provided for wheelchair-user's knees, see figure 63. At least one telephone in any group should fulfil these conditions and be equipped with a magnetic field and text display.

Side protection has to be considered according to 7.13 and 7.14.

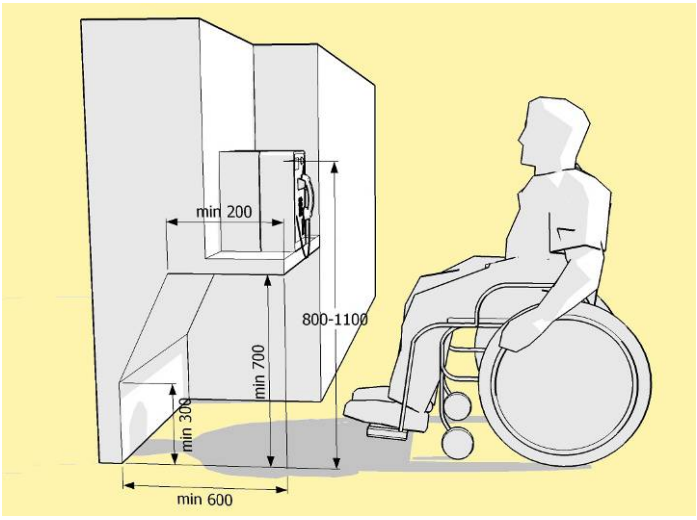


Figure 63 — Height of telephone controls for wheelchair users

36.8 Card access, dispensing machines and automatic teller machines etc.

Machines for dispensing money, tickets or small goods should be accessible and should be located on an accessible level. The approach to dispensers should be clear and unobstructed, at least 900 mm wide. To approach with the wheelchair, a knee space a minimum of 700 mm in height and a minimum 600 mm in depth and 900 mm in width should be provided.

The clear area immediately in front of the machine should be at least 1 800 mm x 1 800 mm, to allow a wheelchair user to approach the controls sideways, and to turn around after use. An area of this dimension also provides an element of privacy.

The operation of the machine should be easy to understand.

Glare from sun, artificial lighting and streetlight on the screen should be avoided.

Card access shall:

a) have a slot
   – located at a height of between 800 mm to 900 mm from the floor,
   – with its edge bevelled and
   – colour–contrasted with the surrounding surface

b) include tactile graphic symbols on the surrounding surface that
   – represents the card and
   – identifies the orientation of the card insertion, and

c) have both audible (beep) and visual (light) signals to indicate that access has been granted.

The keypad shall:

a) be located a a height between 800 mm to 1 100 mm from the floor,

b) be colour-contrasted with the background,

c) have characters that are colour-contrasted with the keys,

d) if numeric, be telephone type and have a raised dot on number 5 that
   – is 0.7 ± 0.1 mm high and
   – has a base 1.5 mm in diameter and

e) have both audible (beep) and visual (light) signals to indicate that access has been granted.

NOTE The keys should be readable from both a standing and a seated position.

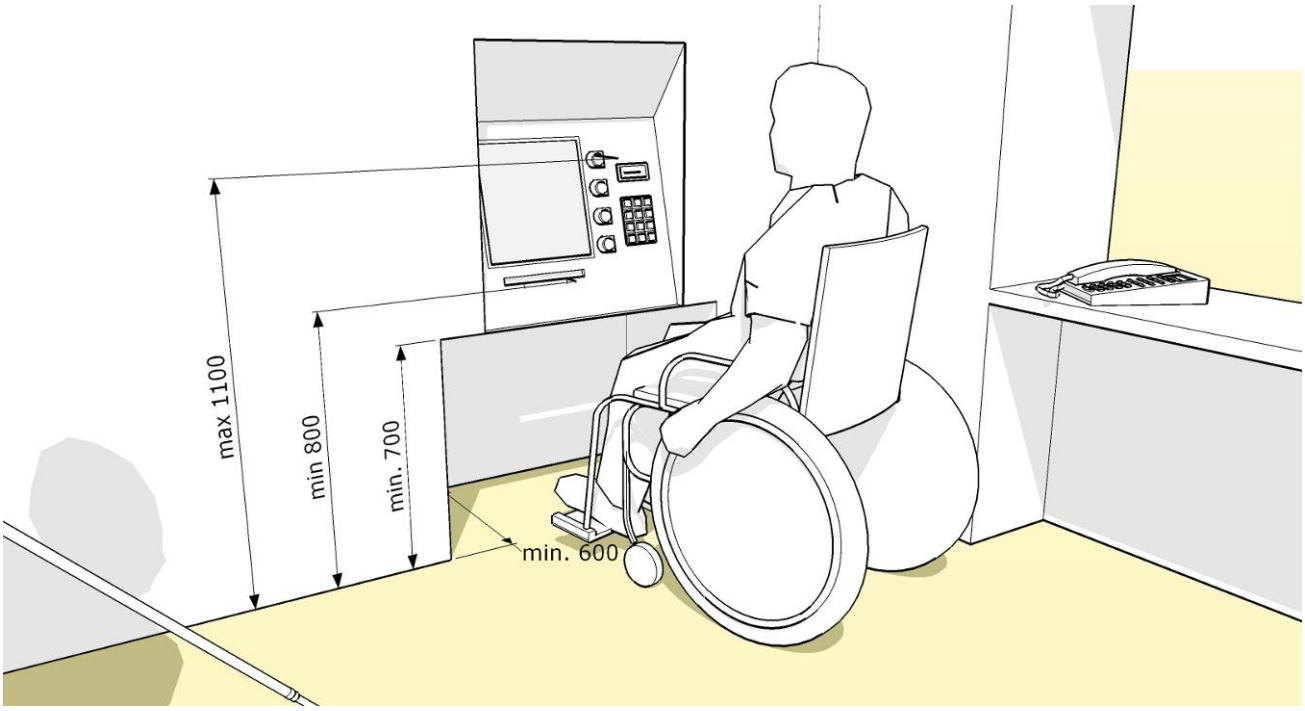


Figure 64 — Example of a vending machine

36.9 Security access systems

Security access systems shall

(a) be located on the accessible route,

(b) comply with all requirements of accessible manoeuvring space according for B.8.1 and accessibility of all controls and devices,

(c) comply with card access and keypad requirements given in 36.8,

(d) provide equitable alternative means to allow persons with disabilities through the security system.

Security gates or screens shall consider all relevant requirements for accessible manoeuvring space according B.8.1 and where queue systems are used, have both audible (beep) and visual (light) signals to indicate “proceed” and “stop” instructions.

NOTE Security access systems should be usable by everyone. Proximity or contactless scanners may facilitate this. Biomentric systems (e.g. retinal or palm sanners) cannot accommodate all users.

36.10 Drinking fountains

Drinking fountains shall be accessible according to B.8.1, B 8.2 and 36.1, situated adjacent to a path of travel and have at least two different heights.

Where only one is provided, it shall be at a height of 700 mm above floor level.

The water outlet shall be as close as possible to the front of the unit. It shall direct the flow of water to a height of 80 mm – 100 mm in a trajectory that is parallel or nearly parallel to the front of the unit.

Controls shall be centrally positioned at the front of the unit or, if at the side, on both sides, not more than 180 mm from the front. Controls shall be operable with one hand with an operating force of not more than 19,5 N.

36.11 Refuse bins

Refuse bins should be designed for accessibility and made accessible for wheelchair users.

37 Furnishing

Seating facilities should be provided in public buildings to provide people with a place to wait and to rest; see also 19.6.

The location of seats (including reserved areas for wheelchairs) should not disturb the general circulation.

Seats should be designed with armrests to facilitate sitting down and standing up. The seats should also have support for the back.

Consider also 30 regarding facilities for guide dogs and other assistance dogs.

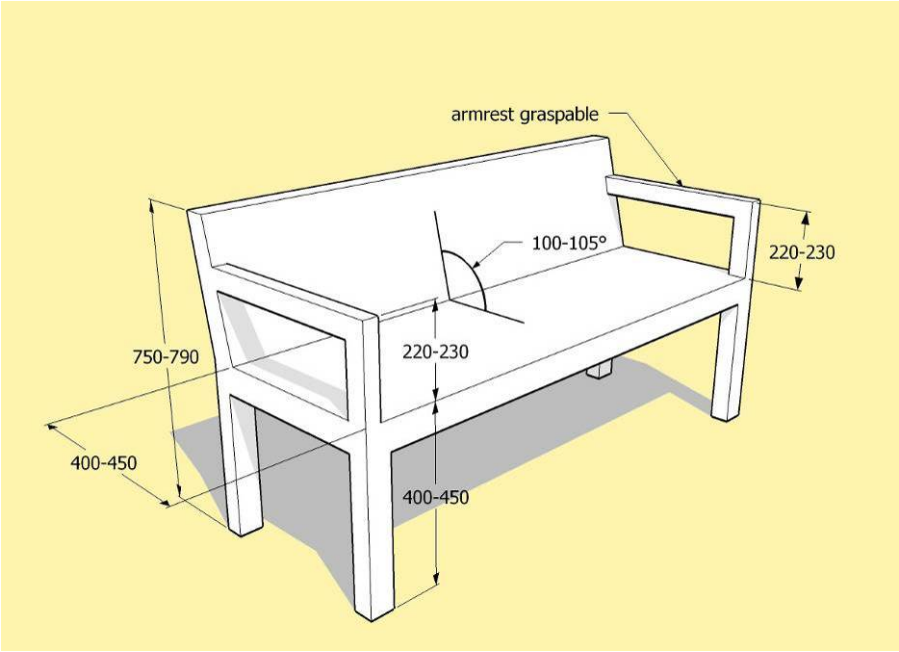


Figure 65 — Example of a bench with armrests and back support

37.1 Seating in waiting areas

A range of different types of seating should be provided at 60m intervals complying with:

— seat height 400 mm – 450 mm,

— back support height 750 mm – 790 mm,

— seat depth 400 mm – 450 mm,

— angle of seat to backrest 100 ° – 105 °,

— armrest height 220 mm – 300 mm above seat,

— armrest set back from front of seat ≤ 75 mm,

— a minimum 150 mm set back under the seat for feet when standing up.

37.2 Seating at desks, tables etc.

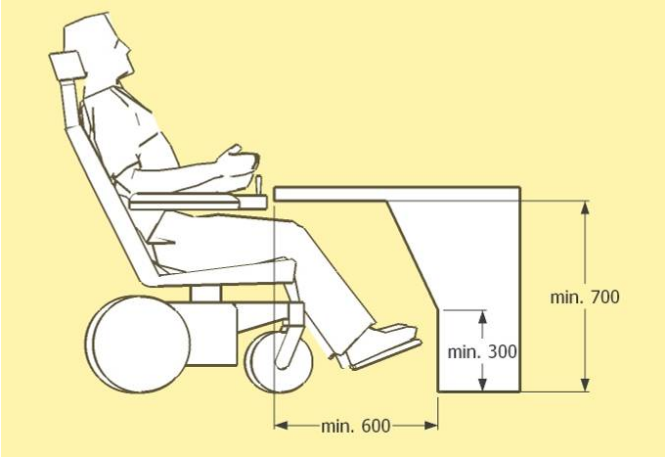


Figure 66 — Table and desk height for wheelchair users

To allow frontal approach with a wheelchair to a table, desk, counter, telephone etc., an unobstructed space shall be provided with a minimum free height of 700 mm and minimum free depth of 600 mm to accommodate knees underneath. For footrests a minimum height of 300 mm is required. See figure 66.

If tables with fixed seats are used, there shall be a place for at least one person in a wheelchair at the table.

38 Fire safety, protection and evacuation for all

38.1 Fire engineering design objectives

In order to adequately protect people with activity limitations in a fire emergency, e.g. frail older people, people with disabilities, children, and women in the later stages of pregnancy, the scope of project-specific fire engineering design objectives should extend beyond the scope of fire safety objectives in national legislation.

Fire engineering design objectives should be developed by a fire engineer or other suitably qualified and experienced person. The two critical design objectives are:

a) People evacuation during a fire:

During and after the process of

— independent evacuation to a 'place of safety' which is remote from a fire building; or

— independent partial evacuation to a 'place of relative safety' within the building, for example, to an 'area of rescue assistance' adjoining a vertical evacuation route; or

— protection in place, for example, in the case of health facilities; fix small fire sections.

The individual health, safety and welfare of those people involved, including firefighters, should be assured.

b) Structural stability during a fire

A building which is on fire (the fire building) should remain structurally stable

— while people are waiting in 'areas of rescue assistance'; and

— until all of these people can be evacuated with assistance, or rescued by firefighters; and

— the people involved, including firefighters, can reach a 'place of safety' which is remote from the building.

38.2 Principles of fire evacuation for all

It is a fundamental principle of fire engineering design for evacuation that there shall be an alternative, safe and intuitive evacuation route away from the scene of a fire, which may occur at any time and in any part of a building. These evacuation routes shall be available to all building users.

The principles of fire evacuation for all:

— protection and evacuation for all should be incorporated at a sufficient early stage in the architectural design process

— partial horizontal evacuation, at the beginning of a fire emergency, to a 'place of relative safety' is the preferred fire engineering strategy,

— if the fire develops to a larger extent, it will be necessary to consider vertical evacuation.

— all lifts (elevators) in new buildings should be capable of being used for people evacuation in a fire situation,

— lifts in existing buildings, when being replaced or undergoing a major overhaul, should be capable of being used for people evacuation in a fire situation too; see 15.6 for more guidance.

