Module 4

Chapter 1

Design Considerations

Internal & External Environment

Explanatory note:

(a) External environment: includes public places such as parks, gardens, malls, zoos, road systems, pedestrian networks and parking facilities.

(b) Public buildings: including government as well as privately, owned buildings (e.g., business offices, shops, restaurants etc).

(c) Housing/residential quarters: private homes, publicly or privately owned apartment buildings.

The following list of design elements needs to be considered when creating a barrier-free environment:

I. Kerbs and Crossings.

II. Parking.

III. Ramps.

IV. Staircases and Steps.

V. Handrails & Grab-Bars.

VI. Lifts.

VII. Signages.

VIII. Information and Service Counters.

IX. Communication Facilities.

X. Corridors.

XI. Doors.

XII. Windows.

XIII. Toilets.

XIV. Ground and Floor Surfaces.

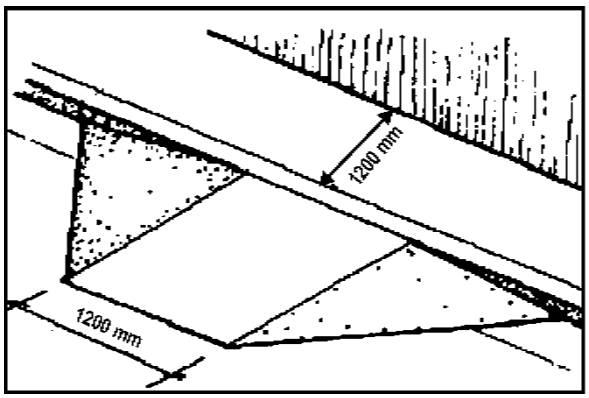
XV. Tactile Surfaces / Guiding Blocks.

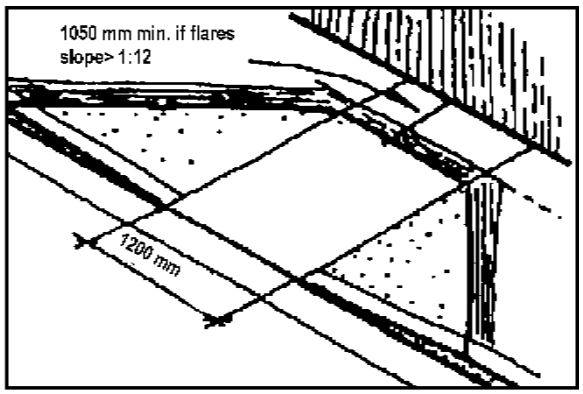
XVI. Switches & Outlets.

XVII. Illumination.

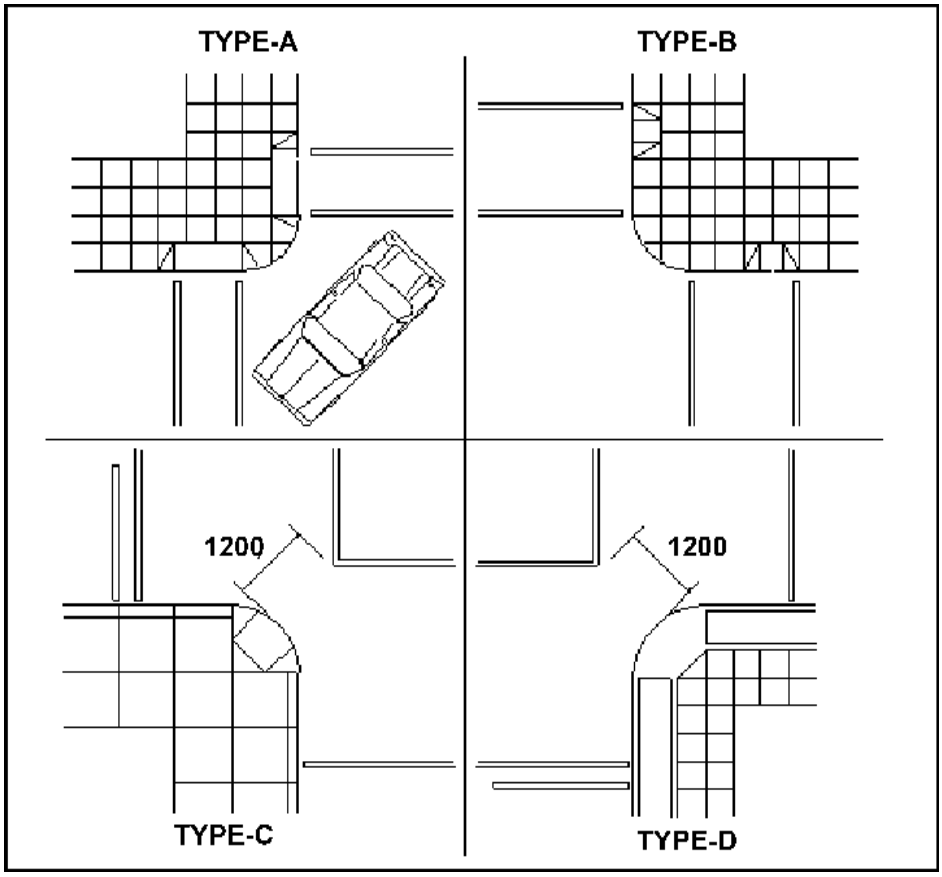
I. Kerbs and Crossings

- Pavement should be dropped to be flush with roadway, at a gradient no greater than 1:12 on both sides of necessary and convenient crossing points.
- Width should not be less than 1200 mm.
- Kerb ramps should never be leading to a zebra crossing.
- Warning blocks to be provided on the kerb side edge of the slope so that a person with vision impairment does not accidentally walk out onto the road.



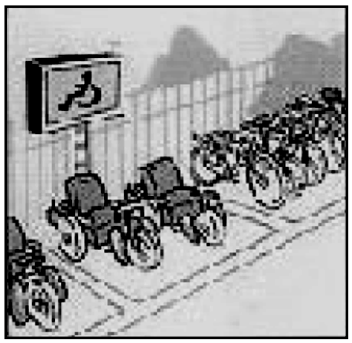


- *All measurements in the reference figures are in millimeters.*
- *The measurements indicated are for reference and should not be viewed as absolute standards.*



Kerb ramps at marked crossings

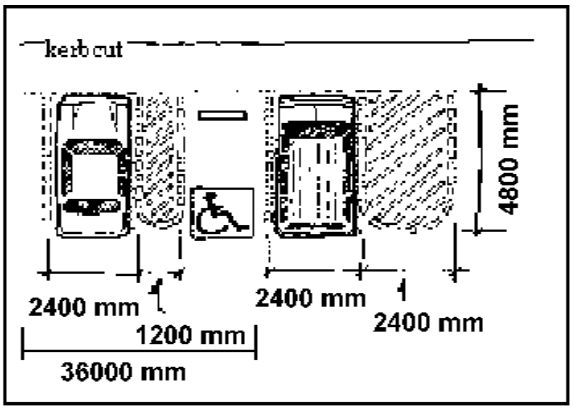
II. Parking

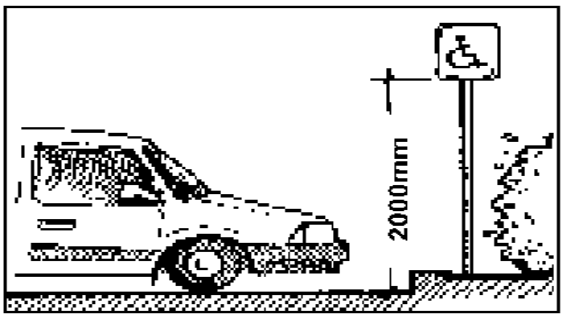


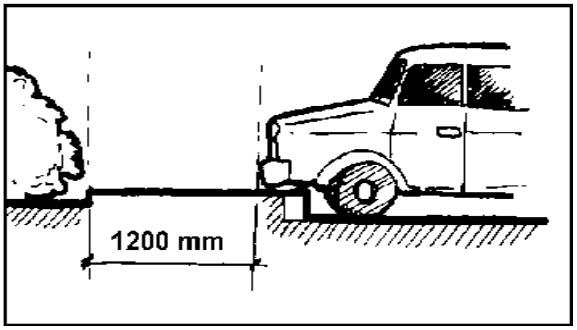
- Parking should be with in 30 meters of the main entrance of the building.
- Rwo accessible parking lots with minimum width of 3600 mm should be provided.

  (Overall minimum dimension being 3600 mm x 4800 mm)
- The parking should have the international signage painted on the ground and also on a signpost\ board put near it.
- There should be directional signs guiding people to the accessible parking.
- Wheel stoppers to be provided to avoid vehicles to occupy space on the pedestrian pathway.

Spaces in Lot	Required No. of Accessible Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2% of Total
1001 and over	20 plus 1 per 100 above 1000





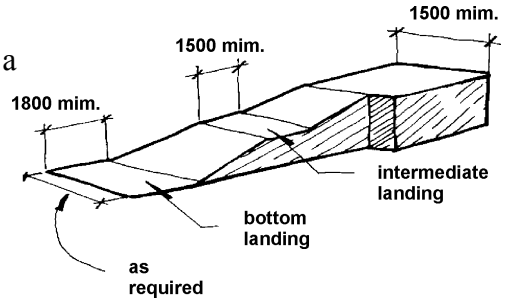


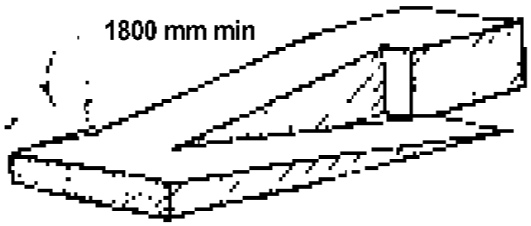
Accessible Parking Lot

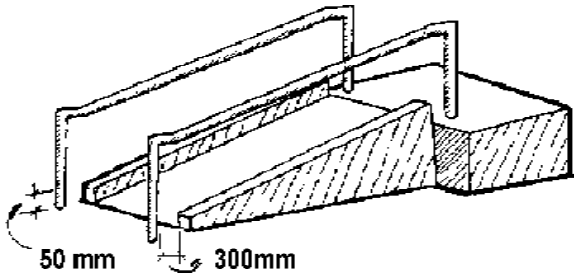
- ✓ Aisle space.
- ✓ International signage painted on the ground.
- ✓ Signage on a signpost\ board.
- ✓ Wheel stoppers.
- ✓ Kerb cut.