NOTE If lifts/elevators cannot be used for evacuation, large numbers of building users will be unable to evacuate independently and will require assistance from other building users, or they will have to wait for significant periods of time in 'areas of rescue assistance' for eventual rescue by firefighters.

38.3 Assisted fire evacuation

The default fire engineering design objective is that every person using a building, whatever his or her abilities, should be facilitated in evacuating the building independently during a fire emergency. This may not always be possible, particularly in the case of existing buildings.

The process of evacuation, whether independent, assisted or achieved by rescue, is only complete when the building user has reached a 'place of safety', which is at least 100 metres from the fire building.

38.3.1 Areas of rescue assistance

An 'area of rescue assistance' is a building space directly adjoining, and visible from, a main vertical evacuation route. The area should be robustly and reliably protected from heat, smoke and flame during and after a fire - where people may temporarily wait with confidence for further information, instructions, and/or rescue assistance, without obstructing or interfering with the evacuation travel of other building users.

NOTE ‘robust’: structurally hardened and resistant to mechanical damage during the fire and for a period of time afterwards, i.e. the cooling phase

It is essential that movement to and from each area of rescue assistance does not encroach on the evacuation travel space of the staircase. Door leaves should also not open into or over this evacuation space.

Fire evacuation routes, including all areas of rescue assistance, shall be kept clear at all times.

An area of rescue assistance should be of sufficient size to cope with expected needs in a fire emergency. For example, if there are only two evacuation staircases on a floor in a building (on opposite sides), each area of rescue assistance should be designed to cater for the expected needs of the full floor.

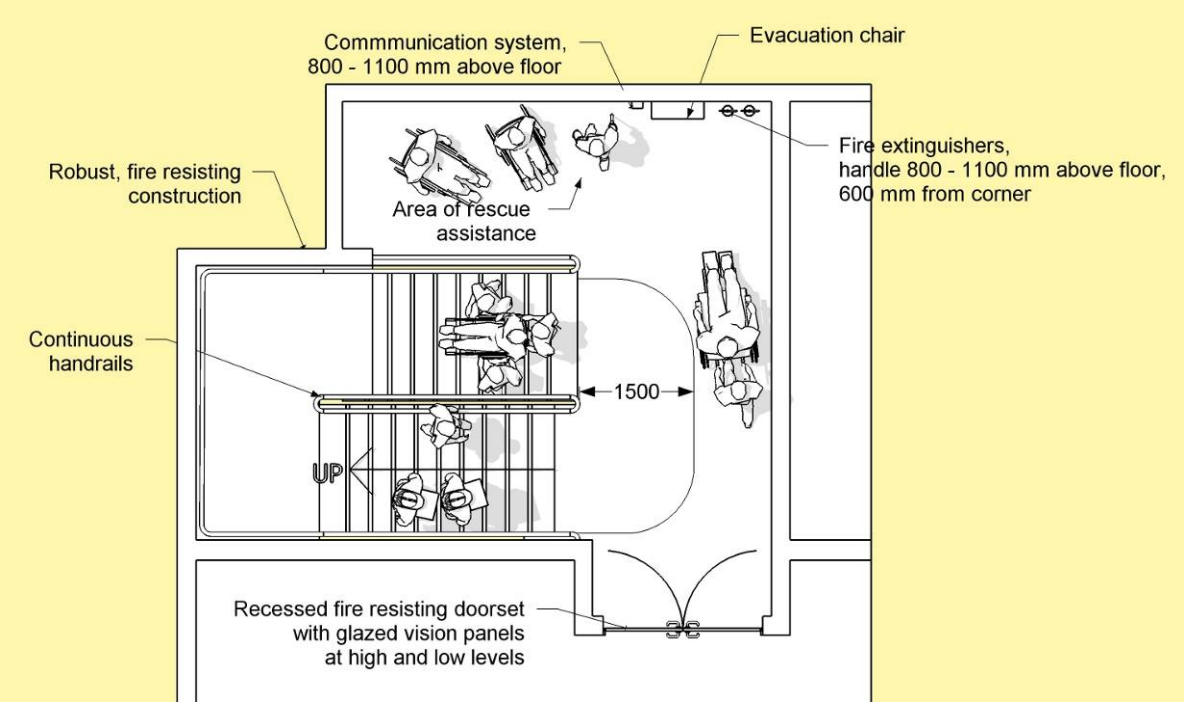


Figure 67 — Example of fire evacuation staircase with an area of rescue assistance

An area of rescue assistance in a building should

— be located on every floor of a building,

— adjoin every evacuation staircase,

— include space for persons in wheelchairs,

— have good lighting and be clearly indicated with good signage,

— be fitted with an accessible and reliable independent communication system placed at a height of 800 mm – 1 100 mm above floor level, facilitating direct contact with a person in the main fire and security centre for the building,

— be of sufficient size for the storage of an (powered) evacuation chair, portable fire extinguishers, a fire hose reel and a manual fire alarm call point, a fire evacuation supply kit containing, for example, smoke hoods, suitable gloves to protect a person's hands from debris when pushing his/her manual wheelchair, patch kits to repair flat tyres, and extra batteries for powered wheelchairs etc.

— be marked with good signage.

38.3.2 Evacuation Chairs

Evacuation chairs should be capable of

— being safely and easily handled,

— carrying people of large weight (up to 150 kg),

— going down staircases, which may be narrow and of unusual shape,

— travelling long distances horizontally and externally, perhaps over rough ground, in order to reach a place of safety,

When going up staircases is necessary, a powered evacuation chair should be provided.

38.4 Emerging fire evacuation technologies

Emerging fire evacuation technologies, which should be provided:

— intelligent evacuation management systems;

— directional sounders for locating fire exits on each floor of a building which may be obscured by smoke.

38.5 Fire defense plans

A 'fire defence plan' elaborates, usually in hard copy and/or electronic format and comprising fire engineering drawings, descriptive text, fire safety related product/system information, with supporting calculations and fire test data, the particular fire engineering strategy which has been developed for a specific building.

The fire defence plan shall:

— demonstrate a proper consideration for the fire safety, protection and evacuation of the 'real' people who will be using the building (occupants, visitors and other users) and who may or may not have a health condition or impairment;

— be completed prior to the commencement of building construction - this may be a requirement of national legislation;

— be stored in an accessible and fire protected location in the building, after its completion, for use by the building's management and, in the event of a fire emergency, by the firefighters responding to that emergency;

— be maintained by the building owner(s) over the life cycle of the building.

39 Orientation and information

The built environment should be designed, constructed and managed to facilitate orientation. Orientation means to find one’s way, to avoid obstacles which could cause hazards, and to know when one has reached the destination.

Suitable provision shall be made at the entrance to the building and at decision points within the building to describe the location and nature of the building. In very complex buildings visual, audible and tactile information should be provided.

Means to achieving satisfactory orientation conditions are

— planning layouts,

— way finding and guided paths with TWSI (see 7.1), other physical support of information (see 33),

— signage (see 40) and symbols (see 41),

— visual contrast (see 33),

— choice of colours (see 35.1),

— avoiding surfaces which might make orientation more difficult,

— lighting (see 33),

— visual, audible and tactile information according to the two-sense-principle, see 33.1.

Orientation should be facilitated by differences in acoustics, material, light and colour. The design should indicate the use of the building elements.

To facilitate people with vision impairments who have some residual vision, routes to be followed should have a difference in luminance to the surroundings (see 35).

Additional illumination or luminance contrast and tactile information, like a change in material or tactile walking surface indicators, should be provided at decision points like entrance, staircase, lift, etc. to assist orientation and way finding.

Tactile walking surface indicators should be used to indicate directional orientation information where no other cues indicate the path of travel. Across large areas, halls and complex buildings people who are blind need a tactile route or guiding line to follow. (see Annexe C)

In complex buildings, an audible beacon should be installed in addition to visual and tactile information to provide information on decision points.

To avoid hazards in buildings and in the outdoor environment consider also section 4.

39.1 Principle of two senses

Supportive measures for information and wayfinding shall be provided in a format that is accessible to people with sensory impairments according to the principle of two senses:

— audible/tactile information for people with vision impairments, and

— visual information for people with hearing impairments

39.2 Audible information

Consideration should be given providing suitable amplification and acoustic conditions; the message should be easily understandable and unambiguous. Consider also the principle of two senses in 33.1.

Public address systems should be clearly audible and equipped with hearing enhancement system as described in 32.

Emergency information and warning systems are described in 15.4.7, 26.13 and in Annex A.

39.3 Levels of information

Information should be clear, concise, accurate and timely. Clarity of information can be defined as information that is legible and easily understood. Clarity of information therefore presupposes that people will be able to distinguish between the different types of information that they receive.

Information can be divided into three levels:

— Level 1 information, such as safety information;

— Level 2 information, general information;

— Level 3 information, such as advertising.

It is important that these three levels of information are clearly distinguished.

Information should be complete but concise. Too much information is difficult for people to retain.

All information provided should be accurate and consistent.

40 Signage

Signs should be readable and legible for people who have vision or mental impairments. Well-illuminated, clear and readable signs shall be placed at a consistent height. Concerning height, consider 40.4.

Information with text should be supplemented with symbols to facilitate comprehension for everyone. Concerning symbols see 41.

Signs should be provided in relief and Braille, see 40.12.

The signs should be made of robust materials and easy to change, clean and repair.

An excessive quantity of signs should be avoided.

40.1 Main types of signs

— Orientation signs: Sketches, plans, models, etc.

— Directional signs: Directional information from point A to B.

— Functional signs: Explanatory information

— Informative signs: Purely information, for example a name

— Signs for emergency exits, see Annex A.

40.2 Location of signs

33.2.1 Placement outside the building

Information signs shall be located adjacent to the entrance door and be illuminated and clearly visible. The sign shall be placed on the latch side. For design and size of letters - see 40.5

Communication systems shall also be placed on the latch side and preferably in a range of 1 000 mm – 1 200 mm above ground level.

40.3 Placement in the building

Orientation signs should be located in accessible places (for wheelchair users and others), and in such a way that they can be examined as quietly and comfortably as possible.

In public buildings there should be an orientation plan immediately inside the main entrance. This plan should follow all relevant design criteria stated in 4 and 35.14.

Directional signs should clearly direct people to the facilities. They should be located where directional decisions are made and constitute a logical orientation sequence from the starting point to different points of destination. They should be repeated, not too often, but every time there is a possibility of alteration in the traffic direction.

Directional signage to washrooms should be provided in all parts of a precinct or building.

Stairwells should have information signs identifying all points of entry and exit.

Floor numbers shall be located on each side of the outer frame of each lift-car entrance on each floor.

40.4 Height and location of signs

Directional signs and functional signs should incorporate raised tactile signage and Braille on signs located below 1 600 mm. Consider also 40.11 and 40.12 for raised tactile signs and 40.13 for Braille signs.

Signs should be located where they are clearly visible to people in seated, standing or walking positions.

Signs should be placed between 1 200 mm - 1 600 mm from the floor or ground surface. It should be possible to approach the sign to allow it to be read from a short distance.

Where it is likely that the sign may be obstructed, as in a crowded situation, the signs shall be placed at a height of at least 2 100 mm above the floor. The same requirement applies to signs fixed to the ceiling or project from walls. In that case, there should be two signs; one that could be seen from a distance above other people's heads, one as a complement at the height recommended above.

Door signs shall be located on the wall on the latch side of the door. The leading edge of the sign shall be between 50 mm – 100 mm from the architrave.

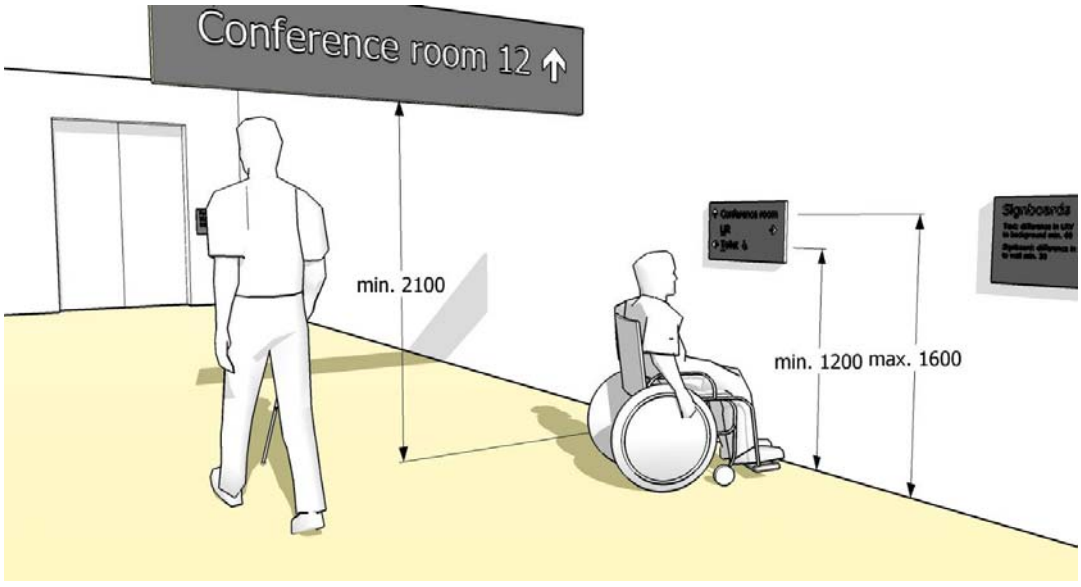


Figure 68 — Height of signs

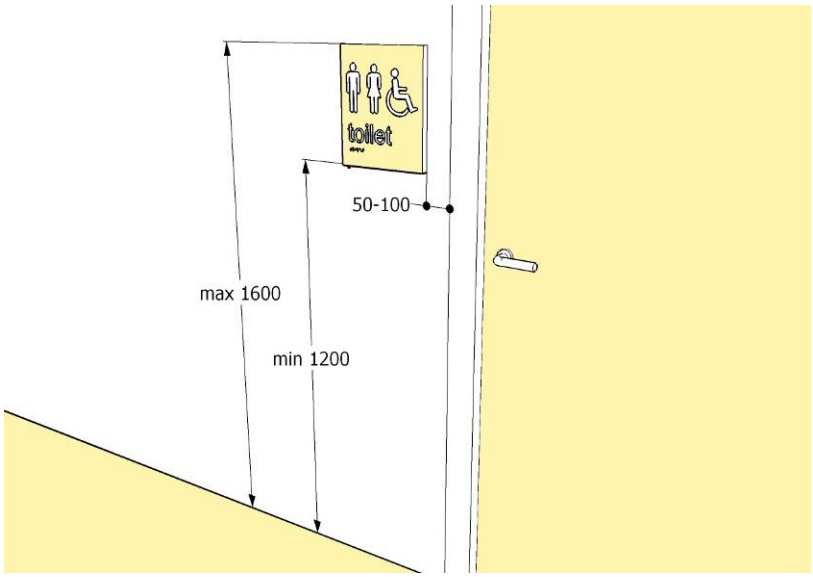


Figure 69 — Location of door signs on the latch side of the door

40.5 Font and size of lettering

The fonts should be easy readable. The font style should be a sans serif font similar to Helvetica or Arial medium.

The letter height will depend on the reading distance. A letter height between 20 mm – 30 mm for each metre of viewing distance is preferred. The letter height should not be less than 15 mm.

It is recommended that all words have a combination of upper and lower case (sentence case).

The words should not be placed too close together. Adequate height spacing should separate the lines. Lines of text should be ranged from a vertical line (unjustified).

Signs with single word may be centre justified.

40.6 Differences in light reflectance values LRV

Minimum difference in LRVs for small targets, like signs and inscriptions, to signboards, should be 60 points.

Signboards should have a minimum difference in LRVs from the background of 30 points.

Red-green combination should be avoided. Difficulties in perception can also appear when using the colours green, olive green, yellow, orange, pink and red. Refer to the contrast section within Annex B.9.

40.7 Glare free

Signs should be glare free when mounted. This depends on how the sign is placed, the material and the illumination. The background, symbols, logos and other features shall be of a matte or low sheen finish.

40.8 Illumination

Signs should be well illuminated with no glare.

Signs can be luminescent or artificially lit.

40.9 Understandable

Signs should be readily understandable. They should be designed so as to be simple and easy to interpret. The message should be unambiguous.

Short sentences and simple words should be used. Abbreviations and very long words are hard to understand and should be avoided.

40.10 Provision of raised tactile and Braille signs

Signs on panels in lifts, room numbers of rooms in hotels, doors to public toilets and so on shall be raised tactile and include Braille. See also 40.4.

The height of raised tactile information is preferred at a height between 1 200 mm – 1 600 mm. Signs with tactile information placed at a lower height should be mounted at an angle from the horizontal (preferably 20 ° – 30 °, max. 45 °).

40.11 Tactile letters

Letters of 15 mm - 55 mm in height and between 1 - 1.5 mm in raised relief are preferred.

40.12 Braille

Where an arrow is used in the tactile sign, a small arrow shall be provided for Braille readers.

On signs with multiple lines of text and characters, a semi circular Braille locator at the left margin shall be horizontally aligned with the first line of Braille text.

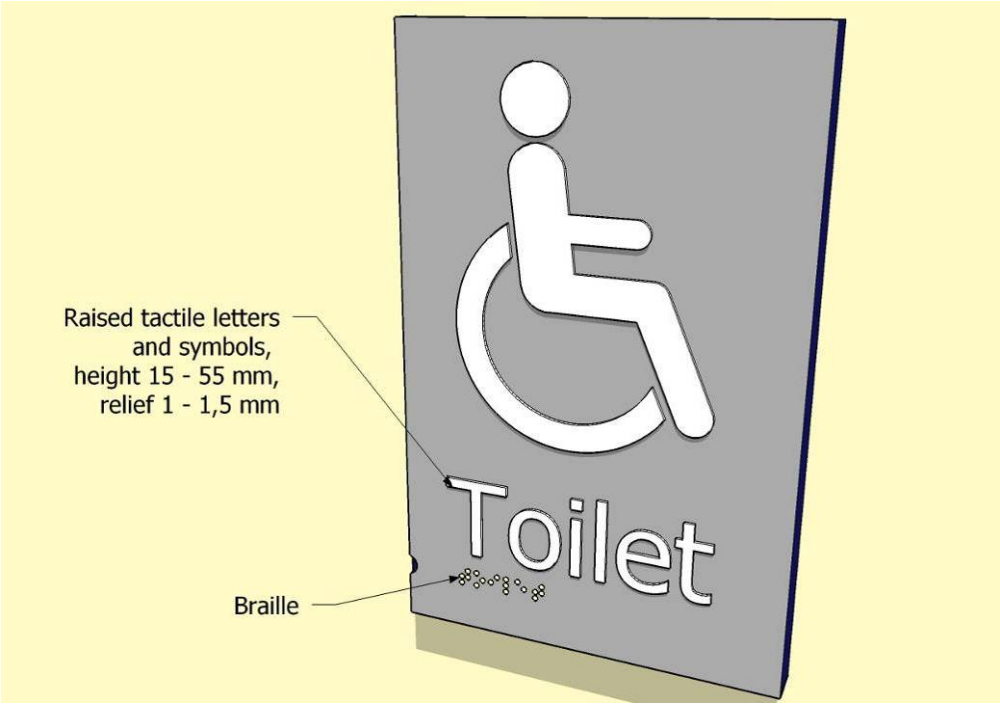


Figure 70 — Example of raised tactile signs and Braille

Braille should be raised, domed and comfortable to touch. It should be located 8 mm below the bottom line of the text and be left justified.

40.13 Tactile Symbols

Tactile symbols applied on handrails, doors, maps or floor plans shall have a raised relief contour similar to tactile letters.

40.14 Tactile Maps and Floor Plans

Only essential information shall be included on a tactile map or floor plan.

Mounting angles for maps and floor plans should be between 20 ° and 30 ° from the horizontal for ease of reading.

Illumination levels over the face of the map should be between 350 lux and 450 lux, without glare.

The legend should be located at the bottom of the map and left justified. The use of a recessed Braille locater on the left hand side will assist in locating the legend.

The map shall be oriented with the building.

40.15 Information Displays

If video and media information displays are used, they should be placed at a height according to 40.2 and their lettering, etc. should be in conformity with the recommendations above.

A complementary audible information system should be provided.

41 Symbols

ISO/TC 145 *Graphic Symbols* provides some symbols in ISO 7000:2004 and ISO 7001:2007 that relate to accessibility and are presented here, noted as (ISO). International organizations of people with disabilities have officially approved symbols and are so noted.

Symbols should be used in conjunction with building signage systems wherever possible.

Symbols shall

— be highly contrasted with a minimum difference in LRV of 60 points and properly illuminated, .

— be tactile,

— be used on guides and directional signage.

The size of symbols, lettering and other information is dependent from the viewing distance *(D)* and the height of application. For normal sighted people the miminum size of the inner outline of the frame of symbols and lettering *(s)* can be derived from formula s = 0,01 *D,* applicable from 1 m – 100 m. For partially sighted people with visus 0,1 the minimum size of the inner outline of the frame of symbols and lettering *(s)* can be derived from formula s = 0,09 *D,* applicable for a viewing distance of 1 m – 10 m.

The following accessible symbols shall be used to denote particular components of a facility. The following facilities for disabled persons shall be marked:

(a) Those relating to people with mobility impairments:

— car parking places (parking places, garages),

— access and entrances without steps to buildings, especially where they are not identical with the main entrance,

— accessible elevators, in cases where not all are accessible; lifting platforms and similar mounting devices,

— accessible sanitary rooms,

— wheelchair viewing spaces and accessible seating,

— changing rooms,

— entries into swimming pools or mechanical lifting devices.

(b) Those relating to people with vision impairments:

— guide dog facilities,

— locations where audible and tactile information is provided.

(c) Those relating to people with hearing impairments;

— telephones and emergency call facilities, equipped with sound amplification,

— the provision of an assistive listening system.

Figure 71 — Accessible facility or entrance (ISO)

Figure 72 — Accessible parking (ISO)

Figure 73 — ramped access (ISO)

Figure 74 — Accessible toilet unisex (ISO)

Figure 75 — Accessible toilet for women (ISO)

Figure 76 — Accessible toilet for men (ISO)

Figure 77 — Accessible lift (ISO)

Figure 78 — Mobility impaired

Figure 79 — Guide and service dogs

Figure 80 — Blind person (World Blind Union)

Figure 81— Facilities for hearing impaired (World Federation of the Deaf symbol)

Figure 82 — Induction loop system (World Federation of the Deaf symbol)

Figure 83 — Text Telephone (UK)

Figure 84 — Sign language interpretation

Figure 85 — Accessible route for evacuation

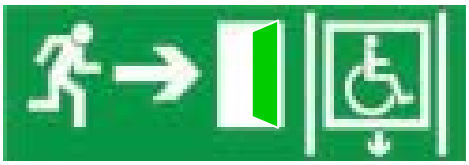


Figure 86 — Evacuation route to a lift which could be used by fire evacuation

Annex A
(informative)
Fire safety for all in buildings and assisted evacuation

A.1 Fire safety, protection and evacuation for all

A.1.1 A new benchmark for modern fire engineering

The 2005 NIST(USA) NCSTAR 1 Report introduced three important keywords for fire engineering design: 'reality' - 'reliability' - 'redundancy' and a new key phrase in relation to fire evacuation from buildings: 'intuitive and obvious'. See Bibliography.

The recommendations contained in chapter 9 of the report have special relevance here, for the following reasons:

— on 11th September 2001, approximately 8% of World Trade Center building users were people with disabilities, with 6% having mobility impairments;

— NIST found that the average surviving occupant in the WTC Towers descended stairwells at about half the slowest speed previously measured for non-emergency / test evacuations. This calls into serious question the concept of standard movement times for people evacuating;

— NIST strongly recommended that fire-protected and structurally hardened lifts (elevators) should be installed in buildings to allow evacuation of building users with disabilities, and to improve emergency response activities by providing timely emergency access to firefighters;

— NIST recommended that evacuation routes should have consistent layouts, and be 'intuitive and obvious' for all building users, including visitors who may be unfamiliar with the building, during evacuations;

— NIST recommended that staircase capacity and stair discharge door widths should be adequate to accommodate contraflow in circulation spaces, i.e. the simultaneous emergency access by firefighters into a building and towards a fire, while building users are still moving away from the fire and evacuating the building. This has implications for the minimum clear width of all staircases in all buildings. Wider staircases facilitate the assisted evacuation and rescue of people with disabilities.

Such was the catastrophic failure, at every level, in common practices and procedures up until September 2001, that a critical new benchmark for modern fire engineering has been created by this 2005 report.

A.1.2 Human behaviour in fire emergencies

The 'real' people who use 'real' buildings every day of every week, in all parts of the world, have widely differing ranges of human abilities and activity limitations. They are different from each other, and they will react differently in a fire emergency.

Building users should be skilled for evacuation to a place, or places, of safety remote from the building. In the case of people with a mental or cognitive impairment, there is a particular need to encourage, foster and regularly practice the adaptive thinking which will be necessary during a 'real' fire evacuation.

Meaningful consultation with every person known to occupy or use a building, for the purposes of receiving his/her active co-operation and obtaining his/her informed consent (involving a personal representative, if required), is an essential component of adequate pre-planning and preparation for a fire emergency.

Warnings of any fire incident in a building should be communicated well in advance of the time when it is necessary to act and should continue for the full duration of the incident. Warnings should be informative, and be easily assimilated in a form (e.g. oral, written, braille) and language understood by the people using the building.

Panic attacks, during evacuation in a 'real' fire incident, exist.

Standard movement times, during evacuation in a 'real' fire incident, do not exist.

A.1.3 Building design for accessibility and reliability

Accessibility design guidelines should be applied to the design of all fire evacuation routes - horizontal and vertical, inside the building and externally to a 'place of safety' which is at least 100 metres from the building. See Section 3 - Terms and definitions.

There should be one harmonized understanding of important accessibility design concepts, e.g. the 'clear width' of door openings, staircases and horizontal circulation spaces, among all disciplines involved in the design and construction of a building.

As people may be directed to wait in a building which is on fire for a significant period of time, the fire protection measures and fire management systems in an occupied building should be 'reliable'. In other words. at design stage, the fire engineer (or other suitably qualified and experienced person) should be confident that the selected fire protection measures and management systems will perform as expected during a 'real' fire incident, which may take place at any time in the long life cycle of a building. Sufficient attention, therefore, should be placed on proper pre-planning and preparation for a fire emergency, and on 'reliable' fire prevention measures once the building is occupied.