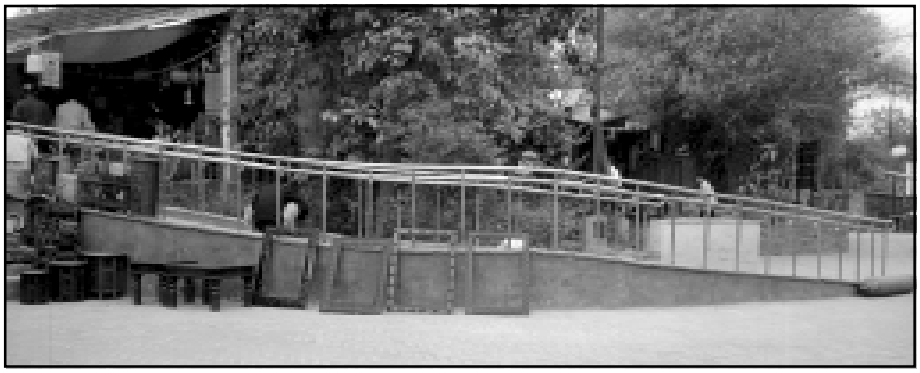
III. Ramps

- Gentle slope (1:12 minimum).
- Landings (every 750 mm of vertical rise).
- Width (1200 mm or more).
- Handrails on the ramps should be on both sides at a height of 850 mm-900 mm; both end to be rounded and grouted; extend 300 mm beyond top and bottom of ramp.
- Surfaces (ramp + landing) should be slip resistant.
- Wherever possible a ramp should be accompanied by a flight of easy going steps.









13-metre ramp with landing in Dilli Haat, New Delhi

Switchback platform ramp (Photograph: Mobility India, Bangalore)

- Handrails on two levels:

  Lower level for wheelchair users 750 mm.

  Upper level for persons at standing height 850 mm-900 mm.
- Non-slip flooring.
- Handrails, flooring of the ramp including landing is in bright colour contrast.

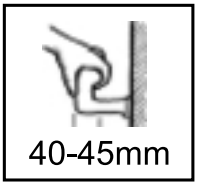
IV. Staircases and Steps

- Uniform risers: 150 mm and tread: 300 mm.
- Stair edges should have bright contrasting colours: 50 mm min.
- The maximum height of a flight between landings to be 200 mm.
- Landing should be 1200 mm deep, clear of any door swing.
- The steps should have an unobstructed width of at least 1200 mm.
- Have continuous handrails on both sides including the wall (if any) at 850 mm - 900 mm.
- Warning blocks to be placed 300 mm at the beginning and at the end of all stairs.
- Nosing to be avoided.

Staircase At DMRC Welcome Station

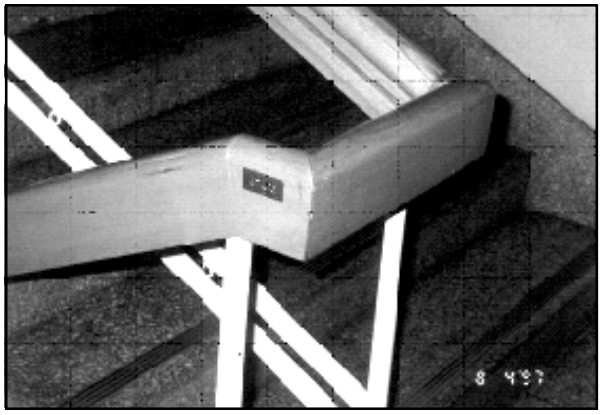
- ✓ Uniform Risers.
- ✓ Handrails at two levels.
- ✓ Rounded.
- ✓ Grouted in ground.
- ✓ Diameter of handrails.
- ✓ Warning strip.

V. Handrails & Grab Bars

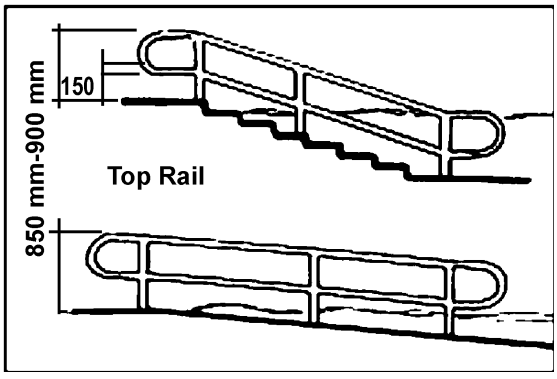


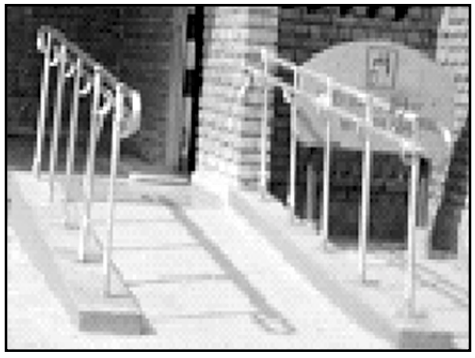
- Handrails should be circular in section with a diameter of 40-45 mm.
- At least 45 mm clear of the surface to which they are attached.
- At the height of 850 mm-900 mm from the floor.
- Extend by at least 300 mm beyond the head and foot of the flight in the line of travel and grouted in the ground.
- Handrails/grab bars should be in a colour that contrasts sharply with the surrounding area.

Handrail / Grab Bar



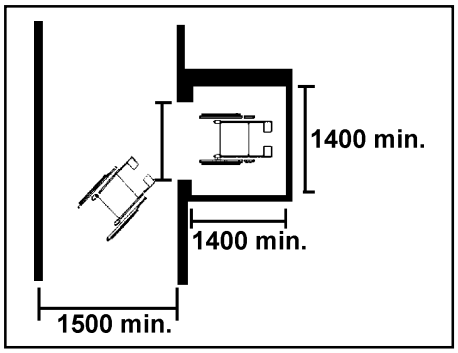
A small plate in Braille to guide persons with visual impairments.

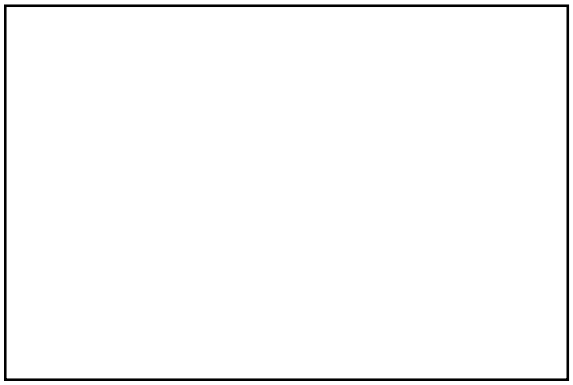




VI. Lifts

- Floor space: 1400 mm x 1400 mm (minimum).
- Doors: Clear opening 900 mm.
- Lift door closing mechanisms should be adjustable to give adequate entry time for people with disabilities. The installation of a photoelectric sensor may be considered for controlling the closing of the lift door.
- Call and Control button: At a reach of 900 mm-1000 mm; at least 400 mm from any corner.
- Braille information/raised numbers, audio and visual indicator, grab bars, review mirror and kick plates may be fitted.





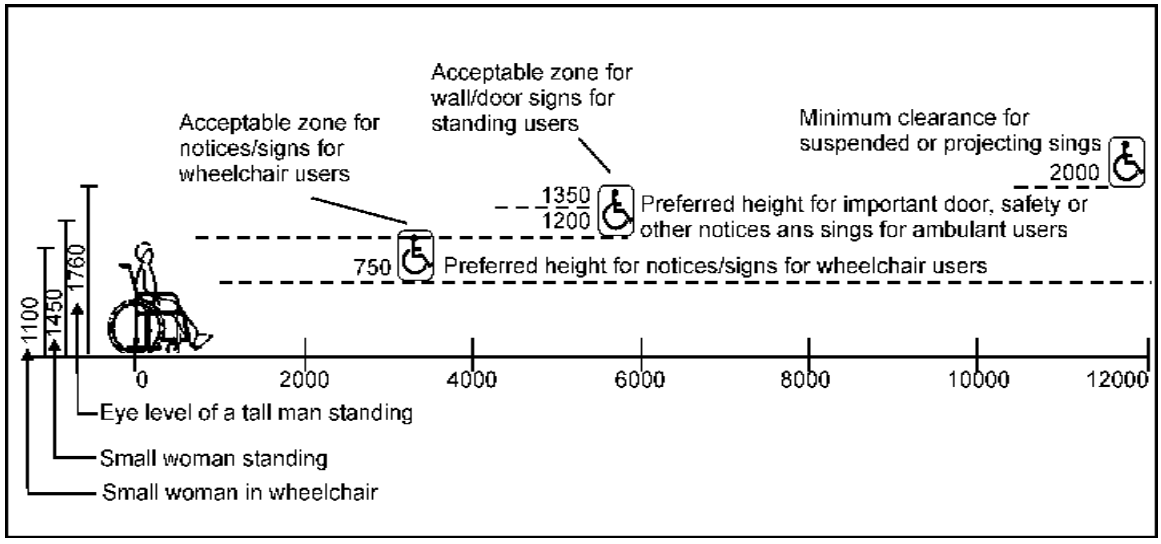
Lift at All Metro Stations, Delhi

- ✓ Signage at eye level.
- ✓ Lowered control panel.
- ✓ Door closing mechanism.
- ✓ Wide door.
- ✓ Grab bars inside lift.
- ✓ Rear view Mirror.
- ✓ Audio Announcement.
- ✓ Braille information/raised numbers.

VII. Signages

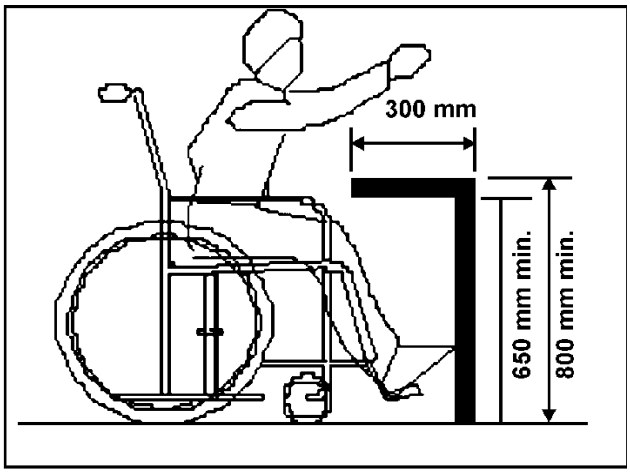
- Signs should be mounted between 1400 mm and 1700 mm from floor level.
- The individual characters between 15 mm-50 mm tall, raised by 1-1.5 mm and bold and colour contrasted with their background

Sign Posting



VIII. Information and Service Counters

- Writing surfaces and public dealing counters should not be more than 800 mm from the floor, with a minimum clear knee space of 650 mm-680 mm high and 280 mm-300 mm deep.
- Staff manning the counters should know sign language.