Equivalent to the concept of 'maximum credible fire scenario' which was introduced by the 2005 NIST Recommendations, the fire engineer (or other suitably qualified and experienced person) should develop his/her 'real' fire engineering strategy on the basis of a 'maximum credible user scenario', i.e. building user conditions which are also severe, but reasonable to anticipate, i.e.

— the number of people using a building may increase, on occasions which cannot be specified, to 120 % of calculated maximum building capacity; and

— 10% of people using the building (occupants, visitors and other users) may have an impairment (visual or hearing, physical function, mental, cognitive or psychological, with some impairments not being identifiable, e.g. in the case of anosognosia).

NOTE A 'maximum credible fire scenario' includes conditions that are severe, but reasonable to anticipate, conditions related to building construction, occupancy, fire loads, ignition sources, compartment geometry, fire control methods, etc., as well as adverse, but reasonable to anticipate operating conditions. Footnote 26, Chapter 9, Page 208, NIST NCSTAR 1.

Throughout the duration of a fire incident and for a specified period afterwards, the accessibility of available fire evacuation routes, inside the building and externally to a 'place of safety', should be maintained. Particular care should be taken with regard to the positioning of water hose lines and other firefighting equipment.

A.2 'Evacuation for All' Matrix

A useful fire engineering design aid:

Built, Social, Virtual (including EICT's) & Economic Environments		People with Activity Limitations (2001 WHO ICF)					
		All Users incl. children & frail, older people & late-stage pregnant women & people with health conditions, etc.	People with Disabilities / Impairments (2006 UN Disability Rights Convention)				
			Visual Impairment	Hearing Impairment	Physical Function Impairment	Mental / Cognitive Impairment	Psychological Impairment
1. Buildings	i List A	Building Priorities - See 2004 Rio Declaration on Sustainable Social Development, Disability & Ageing					
	ii List B						
	iii List C						
2. Street Pavements & Public Spaces							
3. Means of Transport	a Buses						
	b Taxis						
	c Trains						
4. Transport Interchanges							
5. Miscellaneous							

A.3 Assisted evacuation and rescue from buildings

A.3.1 Assisted evacuation and rescue techniques

Firefighters have two functions:

a) fighting fires and

b) rescuing people who are trapped in buildings, or for some reason, cannot independently evacuate a building which is on fire.

People with disabilities are participating more and more, and in ever increasing numbers, in mainstream society. It is necessary, particularly for firefighters, to become skilled in how best to rescue a person with a disability from a building, using procedures and equipment which will not cause further harm or injury to that person.

The 2002 FEMA(USA) Orientation Manual (see Bibliography) shows and describes many assisted evacuation and rescue techniques for people with widely differing ranges of activity limitation.

Manual handling of occupied wheelchairs in a fire evacuation staircase, even with adequate training for everyone directly and indirectly involved, is hazardous for the person in the wheelchair and those people - minimum three - giving assistance.

Local fire authorities should ensure that they possess the necessary equipment to rescue people with a wide range of impairments, and that specialized rescue equipment is regularly serviced and maintained. Every fire authority should have an 'accessible' and 'reliable' emergency call system which is available, at all times, to the public within its functional area.

It is essential that every firefighter is fully aware of this important public safety issue, and is regularly trained in the necessary rescue procedures involving people with a wide range of impairments.

A.3.2 A 'reliable' buddy system

In buildings with a reasonably stable user profile, e.g. workplaces, a buddy system should be introduced throughout the building user population. For reliability and flexibility, e.g. to accommodate absence or holiday leave, a buddy system should always comprise at least three or four people.

A.4 Management of fire evacuation lifts in buildings

A lift (elevator) to be used for the fire evacuation of frail older people and building users with disabilities should be operated under the strict direction and control of a building's management.

It is essential that the lift (elevator) can continue to operate effectively and safely for a specified time during a fire, and that it is taken only to those floors where it is necessary to evacuate a person by lift (elevator).

For such a management system to work properly, a suitable number of trained and experienced 'fire wardens' should be designated on each floor of a building. They should be competent to carry out their duties in a fire emergency, and should be available at all times when the building is occupied.

Procedures for independent evacuation and assisted evacuation - by lift (elevator) and under the control of a fire warden who operates the lift car - should be documented in consultation with building users and the local fire authority. See section 15.6 - Use of lifts (elevators) for fire evacuation.

A lift (elevator) used for fire evacuation should be fitted with an accessible and reliable communications system, which facilitates direct contact with a person in the main fire and security centre for the building.

If an evacuation lift fails to arrive at a floor landing, or access to it on any floor is obstructed by fire and/or smoke, it will be necessary to use an evacuation staircase. Should the lift (elevator) remain safe to use, it may only be necessary to descend to the floor below the fire using an evacuation staircase, and from there continue the descent by lift (elevator).

Duties to be undertaken by fire wardens on each level should include the following:

- ensuring that any person on the floor requiring evacuation assistance moves directly to the nearest, safe area of rescue assistance;
- assisting with the evacuation of people requiring to use a lift (elevator);
- informing the relevant people in charge during the fire emergency of the situation on the floor, and in the evacuation staircase, area of rescue assistance, and lift (elevator) lobby for which they have responsibility;
- notifying the relevant people in charge during the fire emergency when everyone on their floor has been evacuated.

A.5 Evacuation skills and self protection from fire in buildings

A 'skill' is the ability of a person - resulting from adequate training and regular practice - to carry out complex, well-organized patterns of behaviour efficiently and adaptively, in order to achieve some end or goal.

Building users should be skilled for evacuation to a 'place of safety', which is at least 100 metres from the building. See Section 3 - Terms and definitions.

Non-emergency / test evacuations should be carried out sufficiently often to equip building users with this skill.

Fire protection measures and human management systems are never 100% reliable. It is necessary, therefore, for frail older people and building users with disabilities to be familiar with necessary guidelines for self-protection in the event of a fire emergency.

Annex B
(informative)
Human abilities and associated design considerations

B.1 General Introduction

The prime objective in designing, constructing and managing the accessible built environment is to ensure that, it will satisfy the diverse needs of all of its intended users. Such an environment should reasonably satisfy the needs of any one individual without unreasonably compromising those of another. This is particularly important in areas of health and safety. In many instances, the use by specific individuals, of assistive technology, will assist them in using the built environment.

Every effort should be made to address constraints, such as limitations of space or topography, on the development of new environments that suit everyone's needs. Different constraints are likely to be encountered when attempting to modify the layout and structure of an existing building or external environment. However, as many as are feasible of the individual provisions within this standard should be adopted, whether the environment is newly constructed or an existing one is to be modified.

Clause B.2 describes the principal human faculties that need to be considered when designing, constructing and managing the built environment. As well, the section highlights a number of design considerations that should allow the environment to accommodate different levels of performance.

Physical, sensory and mental faculties vary from person to person. Diversity is normal. However, some differences may be heightened through age or social condition, be congenital or result from accident or illness. It may be temporary or permanent, or in transition.

B.2 Physical abilities

Physical faculties include walking, balance, handling, pulling, pushing, lifting and reaching. Many activities involve simultaneous use of more than one of these skills.

B.2.1 Walking

For some people walking on the level or up gradients is difficult. Some people may have limited range of motion or may use a mobility device shuch as a wheelchair or a walker. They may need to stop frequently, to regain strength or catch with breath.

In addressing the needs of people with walking limitations, the principal design considerations include:

— a clear, unobstructed path of travel and an appropriate width

— the proximity of facilities to one another;

— the ease of incline of gradients and of the pitch of steps and stairs;

— the availability of seats to rest upon;

— the number of steps in a flight;

— optional means of travel from one level to another;

— the provision of hand and arm supports on both sides;

— the evenness, firmness and slip-resistance of walking surfaces.

In the event of emergencies egress needs to be established by planning architectural and evacuation strategies for people with limited abilities. Specific accommodation and management systems need to be planned to effect assisted means of egress in the event of emergency, see Annex A.

B.2.2 Balance

People with balance limitations will benefit from controls within easy reach.

A surface against which a person may stumble against or walk into should be designed to limit abrasion.

B.2.3 Handling

Handling involves the use of one or both hands. A significant minority of people are, left-handed. Others might, for a variety of reasons, not have the use of either one or both of their hands. Facilities and components should be designed to be suitable for use with one and with either hand.

Handling includes gripping, grasping and manipulation. Each of these has a different purpose with specific design considerations. For instance, components should be designed to be graspable. Their circumference of the supporting structure and stability are critical.

Manipulation involves the moving, turning and twisting of components with a hand or hands. For those who have limited manipulation abilities size and shape and ease of movement are critical. .

Manipulation by using a pushing, pulling or pressing action using a clenched fist, or by using the wrist or the elbow, is preferred.

B.2.4 Strength and endurance

Strength and endurance may be required on sloping paths and floors, stairways and long travel distances, when sustained effort may be needed.

For those with limited endurance, frequent resting-places are essential.

People, generally, find it easier to push a component, than to pull it. This is particularly so, if the individual uses a wheelchair. Nevertheless, self-closing devices on manual doors can be difficult for some people to operate, particularly if the doors are required to resist wind forces. For these reasons, doors that open and close automatically are preferred.

B.2.5 Lifting

Activities such as opening vertically sliding sash window and an upward opening access gate, should be designed to be easily operated with minimal force.

B.2.6 Reaching

Telephones, desks, counters and work surfaces, electrical and other service controls, taps, door and window furniture should be positioned within reach. Comfortable reach ranges' should be considered to ensure use by a greater number of people.

A 'comfortable reach range' has been defined as one that is appropriate to an activity that is likely to be frequent and in need of precise execution and that does not involve stretching or bending from the waist.

An 'extended reach range' has been defined as one that is appropriate to an activity that is likely, neither to need precision nor to be frequent and that can involve stretching or bending from the waist.

Having components within easy reach is particularly important for those with more severe limitations in mobiliy. .

For wheelchair users, the reach range is limited depending on the seated position and if the wheelchair can come close to a component.

The reach range is also dependant on the height of the person, their use the arms and balance and mobility of the upper body.

B.2.7 Speech

Speech is the expression of thoughts by means of articulate sounds. Where two-way communication is required, the built environment should be designed to facilitate communication with information in visual, and audible formats, with adequate illumination and appropriate alarm systems. .

B.3 Sensory abilities

These are abilities by which the body perceives an external stimulus. They include sight, hearing, touch, smell and taste. This Standard does not deal with matters relating to smell and taste.

B.3.1 Sight

Vision allows an individual to be aware of the luminance of surfaces and objects and their form, size and colour.

For people who are blind or have a severe vision impairment, the provision of suitable tactile walking surface indicators and tactile or acoustic warnings at hazardous locations, should provide information on using the built environment and should limit the risk of injury. The built environment can be designed for orientation by providing sound cues and tactile cues.

Differences in friction between one floor surface, or one stair tread surface, and the next should be avoided. Therefore, adjacent surfaces that display different standards of slip-resistance, or that depend on raised surfaces, should be carefully considered.

An effective visual contrast between surfaces or objects will aid in or identification of critical locations.

Simple and clear images should be used.

Visual contrast between adjacent surfaces, and components should be carefully considered

An environment that accommodates a broad range of visual characteristics will display:

— a simple, logical and easily understood arrangement, preferably with intersecting routes at right angles to each other;

— an easily discernible system of ‘wayfinding’

— visual contrast between adjacent objects and surfaces where it is necessary to provide important information,

— choices of colour that satisfy the needs of those with anomalous colour vision;

— appropriate warnings of the edge of abrupt changes of level or the existence of obstructions;

— absence of reflections from floor and wall finishes or the placement of mirrors and glazing;

— a suitable level of lighting, free of glare;

— complementary audible information.

B.3.2 Hearing

Hearing allows an individual to be aware of sound, to determine its direction and, possibly, its source, and to discern its pitch, frequency, volume and variation. Its quality contributes to an effective means of communication and information. A low level of background noise is essential.

Hearing enhancement systems amplify audible communication and can be used by people who have a hearing impairment. They include a direct wire system, an induction loop system, an infrared system and a radio frequency system. All of these systems transmit a signal. Special-purpose receivers are required for infrared and radio frequency systems, while hearing aids equipped with a T-switch are capable of receiving the signal from an induction loop system. Receivers can be equipped to be compatible with hearing aids. Written information that complements oral information such as fire and other emergencies is especially important.

The selection of structural and surface materials can make a substantial difference in audibility. Auditoriums, meeting rooms and reception areas can benefit from additional sound enhancement such as an hearing enhancement system.

The careful design of illumination can assist in communication such as lip reading and sign language.

Most people with hearing impairments use a hearing aid which amplifies all sounds caught by the microphone, making communications very difficult in noisy environments.

B.3.3 Touch

Touch stimulates the perception of an object through physical contact. For those individuals who use touch in the built environment, it is important to consider the selection of surfaces that do not cause distress or injury.

Surfaces should be free of abrasions and not cause an allergic reaction. Some metals may cause adverse reactions when touched so their use should be carefully explored.

B.4 Mental abilities

Mental faculties include those processes that are carried out in the mind of the individual. They include cognition, intellect, interpretation, learning and memory. To provide a usable environment for the population at large, all means of communication should have an immediate impact and be easily understood.

B.4.1 Cognition

Cognition is the acquisition of knowledge and understanding through thought, experience and the senses. By this means, and through recognition, people can understand and interpret signs and other forms of information or instruction.

B.4.2 Intellect

Intellect is the faculty of reasoning and understanding objectively, especially with regard to abstract matters.

B.4.3 Interpretation

Interpretation involves understanding messages and information as having a particular meaning or significance.

B.4.4 Learning

Learning is central to many aspects of understanding, reasoning and interpretation. A failure to recognise words and their meanings may adversely affect an individual's ability to move successfully and safely in the built environment.

B.4.5 Memory

Memory is the ability to remember information. As people age, some find it increasingly difficult to absorb new information so changes in the environment should be carefully considered before implementation

B.4.6 Design considerations that take account of mental abilities

Aural and visual messages should be simple, clear and have immediate impact. Figures, symbols and simple words are likely to be the most effective. Symbols should be instantly recognisable as representing images seen and activities undertaken in everyday life.

Special design considerations:

— simple and clear planning layout; important parts and details placed in a consequent way and designed so that they are easy to find;

— Whenever changes are undertaken, clear and simple information with respect to the new layouts should be provided,

— self-explanatory environment; design should indicate the use of the built environment or elements in it; unnecessary complexity should be avoided,

— simple, intuitive design of circulation routes;

— doors designed so that their operation is intuitive, whether they are push, pull or sliding doors;

— text signage that uses plain language;

— aural and visual messages which are conspicuous, concise, comprehensible;

— wayfinding plans or maps that clearly indicate the person's position in the building or facility, and which do not include extraneous information;

— wayfinding cues that are easy to follow; e.g. tactile, graphic, audible or architectural;

— directional and other information which combine text with universally recognisable symbols;

— signs with graphics that are in conformance with ISO 7000 and ISO 7001;

— in areas where key cards are used for access, such as hotels, the need for fine motor control and precise timing of the swipe or dip of the card in the reader should be minimized.

Messages should be conspicuous, concise, comprehensible and relatively frequent.

B.5 Additional factors

B.5.1 Accommodating the developing child

An element of risk is an essential part of a child’s development. It is important to ensure that components of the built environment are safe for children.

B.6 Accommodating ageing adults

Life span within the human population is increasing. More and more do we expect to maintain an economic and social life within both the public and private domains as we age. However, many human faculties are in marked decline as we age and familiarity with a particular environment is an aid.

B.7 Diversity of stature

There is a wide diversity of stature within the human population. Predominantly, this has to do with the average height of people in various parts of the world. The increase in tourism, business travel and population migration has led to a demand for more rationalisation, internationally, in the use of anthropometrics and ergonomics and in their influence on the design of the built environment. The provisions in this standard include ranges that should accommodate those regional differences. The ranges have been set so that member nations who decide to adopt specific criteria that reflect their own circumstances will not unduly inconvenience other individuals.

The ranges included for the positioning of components or the heights of, for instance, steps, should also recognise the needs of those who do not reach their anticipated full height.

Changes in diet and an increasing use of the motor car for short journeys, for instance, have combined in a trend towards increased girth and weightof some populations. It remains to be seen whether these latter lead to demands for an increase in specific spatial and stability standards. These matters are beyond the scope of this Standard.

B.8 General design considerations for wheelchair users

B.8.1 Application and manoeuvring space

Manoeuvring space of 1 500 mm diameter shall be provided in all areas where a significant change in direction for wheelchair users and persons with walking aids is required.

“Exceptional considerations for existing buildings in developing countries”: In some member states where shorter wheelchairs are generally used due to market situations, the manoeuvring space may be reduced to 1 200 mm. Whenever possible this circle should be increased to 1 500 mm.

The dimensions stated in this Standard, relevant to the use of wheelchairs, are related to the footprint of commonly used wheelchair sizes and users (see Figure B.1).

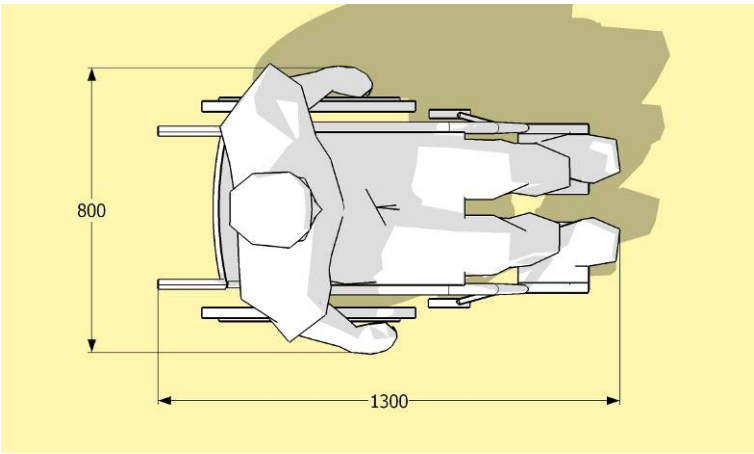


Figure B.1 — Footprint of a wheelchair

The footprint for a wheelchair within this standard is based on ISO 7176-5 and ISO/TR 13570-2 and is 800 mm wide and 1 300 mm long.

B.8.2 Space allowance for wheelchair users

Wheelchairs have different dimensions and space requirements depending on the user and the type of wheelchair. The type of wheelchair used is dependant on whether the wheelchair is to be used outside or indoors.

Consideration has not been given to the fact that some people need individual adaptation of the chair, for example, if they have a stiff leg and have to sit with their leg stretched out, if the back of the chair is lowered or if an exceptionally wide wheelchair is needed.

The circulation space requirements of wheelchair users and their conditions should be established by taking into account the wheelchair maximum overall dimensions in Table B.1.

At a national level, it should be decided what types of wheelchairs should be considered in different types of built environment.

When wheelchairs are pushed, the total length occupied by the chair and occupant is 1 500 mm, when stationary and 1 750 mm when moving.

To propel a manual wheelchair a clearance of not less than 50 mm, and preferably 100 mm, is needed. Over longer travel distances, additional space may be required.

The area required for turning, is dependant on the ability of the user to manoeuvre the wheelchair and the way the turning is done. Often turning is done with several movements with the wheelchair, including a backing operation. The area needed is dependant on the number of backing operations.

B.8.3 Reach range

Most wheelchairs have a seat height between 460 mm and 550 mm. The seated position of a wheelchair user restricts arm reach in both vertical and horizontal directions, even when the occupant has full use of his or her arms and upper body. Many wheelchair users have limited mobility in their arms or limited balance that make it difficult to lean forward without risk of falling from the wheelchair.

The comfortable reach of a wheelchair user is between 400 mm to 1 100 mm above floor level and a maximum side reach of 250 mm from the outer side of the wheelchair.

To allow front approach by wheelchair users to elements, sufficient space should be provided below the element to allow for the wheelchair user's knees and preferably the armrests of the wheelchair.

B.8.4 Reach of users seated in wheelchairs – distance from corner and other barriers

To reach elements located in corners is limited by the wheels of the wheelchair.

The maximum distance from any wall, transversal element or corners to elements depends on the size of the wheelchair and mobility in the arms. The distance shall not be less than 600 mm if the person has good balance and mobility, and 700 mm – 1 000 mm if the person has impaired mobility in the arms or impaired balance.

B.8.5 Space around elements to provide reachability

A manoeuvring space to turn at least 1 500 mm x 1 500 mm, should be provided in front of all elements.

A minimum clear width for side approach of at least 900 mm should be provided.

B.8.6 Space to provide clearance for wheelchair user's knees

At desks and counters, tables or public telephones, suitable space should be provided below the element in question in order to provide clearance for the wheelchair user's knees and, preferably the wheelchair armrests in order to allow maximum approach.

Where only knee space is required (as in the case of washbasins and counters), the lower free space should be at least 800 mm wide, 600 mm deep at foot level and at knee level, with a minimum free height of 700 mm.

B.8.7 Convenient height of worktops

For wheelchair users, the height of worktops should be between 740 mm and 800 mm.

B.8.8 Eye-level

The eye level of a seated person is between 990 mm and 1 250 mm. This dimension should be taken into account in elements such as windows, information desks, counters or glazed doors.

B.9 Visual contrast

B.9.1 General

Appropriate use of visual contrast between adjacent colours and/or surfaces allows persons with vision impairments to gather the information they need but will assist all users to move around, identify features and communicate with others.

People with visual impairments may be unable to perceive some or all colours. However many visual impaired people can perceive light and dark. The main feature of a surface, which appears to be strongly correlated with the ability of partially sighted people to identify differences in colour, is the amount of light the surface reflects, or its light reflectance value (LRV). Differences in hue (the nature of the colour) or chroma (the intensity of the colour) alone doe not provide adequate visual contrast.

Light condition is essential for the perception of visual contrast. Good illumination assists to achieve adequate luminance reflection. Where the level of illumination is low, a higher level of contrast is required.

It is for reasons of weathering, plus variations in lighting levels (e.g. in strong sunlight or after dark) that, externally, differences in LRV will not always be appreciated in the same way as they would be under controlled internal conditions. However, it is still considered good practice to aim for the recommended LRV differences in the external environment.

B.9.2 Determination of visual contrast

B.9.2.1 Difference in LRV-values

The method for determination of visual contrast recommended in this standard is based on the difference in LRV of the two adjacent surfaces or of a component and its background (LRV_1 - LRV_2). The recommended point difference between two surfaces in LRV-values is described in 35. For appropriate visual contrast one of the two surfaces should have a LRV of minimum 60 points to make sure that the luminance of the lighter surface will be perceptible under the light conditions defined in 33.

B.9.2.2 Determination of light reflectance value LRV

To determine the difference in LRV of two surfaces, their LRV must be known. Manufacturers provide LRVs of colours and finishing determined by test methods.

Measuring LRVs using specialist sphere type spectrophotometer equipment gives the most accurate and repeatable measurements for flat or curved surfaces. This equipment can accurately measure the LRV of both matt and specular reflecting (metallic and glossy) surfaces. A range of internationally standardized light sources are built-in to the spectrophotometer allowing the influence of a wide range of light sources on the LRV of surfaces to be determined. The method is suitable to determine the LRVs of products for which visual contrast is an issue, including paints and coatings, carpets, veneered doors and finished metals.

The LRV of a surface can also be determined by the use of a handheld luminancemeter and a white, high reflectance standard surface. Since the reflectance of the white standard surface is known, it is possible to calculate the reflectance of the surface of interest by measuring the luminance of both surfaces under the same lighting conditions, where luminance is amount of light emitted from a surface. This is commonly termed the brightness of the surface.

The LRVs measured in this way are dependent on the ambient lighting, which should be quoted in relation to any measurements taken. This method is not able to accurately assess the influence of glossy or metallic surfaces on the measured LRV, nor is it able to measure the LRV of curved surfaces. Whilst the LRVs determined by this method are useful, they are not as accurate as those obtained by using the test method

The LRV of a surface can be approximated by reference to colour swatches or panels of colour samples. The LRV of the various colours can be obtained from the manufacturer of the colour swatches or samples. In some cases, the colour notation on the sample includes the LRV. By placing the colour swatch against the coloured surface of interest, a reasonable match can be identified. The LRV of the nearest colour match from the swatch can then be assumed to be the LRV of the surface of interest. The LRVs measured in this way are also dependent on the ambient lighting, which needs to be quoted in relation to any measurements taken. This approximate measurement method is also not able to accurately assess the influence of gloss on LRV. This very approximate method can be used for the initial selection of colours for design purposes and for preliminary site assessments.

B.9.2.3 Other methods for determination of visual contrast

To determine visual contrast, different algorithms are also used throughout the world. The following table gives the equivalent for the recommended minimum contrast determined with the three algorithms most commonly used. All three algorithms are very similar, in that each of the algorithms involves two identical variables and that the resultant difference is a dimensionless ratio, the only difference being the value of the resulting contrast. All three equations involve a fraction with identical numerators, namely the difference between the two luminous reflective values. The denominators, however, are different.

With all these algorithms, a minimum difference in LRVs and thus in luminance between the two surfaces is essential in order to distinguish the visual contrast. All three algorithms have a problem when used to compare two relatively dark surfaces. For example where a dark grey surface with a luminance reflectance value of 0.2 is compared to an almost black surface of 0.1, the visual contrast calculated with all three algorithms would achieve an acceptable value (33 / 50 / 66). But in practice the visual contrast between these two surfaces would be insufficient for people with vision impairments.

Table B.9.2 - Recommended visual contrast according to the different algorithms most commonly used troughout the world by reference to their luminance

Visual task	$\frac{L1 - L2}{L1 + L2} \times 100$	$\frac{L1 - L2}{L1} \times 100$	$\frac{L1 - L2}{05.\ (L1 + L2)} \times 100$
small targets and warning function, potential hazards and text information	60	75	120
large surfaces, elements and components for orientation	30	46	60

L_1 is the greater luminance and L_2 is the lesser luminance.

B.9.3 Relevant design factors

To emphasise features and assist in navigation, certain factors should be considered in any design:

— to distinguish the boundaries of larger surfaces such as floors, walls, doors and ceilings, appropriate differences in LRV should be used. The LRV of a wall colour should be different to that used on a ceiling and floor;

— to provide an accurate impression of the size of a space, the LRV of deep skirting boards should be the same as that of the wall (less important for a shallow skirting up to 100 mm or 125 mm deep);

— reflections and glare from shiny surfaces confuse people with vision impairments and the use of these finishes on larger areas should be avoided. Glare may additionally affect the ability of people who have a hearing impairment to communicate using lip-reading;

— adequate visual contrast should be used to identify potential hazards;

— it is thought that LRV differences are less important between two large areas, e.g. between wall and floor, than between a small object on a larger background surface, e.g. a light switch on a wall.