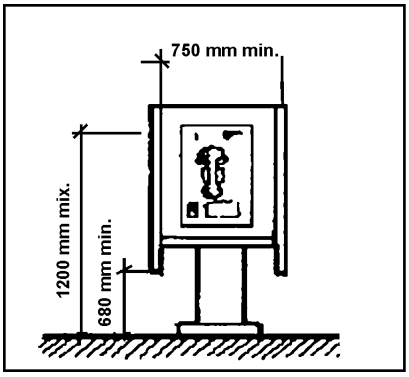
IX. Communication Facilities

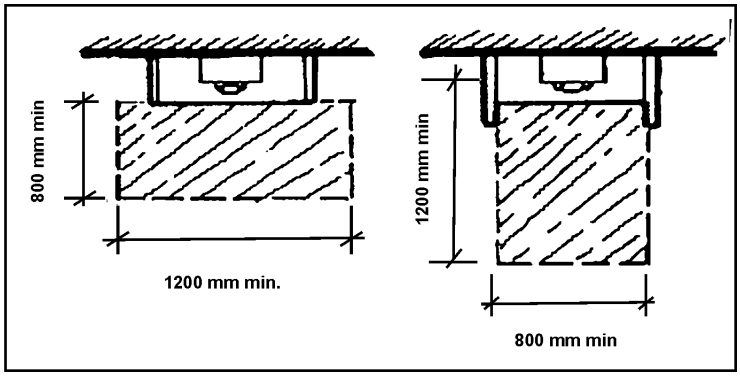
Public Telephone

- Maximum height of the highest part of a telephone: 1200 mm.
- Maximum height of a telephone (knee space for wheelchair user): 650 mm-680 mm.
- Minimum floor/ground space: 1200 mm x 800 mm.
- Guiding blocks may be installed to guide people with visual impairments to public telephones.

Telecommunication Devices for Deaf Persons (TDD)

- Telecommunications devices for deaf persons (TDD) should be installed adjacent to pay-phone booths.
- TDD should be identified by the "TDD" symbol.
- Pay phones should be hearing aid compatible.
- Pay phones should have volume controls.
- Visual Notification Devices should be provided in offices, workplaces, hotel rooms and homes to alert hearing-impaired persons to incoming telephone calls.
- Automatic indicator systems should be devised for persons with hearing impairment.





Telephone installed too high for wheelchair user.

Assistive Listening Devices

- Assembly areas, as well as conference and meeting rooms should provide assistive listening devices for persons with hearing impairments.
- Various types of assistive listening systems are available in the market. They include audio-induction loops, radio frequency systems and infrared transmission devices.
- Assistive listening devices should be available for use in:
  - Theatres, concert halls, auditoriums, stadiums and other places of cultural activity.
  - Museums, galleries and other places for public display.
  - Zoos and amusement parks.

Facsimile

- Facsimile machines are a valuable communication tool for persons with hearing impairments and should be readily available to them in post offices, commercial areas, public places and in their homes.

Sign Language Interpretation

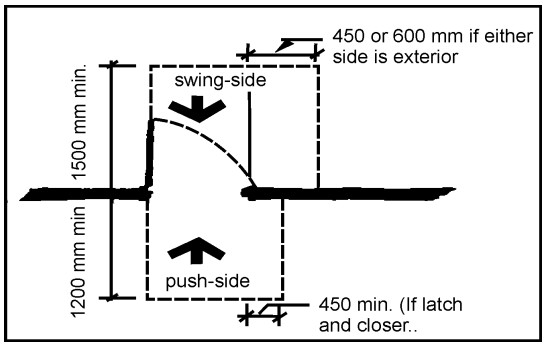
- Adequate lighting, raised platforms and headphone sets should be provided for sign language interpreters.

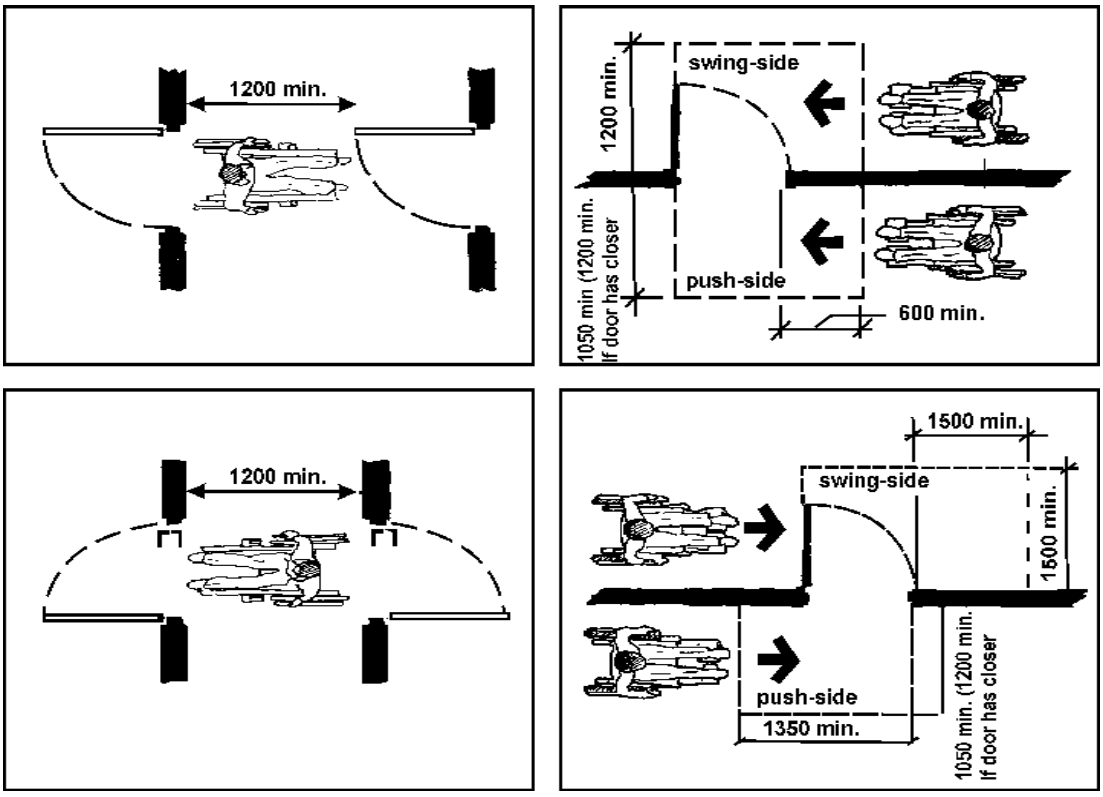
Braille

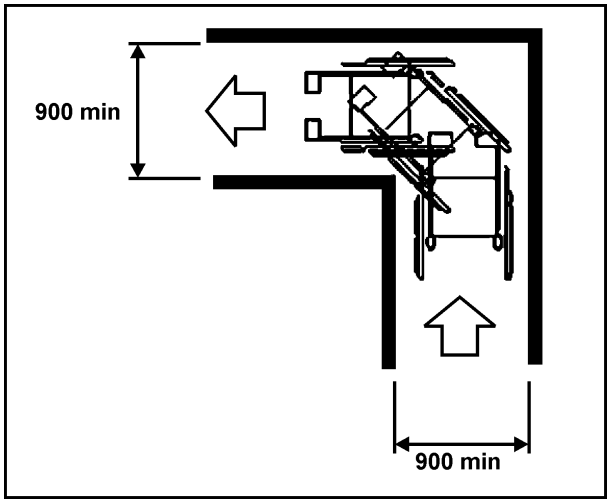
- Braille symbols and/or text in raised format should be provided in places frequented by persons with visual impairments.
- Text/symbols and the background of all signs should have a non-glare finish. They need to be in sharp contrast to their background.
- "Talking signs" should be installed.

X. Corridors

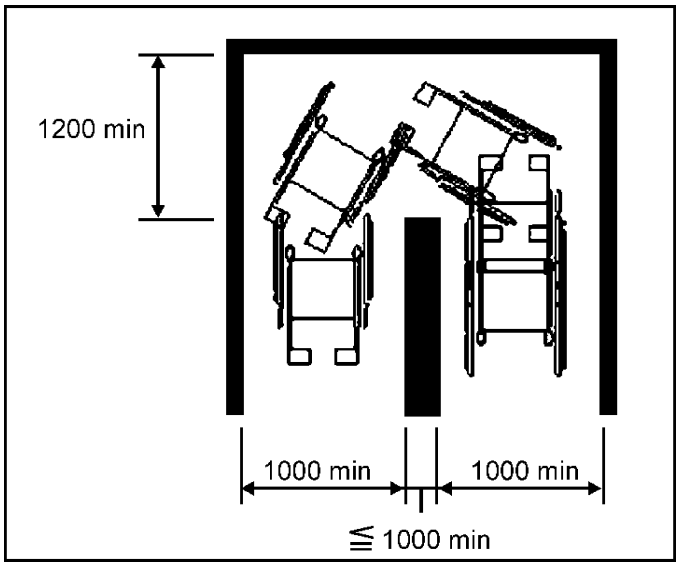
- Corridors should have an unobstructed width of 1500 mm-1800 mm.
- If less than 1500 mm, turning spaces should be located at intervals of 30 meters.
- Level differences should be beveled.
- Threshold should not be more than 12 mm.
- All protruding objects to be placed either in a niche or above 2000 mm from the floor.
- To be well lit.