To highlight the presence of a door, different measures are recommended:

— If the architrave around a door has visual contrast to the surrounding wall, the opportunity to identify the presence of the door will be available even when the door is open.

— Preferably, the door and the architrave should contrast with the surrounding wall. If the door and the wall have similar LRV and only the LRV of the architrave provides the contrast, it will still be possible to identify the presence of a feature, but it may take longer to identify it as a door opening.

— In the case of door opening furniture, the ease with which blind and partially sighted people are able to distinguish them against a background is influenced by their 3-D form (giving light and shade) and the shiny nature of the finish, whether metallic or non-metallic. For such products, it is considered that a difference in LRV between the product and its background of at least 15 points is acceptable.

The above list highlights only one or two areas for consideration. Additionally there are many other factors which affect selection and use of colours in environments.

NOTE More information about Colour Contrast and Perception has been published by the Research Group for Inclusive Environments in the University of Reading, UK: http://www.extra.rdg.ac.uk/ie/

B.10 Indoor air quality

Poor indoor air quality, an important factor in relation to building related ill-health (also known as 'sick building syndrome'), can cause serious health impairments and severely restrict a person's participation in everyday activities, e.g. work.

Symptoms and signs may include

— irritation of eyes, nose and throat ;

— respiratory infections and cough ;

— voice hoarseness and wheezing ;

— asthma ;

— dry mucous membrane and skin ;

— erythema (reddening or inflammation of the skin) ;

— lethargy ;

— mental fatigue and poor concentration ;

— headache ;

— stress ;

— hypersensitivity reactions, i.e. allergies ;

— nausea and dizziness ;

— cancers.

These symptoms and signs are present in the population at large, but are distinguished by being more prevalent in some building users, as a group, when compared with others. The symptoms and signs may disappear, or may be reduced in intensity, when an affected person leaves the building. It is not necessary that everyone in a building should be affected before building related ill-health is suspected.

ISO 16814, *Building environment design - Indoor air quality - Methods of expressing the quality of indoor air for human occupancy* covers methods of expressing indoor air quality (IAQ) and incorporating the goal of achieving good IAQ into the building design process. It also covers ventilation effectiveness, harmful emissions from building materials, air cleaning devices, and heating, ventilation and air conditioning equipment.

The indoor pollutants considered in ISO 16814 include human bio-effluents, which have often been the principal consideration in air quality and ventilation design, but also the groups and sources of pollutants which can reasonably be anticipated to occur in the building during its long life cycle.

These pollutants, depending on the sources present, may include

— volatile organic compounds (VOC's) and other organics, such as formaldehyde ;

— environmental tobacco smoke (ETS) ;

— natural radon, consisting of a number of different isotopes, is an invisible radioactive gas, and is found in the soils under buildings, water supplies to buildings and in the air ;

— other Inorganic gases, such as carbon monoxide (CO), the oxides of nitrogen (NOx), and low-level ozone (smog) which is formed when NOx and VOC's react in the presence of sunlight ;

— viable particles, including viruses, bacteria and fungal spores ;

— non-viable biological pollutants, such as particles of mites or fungi and their metabolic products ;

— non-viable particles, such as dusts and fibres.

The following two performance indicators of good indoor air quality, developed with the aim of protecting human health, are recommended:

— radon activity (incl. Rn-222, Rn-220, RnD) in a building should, on average, fall within the range of 10 Bq/m3 – 40 Bq/m3, but should at no time exceed 60 Bq/m3.

— carbon dioxide (CO2) concentrations in a building should not significantly exceed average external levels – typically within the range of 300 ppm – 500 ppm – and should at no time exceed 800 ppm.

B.11 Allergy related materials

Buildings and their installations shall be designed that necessary conditions for less allergy related materials in rooms which are in frequent use by human beings are created and determined on the basis of the room's intended use. People with allergies or certain sensitiveness are more depending on a good air quality with less pollutants or unpleasant smells and allergy related materials than other persons.

The use of materials with high emission levels is to be avoided. Materials that do not emit large quantities of pollutants or emissions should be selected.

Typical materials to which the user may be allergic include nickel, chromium, cobalt and natural or synthetic rubber. Materials causing allergies should be avoided in buttons, controls, handles or handrails.

Avoid perfumed products and implement a "Scent-free" policy including for example soap used on toilets and scent –free cleaning products or such additives in the climatic system.

Annex C
(normative)
Tactile walking surface indicators TWSI's

C.1 General

When persons with vision impairments travel alone, they may encounter problems and dangers in various situations. In order to avoid obstacles and obtain information on their locations, these pedestrians travelling alone use all the available information, including tactile information, long canes and through the soles of their shoes. Tactile walking surface indicators have been developed to assist the movement of persons with vision impairments.

The TWSIs are used to assist persons with vision impairments travelling alone. These TWSIs should be designed and installed based on a simple, logical, and consistent layout. This will allow tactile indicators to not only facilitate the movement of persons with vision impairments through familiar places, but also support their movement and space recognition in places they are visiting for the first time.

Currently, several TWSIs that convey different information are used; however, the capability of detecting differences in tactile patterns through the soles of the shoes or the long cane varies depending on the individual. Therefore, it is required that empirical and experiential research be used to ensure that TWSIs can be detected and recognized by potential users. To achieve maximum effect in conveying information, it is important that they are installed in a flat, smooth surface where persons with vision impairments can identify them without interference from any irregular walking surface.

It is also necessary to ensure that TWSIs can be effectively used by persons with low vision as well as persons who are blind. For this purpose, TWSIs should be easily detectable by vision. This is achieved through the application of a minimum luminance contrast between the TWSIs and the surrounding pavement or floor surface.

While TWSIs must be effective for persons with vision impairments, it is necessary to ensure that the surface structure and materials used are not detrimental to other pedestrians, including those having mobility impairments.

This annexe specifies two types of TWSIs: attention indicators and guiding indicators.Tactile attention indicators may be installed at the vicinity of pedestrian crosswalks, the platforms of railway stations, and both the top and bottom of stairs and ramps, and in front of escalators, travelators and elevators, and the like to ensure safety. Tactile guiding indicators may be used in combination with attention indicators in order to indicate the walking route where no other tactual information is available from one place to another.

At present, patterns and installation methods of TWSI's vary from country to country. This annexe specifies the basic criteria for detectability and to be able to differentiate between each type of pattern used.

C.2 Application

TWSIs are installed in pedestrian facilities throughout the built environment, where there is a situation that is not highlighted by any other feature detectable by persons with vision impairment.

C.3 Detection and discrimination

C.3.1 Tactile contrast

TWSIs shall be detectable and be able to be distinguished by users from the immediate surrounding surface, under foot and by long cane used by persons with vision impairments.

When attention patterns and guiding patterns are combined, it is necessary that persons with vision impairment can clearly identify both of them.

C.3.2 Visual Contrast

TWSIs shall be detectable by visual contrast. Visual contrast is made up of luminance contrast and color difference. Visual contrast is assisted by good illumination. The effective area of the TWSIs should have a high luminance contrast with the immediate surrounding pedestrian surface in both wet and dry conditions. The difference in light reflectance value between TWSI's and their immediate surrounding surface shall be a minimum 30 points on the light reflectance value scale.

As persons with vision loss often have a color deficiency, color difference is only used to supplement luminance contrast.

C.3.3 Prevent tripping

TWSIs have a maximum height above the surrounding pavement or floor surface of 5mm. They must have bevelled or rounded edges to negate the likelihood of tripping and to enhance safety and negotiability for people with mobility impairments.

C.4 Requirements for attention pattern

C.4.1 Arrangement

Attention pattern should be constructed of truncated cones or domes arranged in a square grid or in diagonal rows (see figure C.1).

C.4.2 Height

The height of truncated cones or domes shall be 4 mm – 5 mm (see figure C.1).

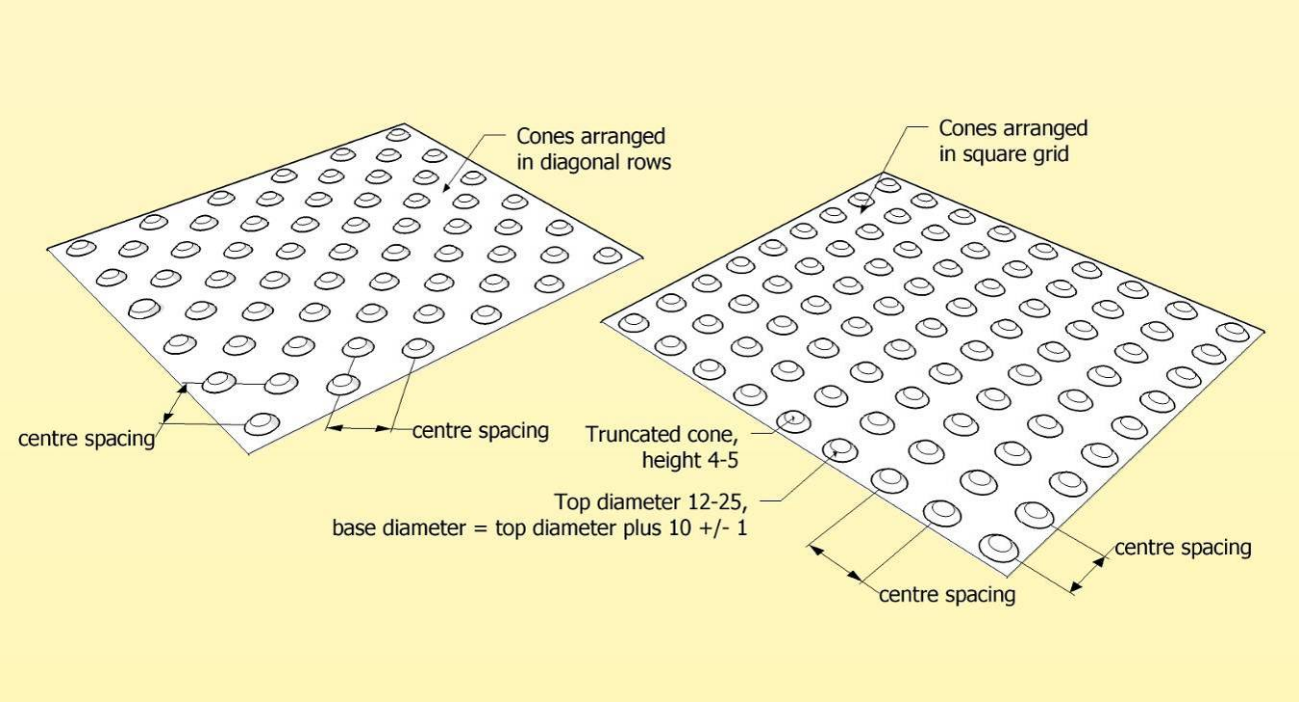


Figure C.1 – Spacing and dimensions of truncated cones arranged in diagonal and a square

C.4.3 Specification for truncated cones

C.4.3.1 Diameter of truncated cones

The top diameter of truncated cones should be between 12 mm and 25 mm, and the diameter of the lower base of truncated cones should be 10 mm +/-1mm greater than the diameter of the top.

C.4.3.2 Spacing of truncated cones

The distance between the centres of adjacent truncated cones should be in relation to the top diameter as shown in Table 1.

Table C.1 – Spacing in relation to top diameter of truncated cones

Top diameter of truncated cones, mm	Centre spacing, mm
12	42-61
15	45-63
18	48-65
20	50-68
25	55-70

NOTE: Within the range of centre spacing the maximum spacing provides a larger gap between the truncated cones which improves detectability under foot while the minimum spacing provides a smaller gap which improves detectability by long cane used by persons with vision impairment.

NOTE: The spacing refers to the shortest distance between the centres of two adjacent truncated cones which may be parallel or at 45 ° to the border of the tactile area depending on whether the truncated cones are arranged in a square grid or in diagonal rows.

C.4.4 Specifications for domes

C.4.4.1 Diameter of domes

The diameter of the base of domes should be between 25 mm and 35 mm.

C.4.4.2 Spacing of domes

The distance between the centres of adjacent domes should be between 45 mm and 61 mm.

NOTE: Within the range of centre spacing the maximum spacing provides a larger gap between the domes which improves detectability under foot while the minimum spacing provides a smaller gap which improves detectability by long cane used by persons with vision impairment.

C.5 Requirements for guiding pattern

C.5.1 Arrangement

A guiding pattern should be constructed of parallel flat-topped bars, ribs or sinuously ribbed pattern (see figure C.2 and C.3).

C.5.2 Specifications for flat-topped elongated bars

C.5.2.1 Height of flat-topped elongated bars

The height of flat-topped elongated bars shall be 4 - 5 mm (see figure C.3).

C.5.2.2 Width of flat-topped elongated bars

The width of the top of flat-topped elongated bars should be between 17 mm and 30 mm. The width of the base should be 10 mm +/-1 mm wider than the top (see figure C.3).

C.5.2.3 Spacing of flat-toped elongated bars

The distance between the axes of adjacent flat-topped elongated bars should be in relation to the top width as shown in Table 2.