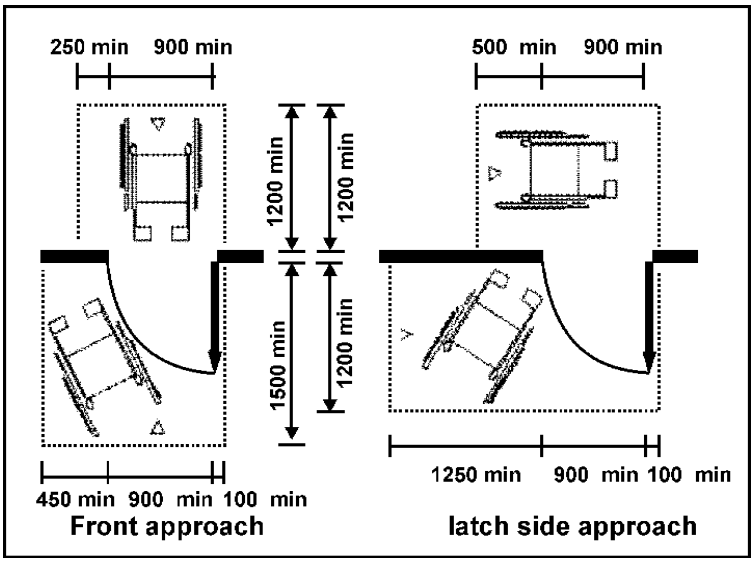




Minimum clearance for 90º turn



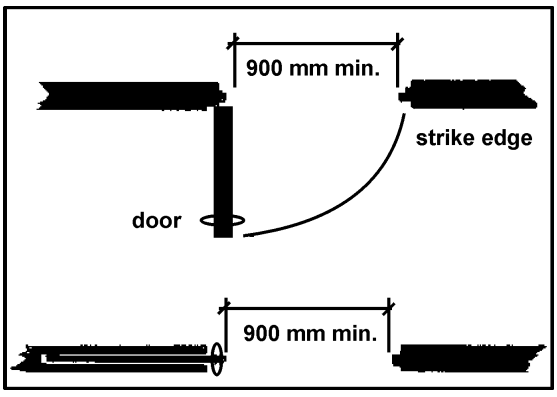
Turn Around An Obstruction



Doorways

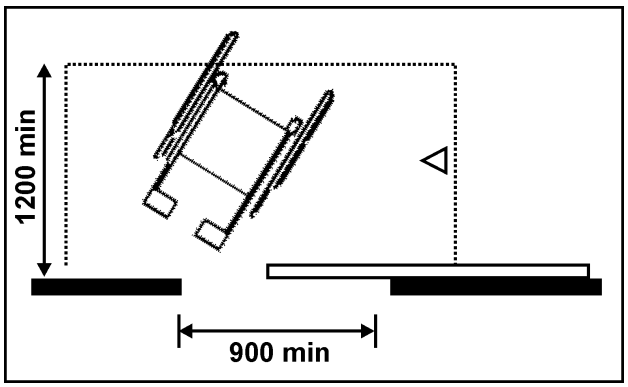
XI. Doors

- All doors should provide a clear opening of 900 mm.
- Be fitted with a lever action locks and D-handles of circular section.
- Lever handles and push type mechanisms are recommended. When a sliding door is fully open, handles should be usable from both sides.
- Also be fitted with vision panels at least between 900 mm and 1500 mm from floor level.
- Be colour contrasted with the surrounding wall and should not be heavier than 22N to open.



- Glass doors must have a bright, coloured motif at eye level.
- Where revolving doors or turnstiles are used, an alternative wheelchair-accessible entrance must also be provided.
- A distance of 400 mm should be provided beyond the leading edge of door to enable a wheelchair user to maneuver and to reach the handle.
- Kick plates are recommended 300 mm from the bottom, to resist wear and tear.

Thresholds of doorways should not exceed 12mm. Raised threshold and floor level changes at doorways should be leveled off with a slope on each side of a threshold. The slope may be a simple, movable ramp.

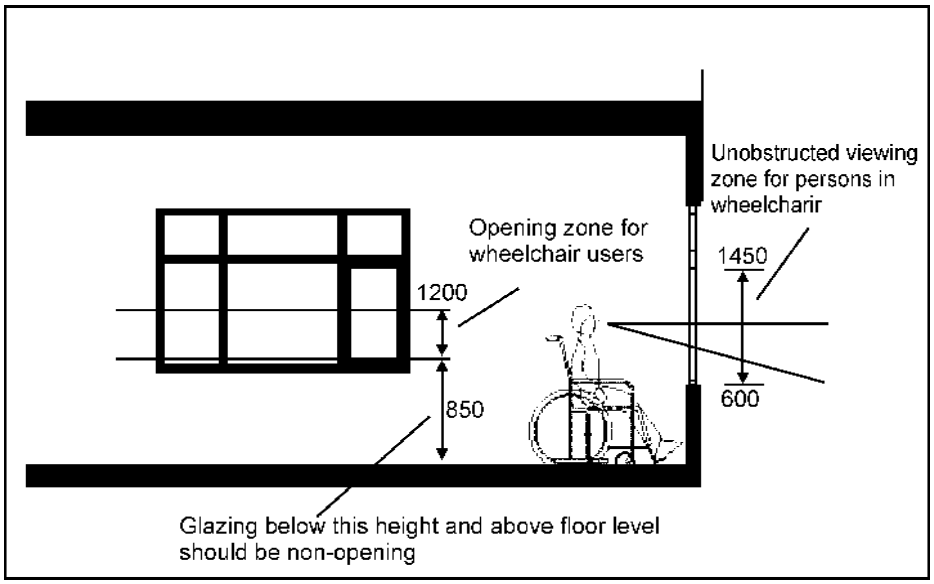


Sliding door

Outside the door

XII. Windows

- A window should have handles/controls at 1200 mm.
- A window should have an unobstructed viewing zone for wheelchair users 600 mm-1450 mm.
- Curtain or Venetian blind controls/ropes should be at 1200 mm.



XIII. Toilets

Accessible public toilets should have the universally accepted symbol for wheelchair access displayed outside.

A minimum of one toilet compartment for public use should have enough floor space for wheelchair users to enter and exit.

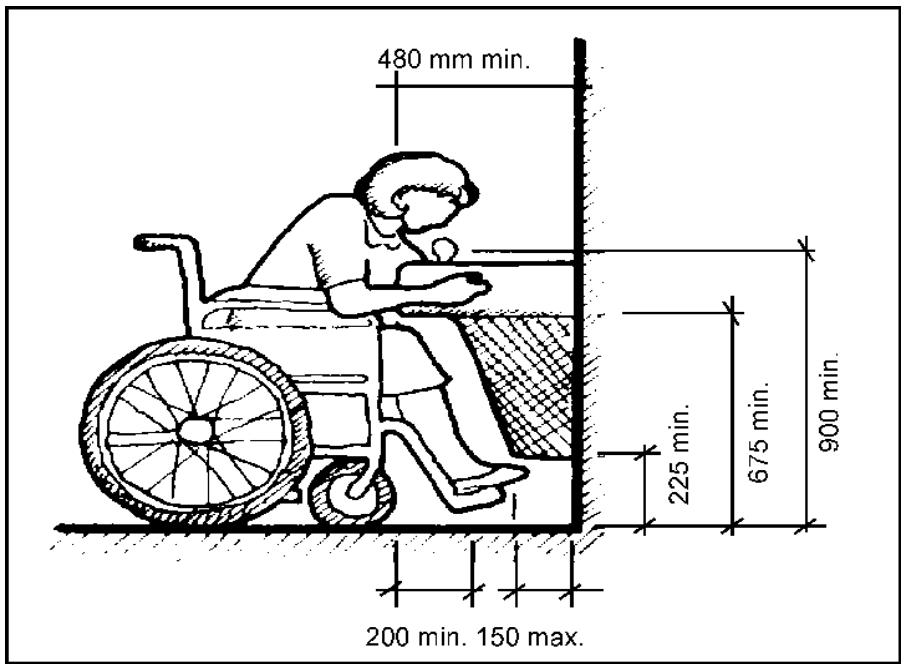
- Clear floor space (1750 mm x 2000 mm min.).
- Provide a door of clear opening of at least 900 mm with the door swing outwards or be folding or sliding type.
- Should have slip resistant flooring.
- Be provided with a horizontal pull bar at least 600 mm. long on the inside and 140 mm. long on the outside, at a height of 700 mm.

Water Closet (WC)

- Have clear space of not less than 900 mm wide next to the water closet.
- Be located between 460 mm to 480 mm from the centerline of the WC to the adjacent wall and have a clear dimension of 800 mm from the edge of the WC to the rear wall to facilitate side transfer.
- The top of the WC to be 450 mm – 500 mm from the floor.
- Have a back support.
- Grab bars at the rear and the adjacent wall.
- On the transfer side swing up grab bars shall be provided.

Washbasin

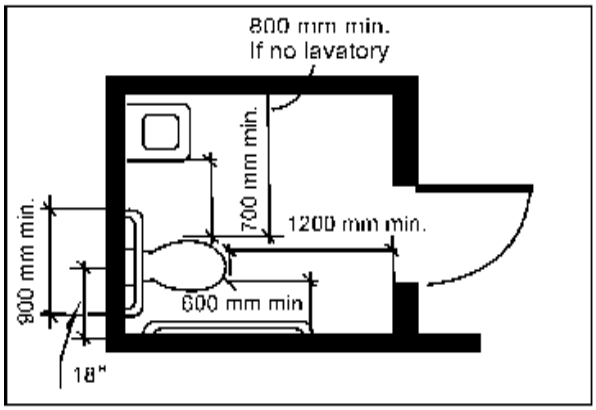
- Be of dimensions 520 mm and 410 mm, mounted such that the top edge is between 800 mm - 900 mm from the floor; have a knee space of at least 760 mm wide by 200 mm deep by 650 mm-680 mm high.
- Lever type handles for taps are recommended.
- Mirror's bottom edge to be 1000 mm from the floor and may be inclined at an angle.

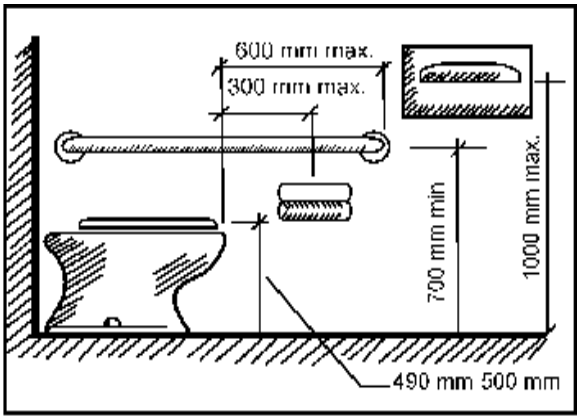


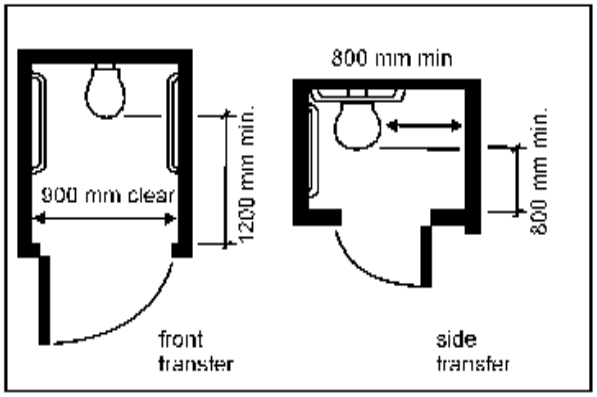
Wall mounted washbasin with grab bars

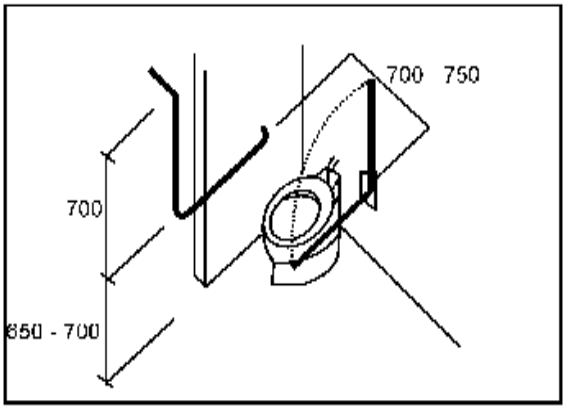
Infra red activated washbasin

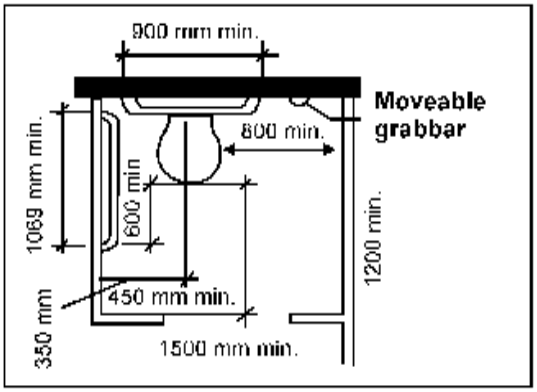
Plans of Accessible Toilet

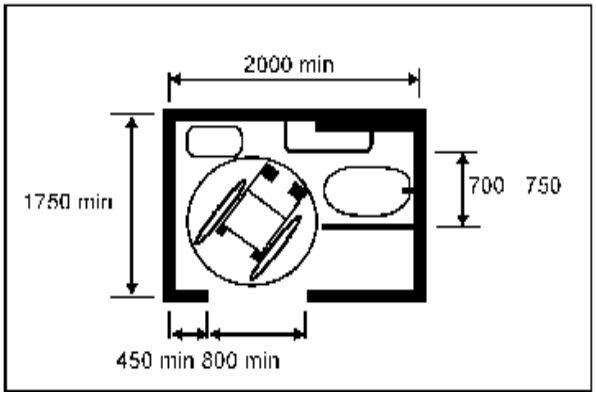




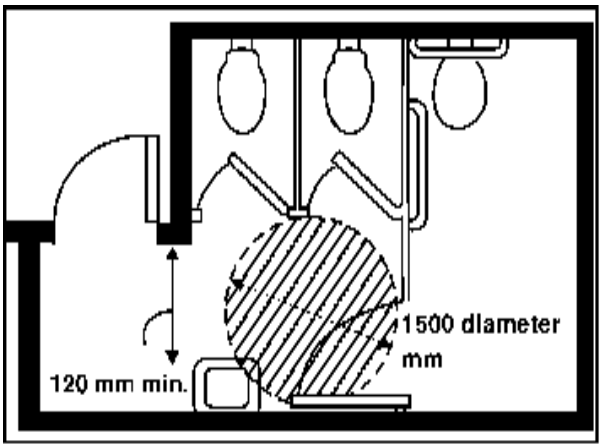


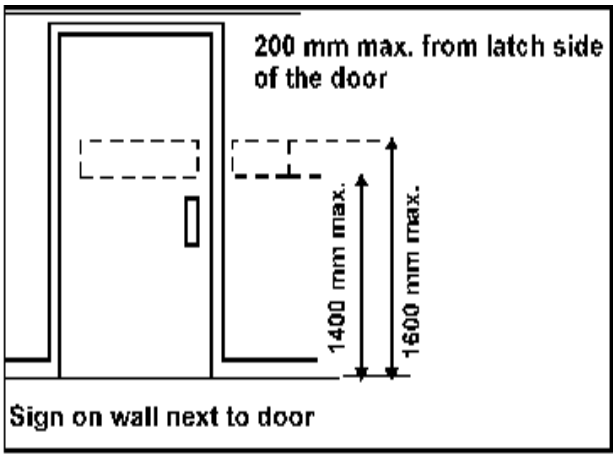


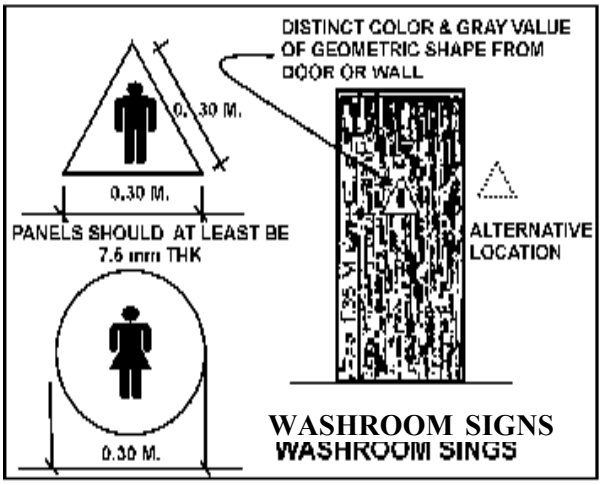


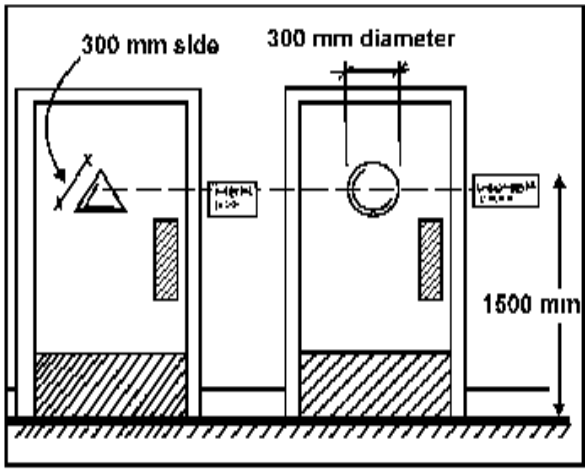


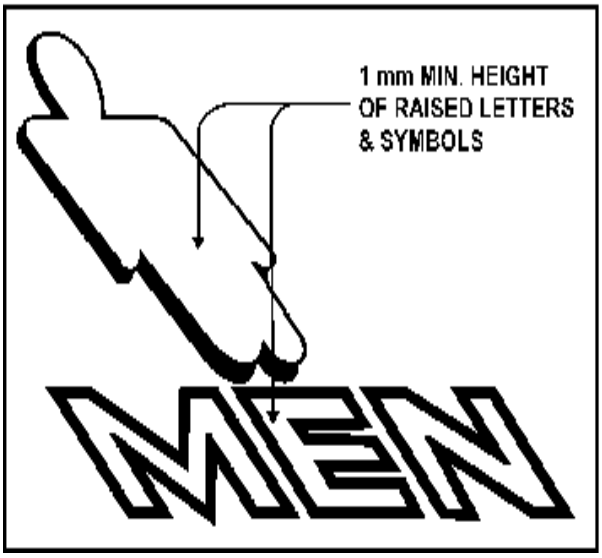
Provisions for Public Toilet

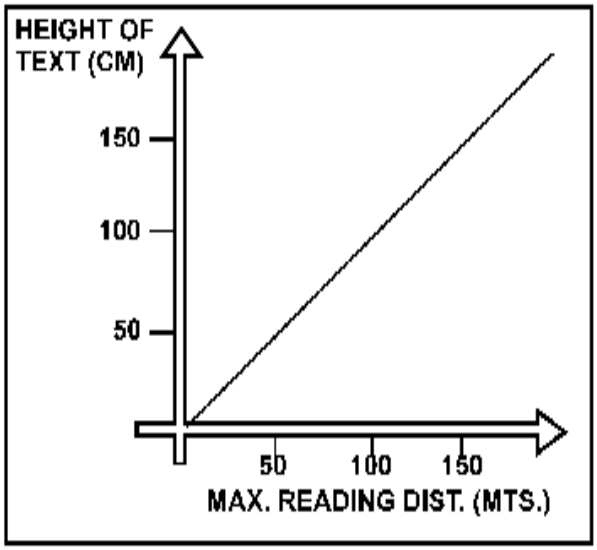












Layout Plans of an Accessible Toilet

VSO Office, New Delhi

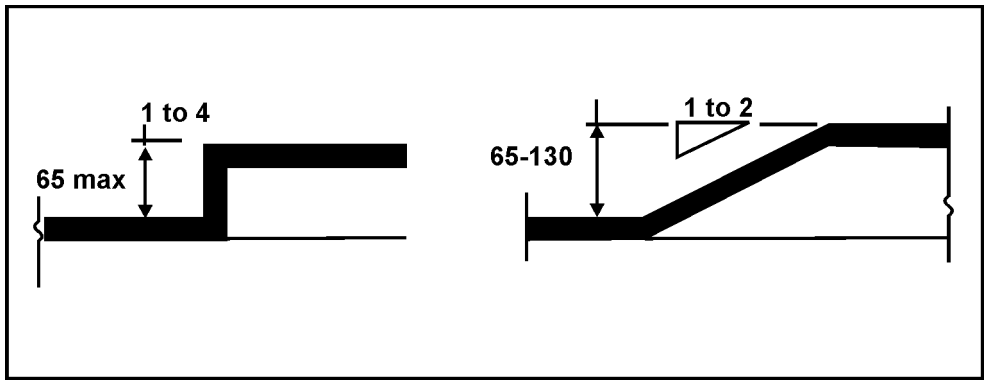
Urinals

- At least one of the urinals should have grab bars to support ambulant persons with disabilities (for example, crutch users).
- A stall-type urinal is recommended.
- Grab bars may be installed on each side, and in the front of the urinal. The front bar is to provide chest support; the sidebars are for the user to hold on to while standing.