Table C.2 – Spacing in relation to the width of the top of flat-topped elongated bars

Width of flat-topped elongated bars, mm	Spacing, mm
17	57-78
20	60-80
25	65-83
30	70-85

C.5.3 Specifications for rib pattern

C.5.3.1 Height of ribs

The height of ribs shall be 4 mm - 5 mm (see figure C4).

C.5.3.2 Width of ribs

The width of the base of ribs should be between 15 mm and 25 mm.

C.5.3.3 Spacing of ribs

The distance between the axes of two adjacent ribs should be 40 mm – 55 mm.

C.5.4 Specifications for sinuously ribbed pattern

C.5.4.1 Height of wave crests

The difference in level between the wave crest and the wave trough of a sinuously ribbed pattern shall be 5 mm – 6 mm (see figure C.5).

C.5.4.2 Spacing between wave crests

The distance between the axes of two adjacent wave crests of sinuously ribbed pattern should be 40 mm – 50 mm.

C.5.5 Length

The length of flat-topped elongated bars, ribs or sinuously ribbed pattern should be more than 300 mm. Where there is a risk of water ponding, a drainage gap of between 20 mm to 30 mm shall be provided. At the ends and any interruption of the flat-topped elongated bars, ribs or sinuously ribbed pattern must be bevelled to negate the possibility of tripping. For the continuity of the guiding pattern, interruptions should not be more than 30 mm.

NOTE It is easier to follow guiding patterns that are as continuous as possible.

C.6 Materials

Tactile indicators shall be made of materials that are durable, slip resistant and should maintain the required luminance contrast.

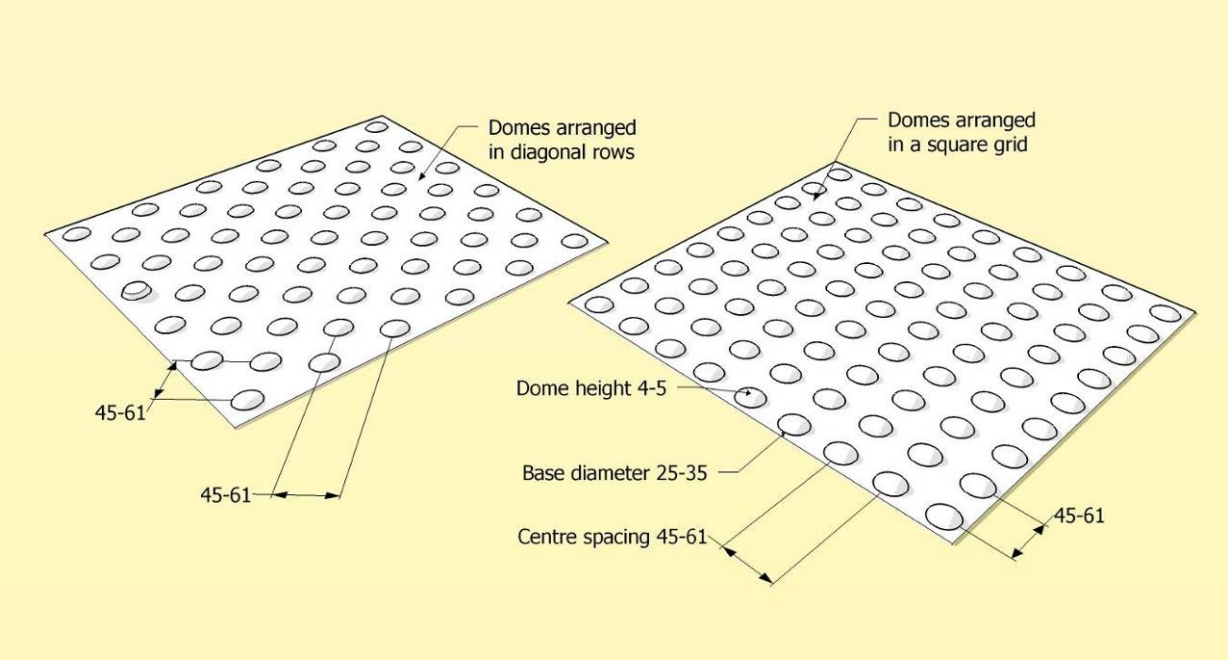


Figure C.2 – Spacing and dimensions of domes arranged in diagonal rows

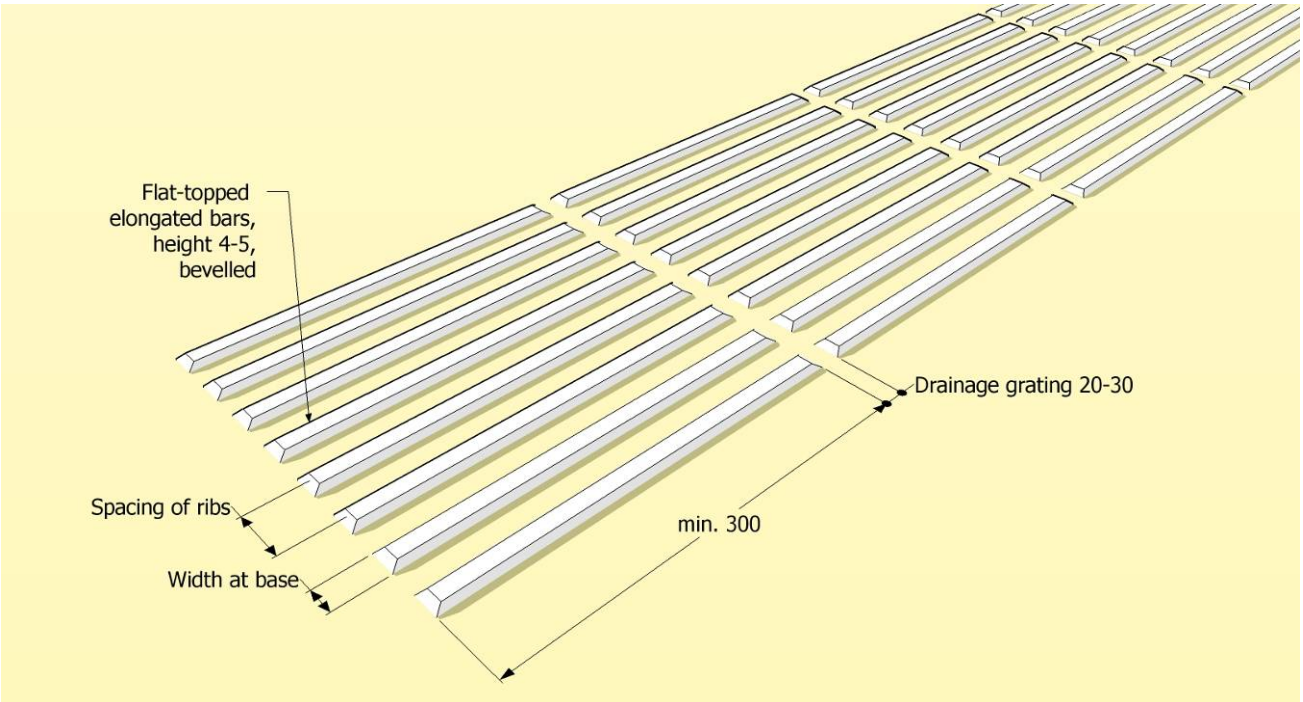


Figure C.3 – Spacing and dimensions of flat-topped elongated bars

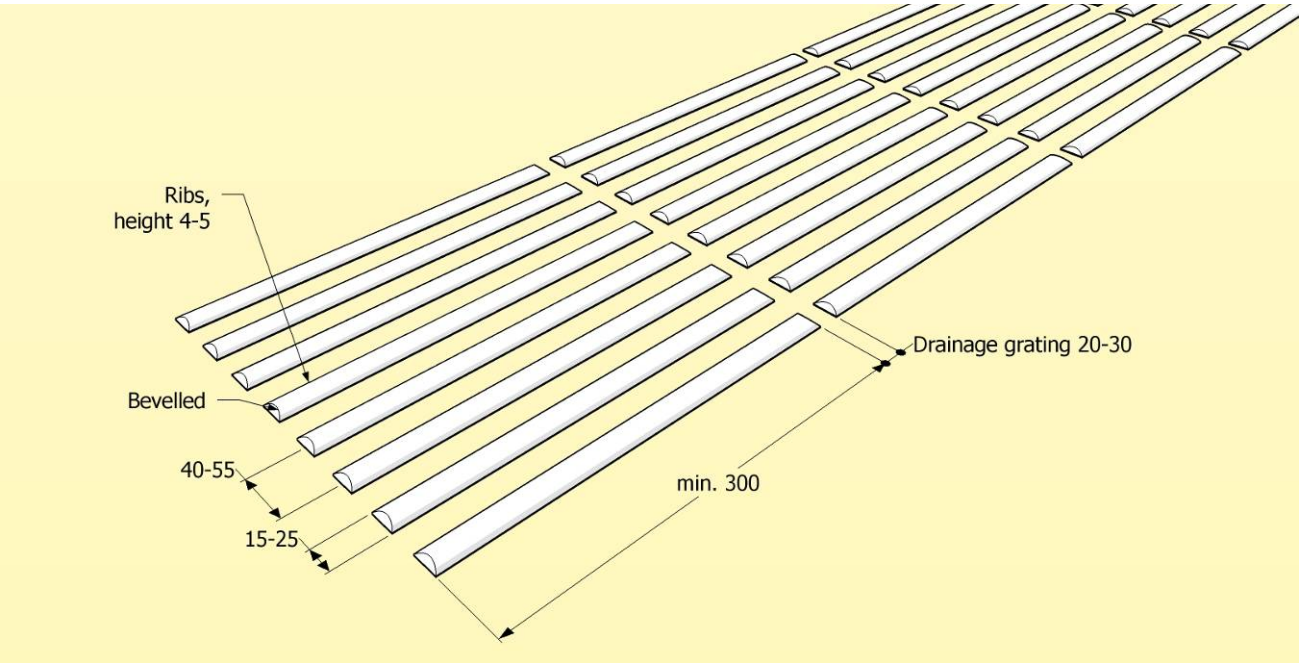


Figure C.4 – Spacing and dimensions rib pattern

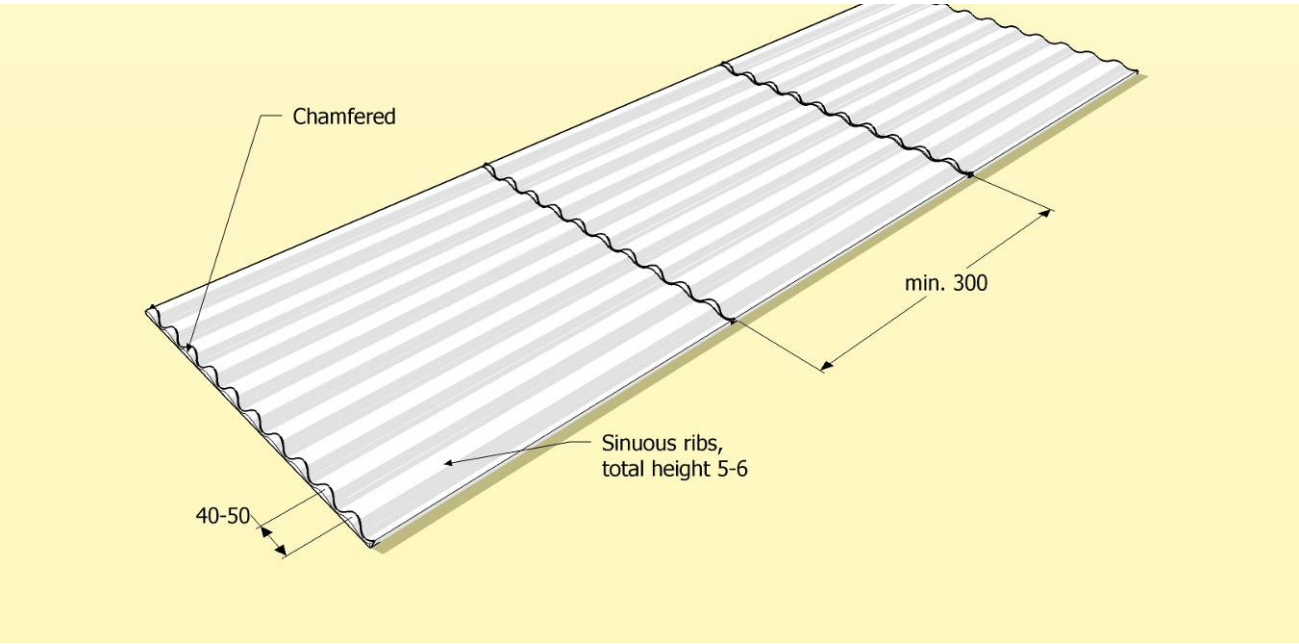


Figure C.5 – Spacing and dimensions of sinuously ribbed pattern

Annex D
(informative)
Management and maintenance issues

The following management and maintenance issues, based on new draft BS 8300, are important factors in ensuring that a building is easily accessed and used by disabled people:

D.1 External issues

(1) keeping external routes, including steps and ramps, clean, unobstructed and free of surface water, snow, ice, dead leaves, lichen, debris etc.;

(2) in car parking areas: ensuring that designated spaces are not being used by non-disabled motorists;

(3) where possible, allocating specific designated parking spaces to individual employees, marked by name or number;

(4) checking side-hung doors accompanying revolving doors to ensure they are not kept´locked;

(5) making available auxiliary aids such as portable ramps, and removing them when not in use.

D.2 Internal issues

(1) ensuring that wheelchair spaces are available in seating areas;

(2) ensuring that staff understand the management issues relating to disabled people, including emergency procedures;

(3) ensuring that storage, planters, bins etc. do not obstruct circulation space, WCs or lift call buttons;

(4) ensuring that cleaning and polishing does not produce a slippery surface;

(5) ensuring that trip hazards such as at junctions between floor surfaces are removed;

(6) ensuring access between moveable tables in refreshment areas;

(7) ensuring, that in sanitary facilities written instructions on the use of equipment is displayed beside each item;

(8) ensuring, in sanitary facilities, that information is available on the type of sling connector and the types of sling that are compatible with their installed hoist and track;

(9) ensuring that a procedure is set up to respond to alarm calls from sanitary accommodation;

(10) ensuring that waterproof mattress covers can be made available for use in accessible bedrooms;

(11) ensuring that, where floor sockets are provided (e.g. in meeting rooms), access to sockets is also available at desk level;

(12) ensuring that any temporary barriers that are used to channel customers to reception or serving points, and whose configuration needs to be changed frequently, have a semi-rigid top barrier (e.g. a spring-loaded band) which contrasts visually with the background against which it is seen;

(13) ensuring that assistance is made available to carry trays where needed in refreshment areas;

(14) ensuring that suitable arrangements are made for assistance dogs while their owners are using leisure facilities.

D.3 Maintenance issues

(1) maintaining doors, door closers and building hardware, including checking that the opening forces of self-closing doors are within acceptable limits;

(2) maintaining access control systems;

(3) checking floor surfaces, matting, surface-mounted carpets etc., re-fixing to the floor where necessary, and replacing where damaged or worn (particularly at entrances to buildings);

(4) maintaining hearing enhancement systems;

(5) maintaining sanitary fittings, including checking that toilet seats are securely fixed, cleaning tap nozzles to ensure correct water flow, emptying and cleaning bins, and keeping equipment clean;

(6) ensuring that adjustable shower heads are lowered to be ready for the next user;

(7) ensuring that emergency assistance pull cords are kept fully extended and in working order at all times;

(8) checking the mountings of all grab rails, and the mechanism of drop-down rails, re-fixing or replacing where necessary.

(9) servicing of all types of lifts and hoists;

(10) ensuring that facilities, such as lifts, hoists etc., are in working order between servicing schedules, and providing alternative arrangements in case of facilities being out of order;

(11) maintaining ventilation and heating equipment;

(12) replacing defunct light bulbs and flickering fluorescent tubes quickly;

(13) keeping windows, lamps and blinds clean to maximize lighting.

D.4 Communication issues

(1) providing information on strobe lighting prior to entry;

(2) removing and/or changing signage as necessary, e.g. when departments relocate;

(3) providing accurate information on facilities prior to arrival;

(4) providing audio description services;

(5) providing all relevant literature, and reviewing/revising it when necessary;

(6) ensuring that a permanently manned position is available for the emergency lift telephone communications;

(7) updating maps of buildings following changes;

(8) replacing signs correctly after decoration.

D.5 Policy issues

(1) allocating and reviewing parking spaces;

(2) changing signs when departments move;

(3) reviewing the number of disabled people attending and needing facilities;

(4) establishing and running user groups;

(5) reviewing the number of instruments supporting infra red systems;

(6) adopting a signage policy;

(7) having the loop position always manned in branches;

(8) providing portable ramps;

(9) arranging audits of journeys made by visitors;

(10) instructing accessibility audits;

(11) ensuring that services are provided when facilities such as lifts break down;

(12) ensuring that responsibilities are defined within the organization;

(13) ensuring that accessibility improvements are picked up whenever possible during maintenance and refurbishment work;

(14) reviewing and improving evacuation procedures;

(15) training of staff;

(16) reviewing all policies, procedures and practices;

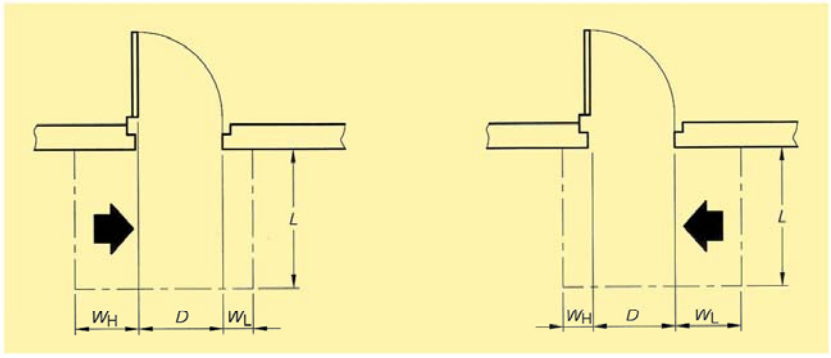
(17) reviewing the provision of auxiliary aids;

(18) considering the impact of background noise (e.g. music) on people who are deaf and hard of hearing, particularly in reception areas.

Annex E
(informative)
Circulation spaces at doorways

On every accessible path of travel, sufficient circulation spaces shall be provided in both directions at doorways.

Where the clear opening width *D* of the doorway is other than specified in figure 31 and 35 before the clear circulation space at doorways on a continuous accessible path of travel shall be not less than the dimensions specified in the tables in figures E.1 and E.2 for the appropriate clear opening width of 800 mm and 850 mm.



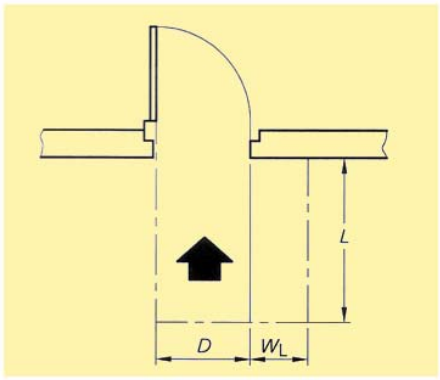
Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1160	610	220
850	1120	610	190
900	1085	610	165
950	1060	610	145
1000	1040	610	145

(a) Hinge-side approach—door opens away from a user

Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1200	200	610
850	1140	95	610
900	1110	50	610
950	1075	0	610
1000	1055	0	610

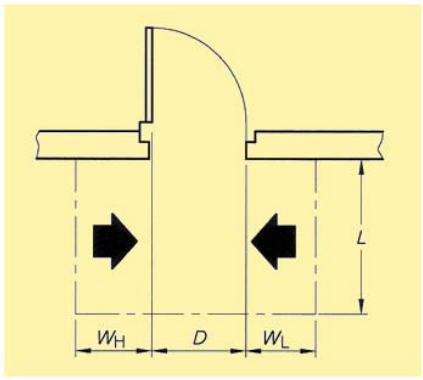
(b) Latch-side approach—door opens away from a user

Figure E.1 (a)–(b) — Circulation spaces at doorways with swinging doors



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1350	0	470
850	1350	0	460
900	1350	0	445
950	1350	0	435
1000	1350	0	415

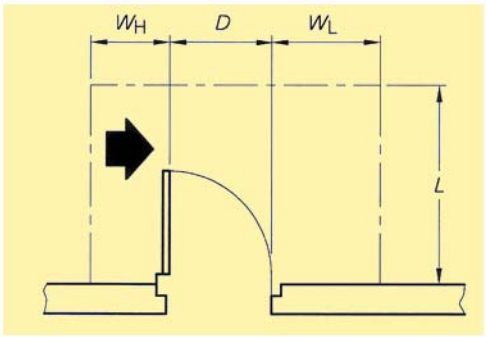
(c) Front approach—door opens away from a user



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1200	610	610
850	1140	610	610
900	1110	610	610
950	1075	610	610
1000	1055	610	610

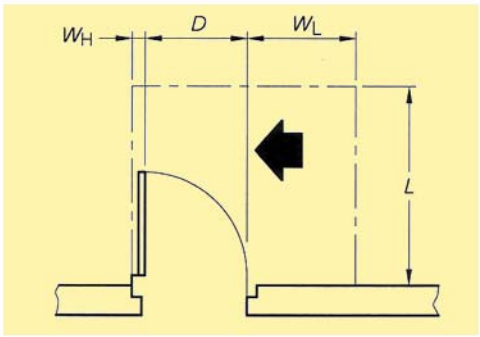
(d) Either approach—door opens away from a user

Figure E.1 (c)–(d) — Circulation spaces at doorways with swinging doors



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1510	610	840
850	1570	610	810
900	1665	610	780
950	1725	610	725
1000	1815	610	625

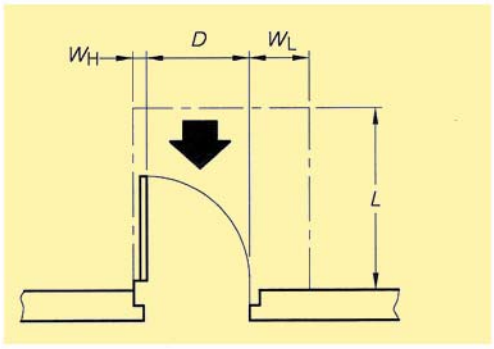
(e) Hinge-side approach—door opens towards a user



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1510	110	840
850	1570	110	810
900	1665	110	780
950	1725	110	725
1000	1815	110	625

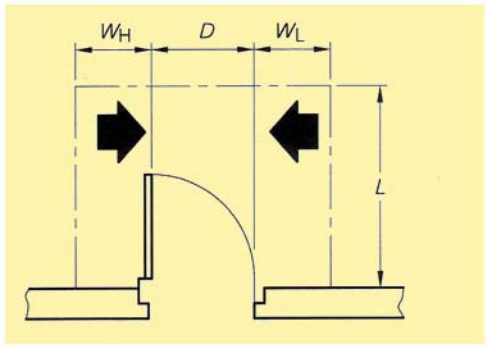
(f) Latch-side approach—door opens towards a user

Figure E.1 (e)–(f) — Circulation spaces at doorways with swinging doors



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1350	110	470
850	1350	110	460
900	1350	110	445
950	1350	110	435
1000	1350	110	415

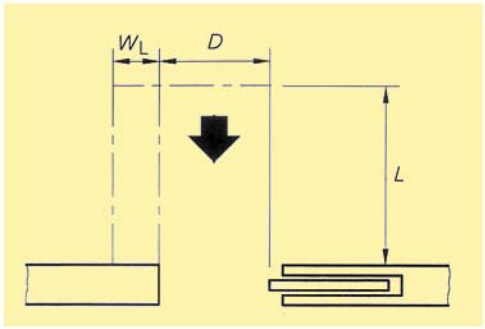
(g) Front approach—door opens towards a user



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1510	610	840
850	1570	610	810
900	1665	610	780
950	1725	610	725
1000	1815	610	625

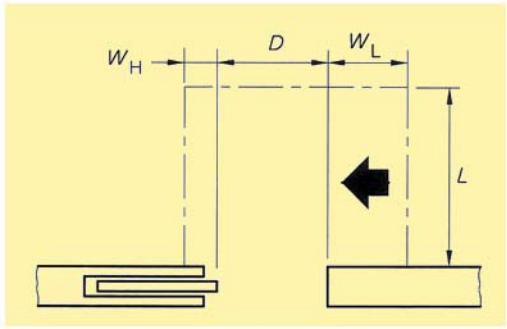
(h) Either approach—door opens towards a user

Figure E.1 (g)–(h) — Circulation spaces at doorways with swinging doors



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1350	0	470
850	1350	0	460
900	1350	0	445
950	1350	0	435
1000	1350	0	415

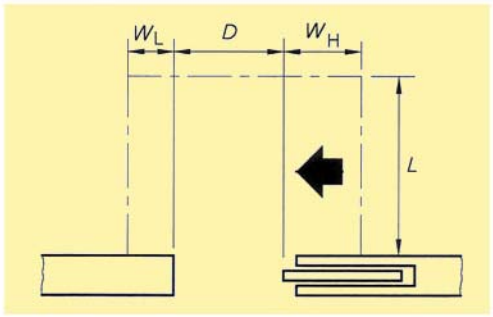
(a) Front approach



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1160	160	610
850	1130	135	610
900	1110	95	610
950	1080	80	610
1000	1055	55	610

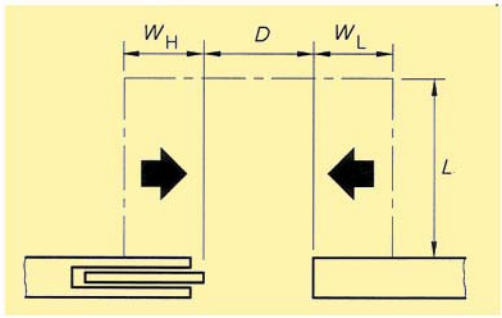
(b) Latch-side approach

Figure E.2 (a)–(b) — Circulation spaces at doorways with sliding doors



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1180	610	305
850	1180	610	255
900	1180	610	205
950	1180	610	160
1000	1180	610	105

(c) Slide-side approach



Dimension *D*	Dimension *L*	Dimension W_H	Dimension W_L
800	1180	610	610
850	1180	610	610
900	1180	610	610
950	1180	610	610
1000	1180	610	610

(d) Either approach

Figure E.2 (c)–(d) — Circulation spaces at doorways with sliding doors

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