- Accessible toilet may be provided with a switch that activates an emergency alarm.
- For the benefit of the vision-impaired people, all toilets to have male or female marked on plates with raised alphabets and put on wall next to door.
- A distinct audio sound (beeper/clapper) may be installed above the entrance door for identification of the toilets.

XIV. Ground and Floor Surfaces

- Ground and floor surfaces (along accessible routes and in accessible rooms and spaces, including floors, walks, ramps, stairs, and kerb ramps) should be stable, firm and slip-resistant.
- Vertical level changes up to 6 mm may not need edge treatment. Changes in level between 6 mm and 12 mm should be leveled off with a slope no greater than 1:2.
- If gratings are placed in pathways, they should have spaces no bigger than a wheelchair's wheels, e.g., 12 mm.
- If carpets or carpet tiles are used on a floor surface, they should be securely attached to it. Long, thick rugs should not be laid in areas likely to be frequented by persons with mobility and sight impairments.
- Edges of paths can be clearly defined by using different colours and textures.
- Street furniture, trees, lighting and dustbins should be located on one side of pathways. The surface texture and colour surrounding may be changed to indicate the approach to those items

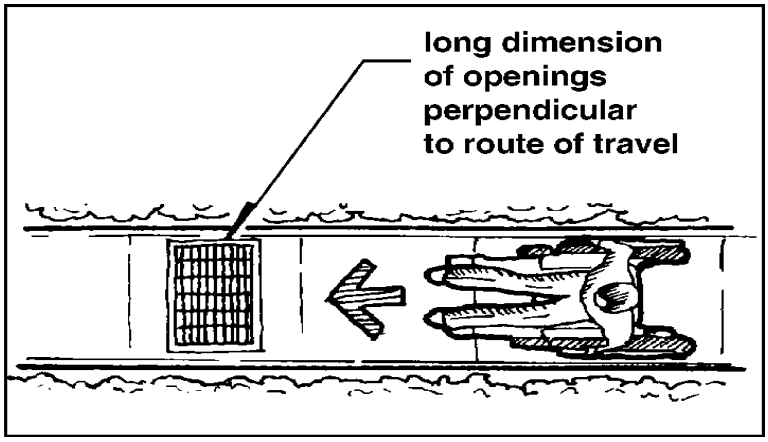


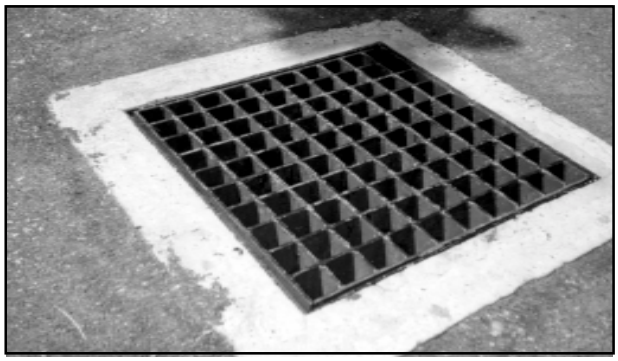
Change in level of accessible route.

Bevel edge

Gratings

- Covers and gratings should be non-slip, flush with the footway surface, and be such that openings are not more than 12 mm wide.
- Gratings and slot type drainage should be sited away from pedestrian flows and perpendicular to the main line of pedestrian flows so as not to trap small wheels.





Uncovered, wide gratings, which trap small castors/ wheels of the wheelchair, walking sticks, white canes and crutches.

XV. Tactile Surfaces / Guiding Blocks

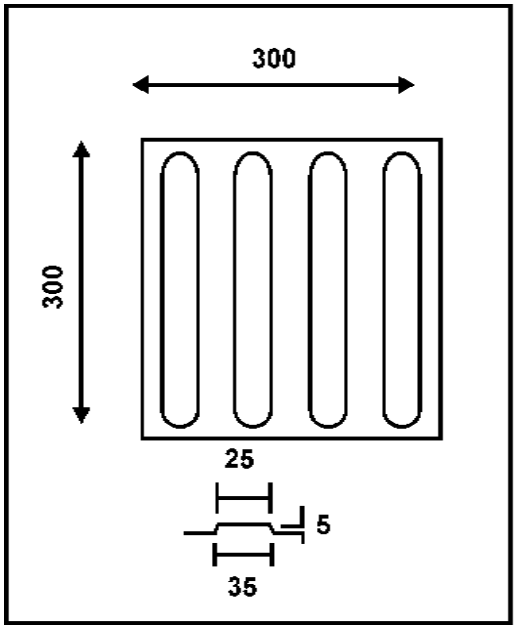
- Dot-type blocks give a warning signal. They are used to screen off obstacles, drop-offs or other hazards to discourage movement in an incorrect direction, and to warn of a corner or junction.
- Line-type blocks indicate the correct route to follow.

Places to install guiding blocks

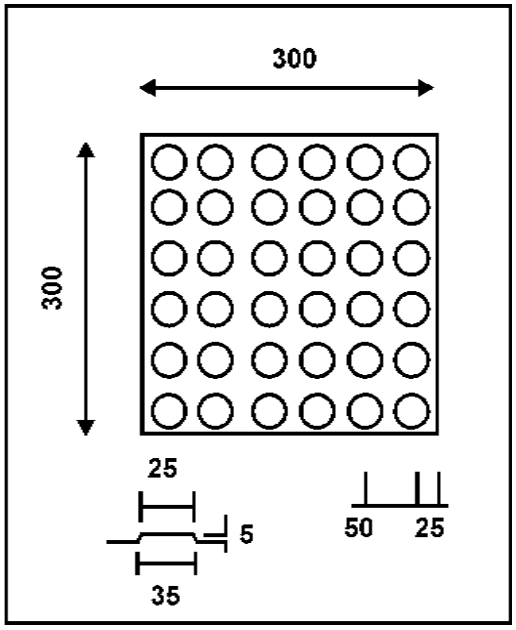
- In front of an area where traffic is present.
- In front of an entrance/exit to and from a staircase or multi-level crossing facility.
- Entrances/exits at public transport terminals or boarding areas.
- Sidewalk section of an approach road to a building.
- Guiding path from a public facility to the nearest public transport station.

Rural areas

- In rural areas, stones of different sizes may be used to separate the road from the kerb, and to indicate the approach to public places.



Guiding Path

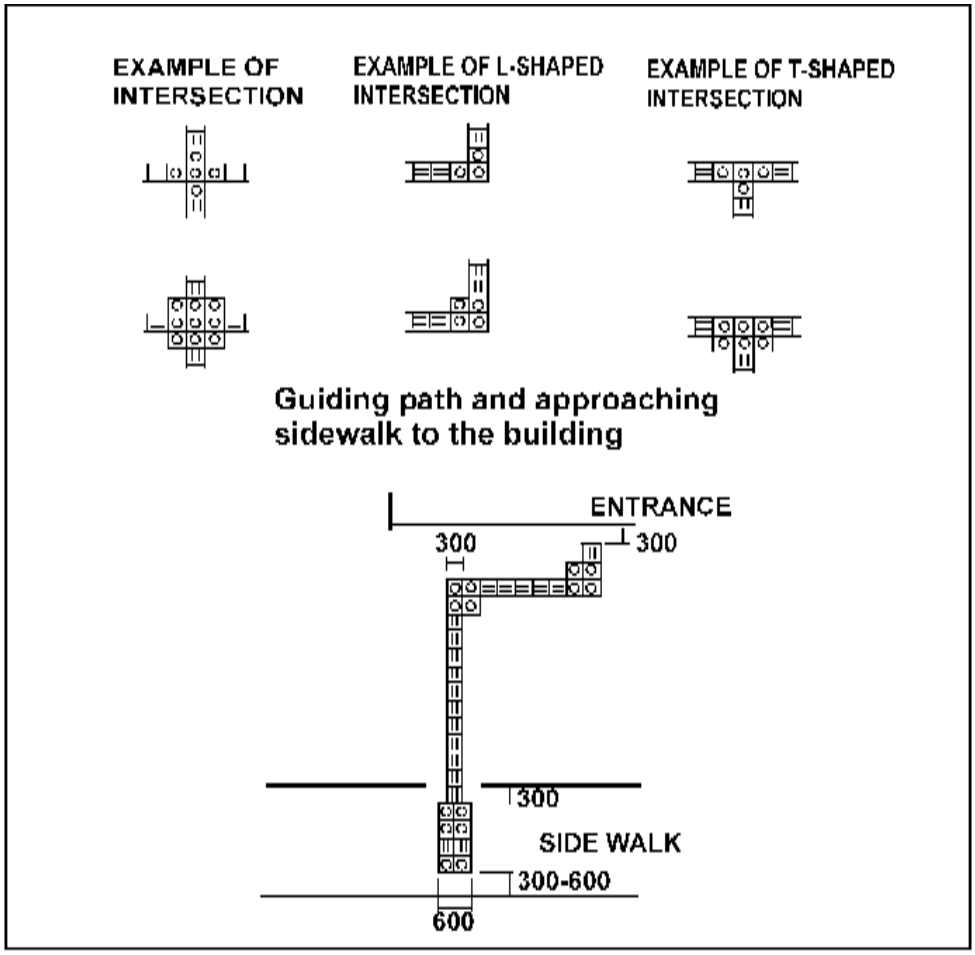


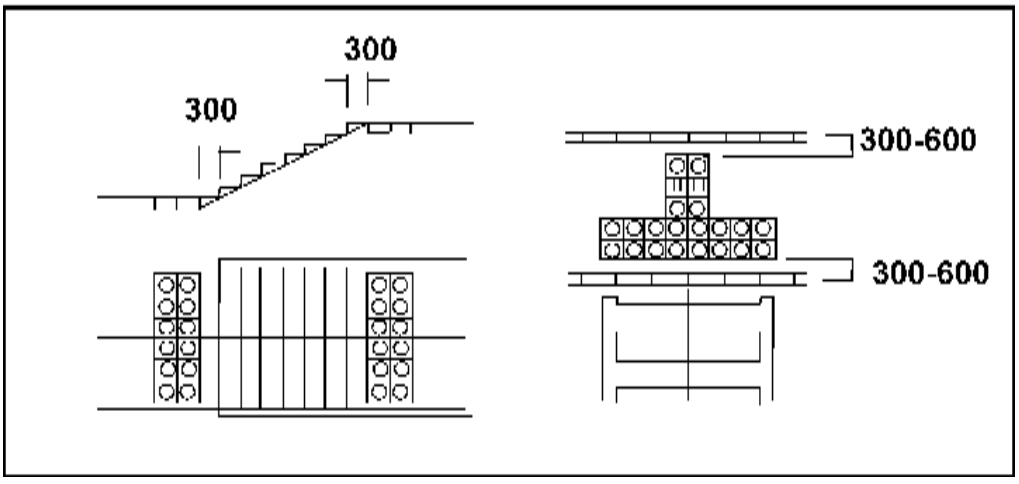
Warning Strip

Strip of guiding and warning blocks

Laying of Warning strip

Arrangement of Guiding Path and Warning Strip





Stairs and Crosswalk

Diverse arrangements of guiding path and warning strip: at crosswalks.

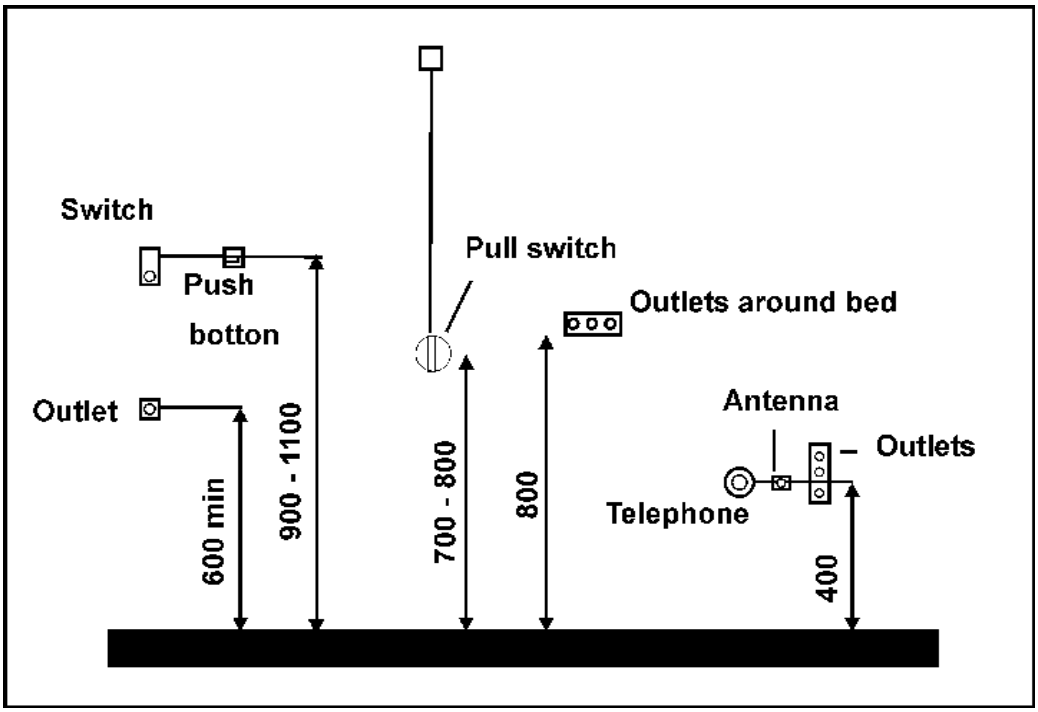
Strip of warning blocks: entrance/exit to and from a staircase.

Entrances/exits at public transport terminal.

Photographs: Shastri Park Station, Delhi Metro Rail Corporation

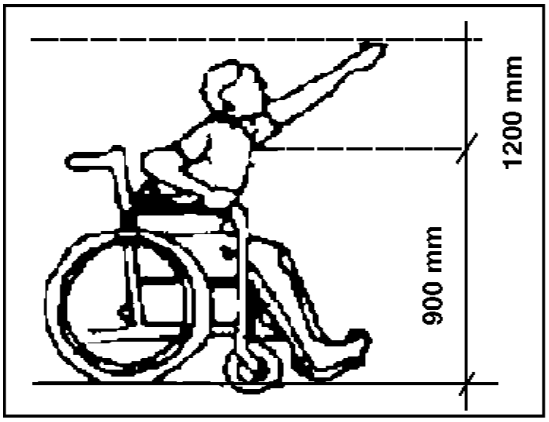
XVI. Switches and Outlets

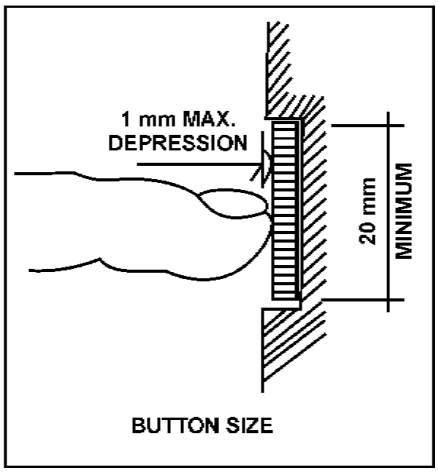
- Switches and outlets should be mounted at an appropriate height and position for easy reach.



XVII. Illumination

- Adequate and well-distributed lighting should be installed.
- Glare from excessively bright lights should be avoided.
- Staircases and corridors should have adequate lighting



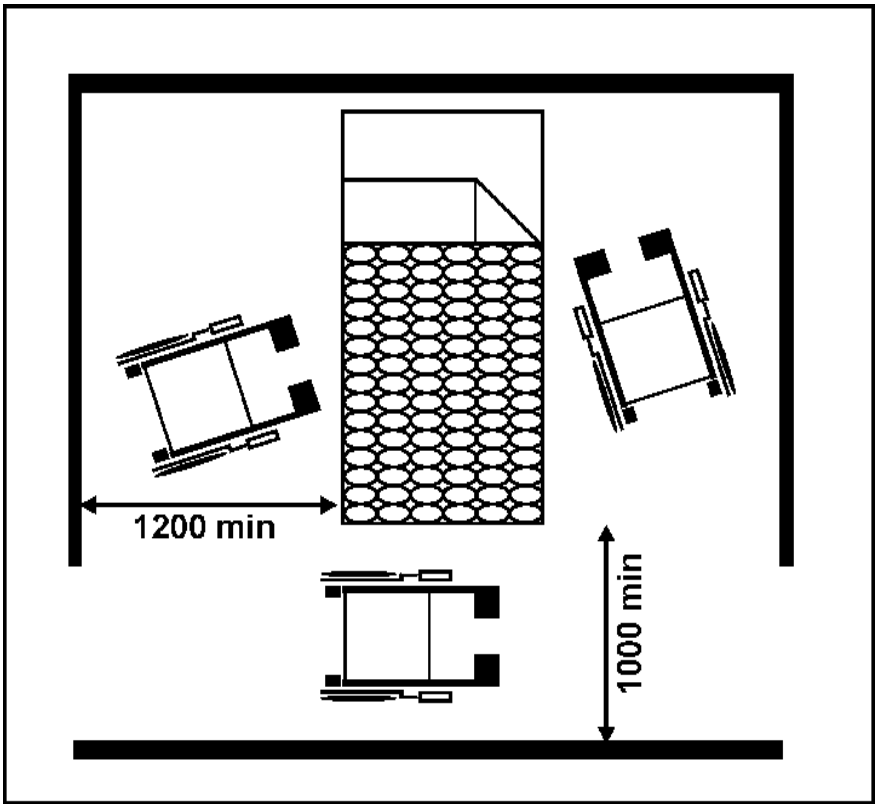


Chapter 2

Residential

Bedrooms

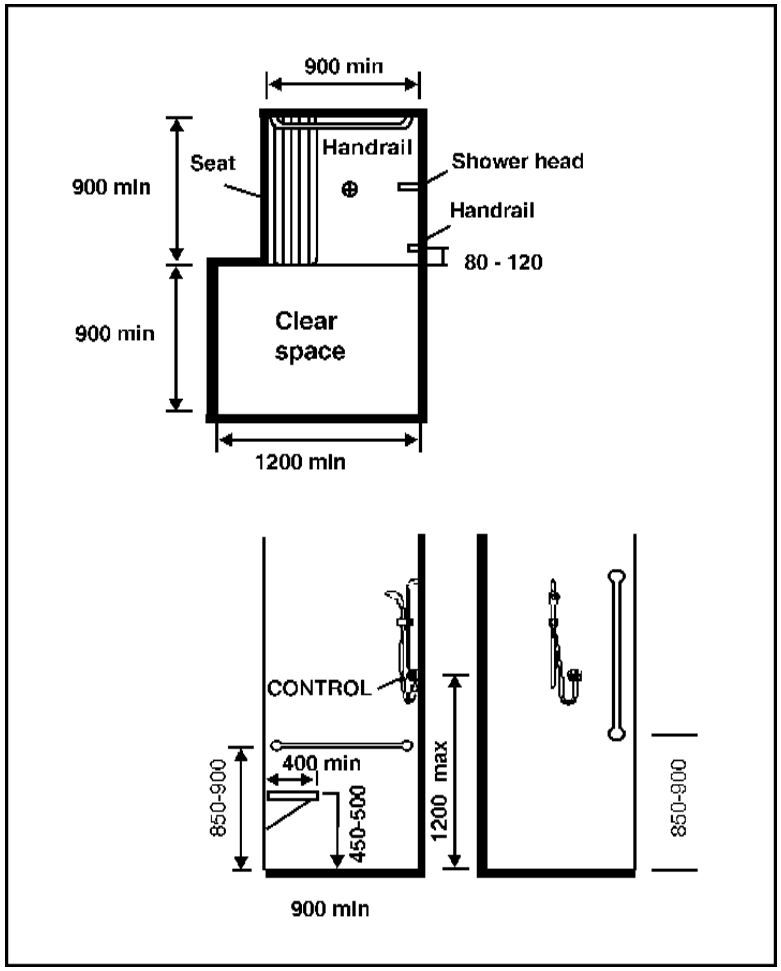
- The space around the bed should be adequate for access by all mobility aid users.
- The space around the bed should be large enough for transfer by a wheelchair user, or for a helper to assist in the transfer.
- The bed should be at a height: 450 mm-500 mm, from the ground that permits wheelchair users to transfer easily.
- There should be a bedside table at a suitable height and position that permits a person lying on the bed to reach it easily.



Shower Cubicles

- Should have seats: height 450 mm-500 mm which, facilitate easy transfer by wheelchair users.
- Grab rails at a height of 700 mm-800 mm.
- Call buttons or other signal devices at a height: 900 mm-1200 mm; can be easily reached in an emergency.
- Sufficient space should be provided beside shower cubicles for transfer by wheelchair users: 900 mm x 1200 mm.
- Shower doors, locks or catches should be of a type that can be opened from the outside in an emergency.
- Shower doors should preferably be of a sliding or outward opening type.

These recommendations are relevant for bathing facilities for low-income households.



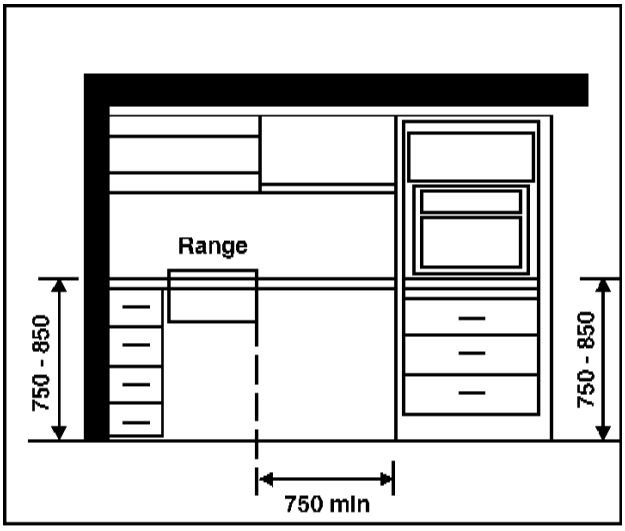
Shower Cubicles

Single shower cubicle

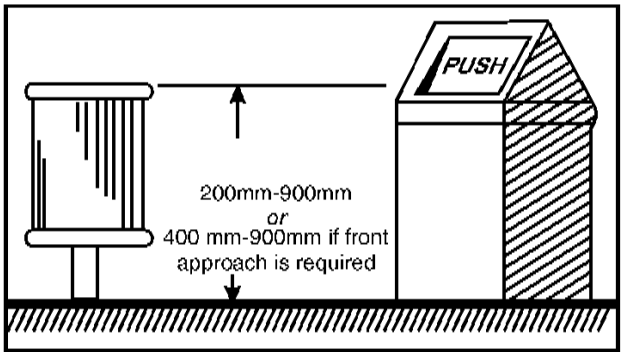
Washroom:
Toilet cubicle
with shower seat

Kitchens

- Floor surfaces should be of a slip-resistant material.
- Worktops, sinks and cooking hobs should be at the same level and at a height: 750 mm-850 mm.
- Adequate knee room- 650 mm min. should be provided beneath workshops and sink.
- Floor space should allow easy wheelchair movement between worktop, sink and cooking hob or stove.
- Tap preferably should be of the mixer type, with lever handles.
- Where cooking facilities have control taps or knobs, these should be at the front of the appliance and be easily and safely operated by people with diverse disabilities.
- Where appropriate, oven doors should hinge downwards.
- Where solid fuel stoves are used, the needs of people using wheelchairs or crutches and of blind people should be considered in designing for adequate operating space and safety.

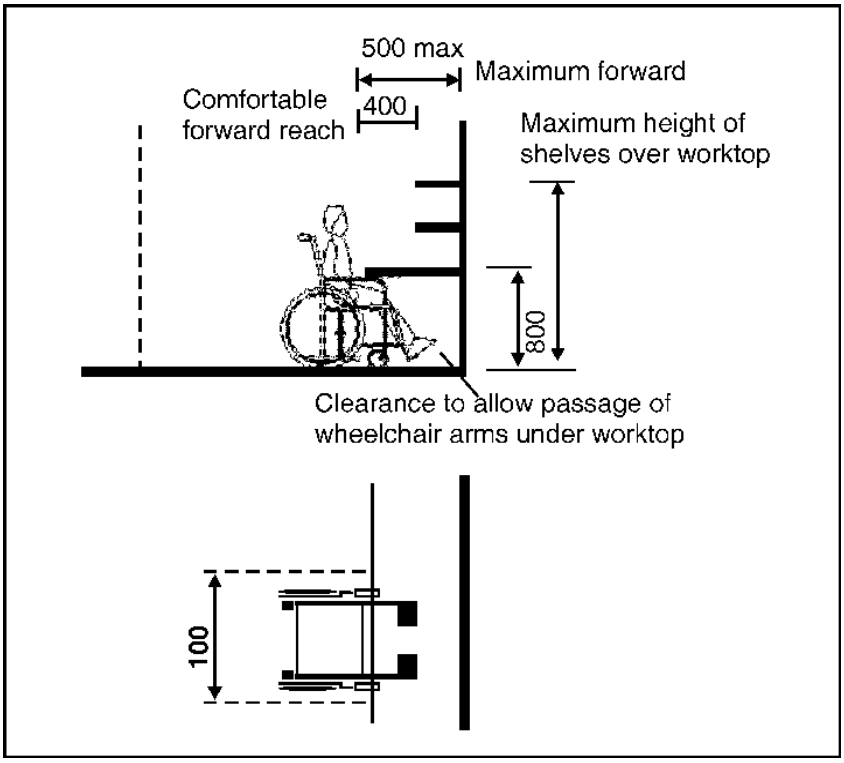


Cooking range



Dustbins

Work Top Bench

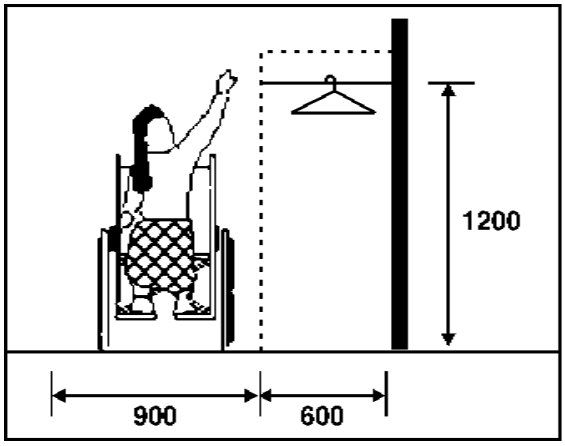


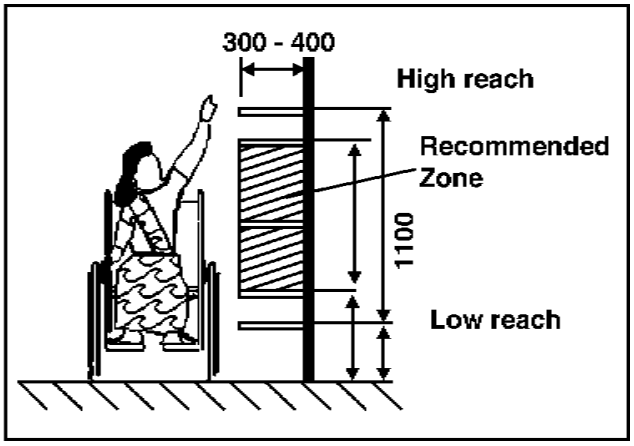
Cooking Range/Slab

Sink

Storage Space

- Space for a wheelchair to be stored (folded or unfolded) should be provided near doors.
- Storage space of various kinds (shelves, wardrobe rails, cupboards and drawers) should be within 1200 mm and depth range and be reachable by people in wheelchairs.
- A recessed plinth should be provided under storage units to accommodate the footrests of a wheelchair.
- Cupboard and drawer handles should be of a shape, which may be easily grasped by a person with limited gripping or pulling strength.
- Lockable drawer handles should be provided for each occupant in residential institutions.
- A refrigerator should be at a suitable height and depth for easy reach by wheelchair users.
- Sufficient floor space should be provided for wheelchair users to maneuver around open doors of cupboards and refrigerators.





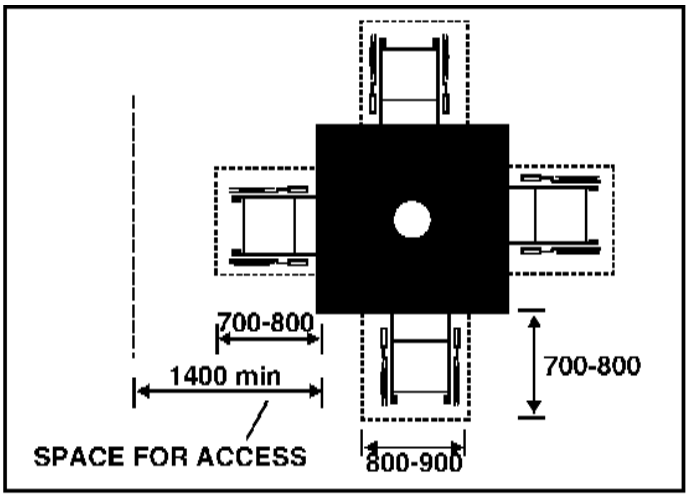
Wardrobe

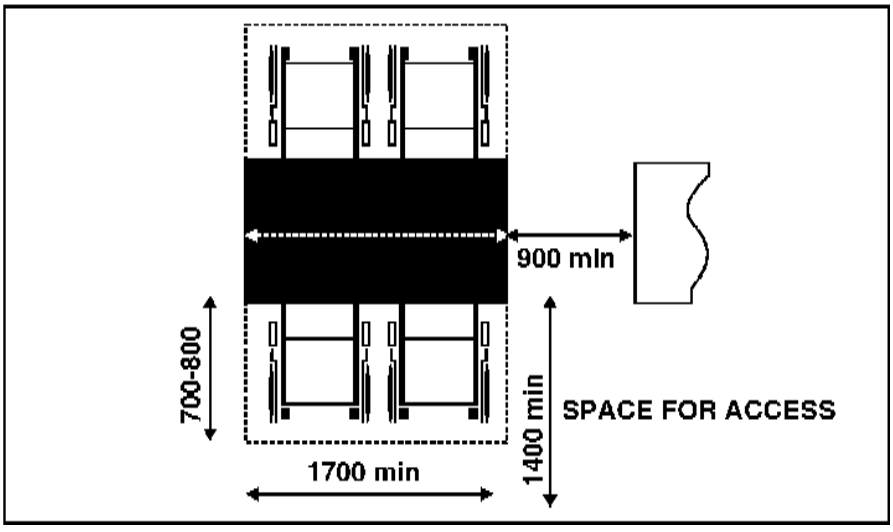
Lever handle to pull hanger at sitting height

Storage shelves

Tables

- A space should be provided for wheelchair users at tables.
- A space should be provided for wheelchair user access to and from tables.



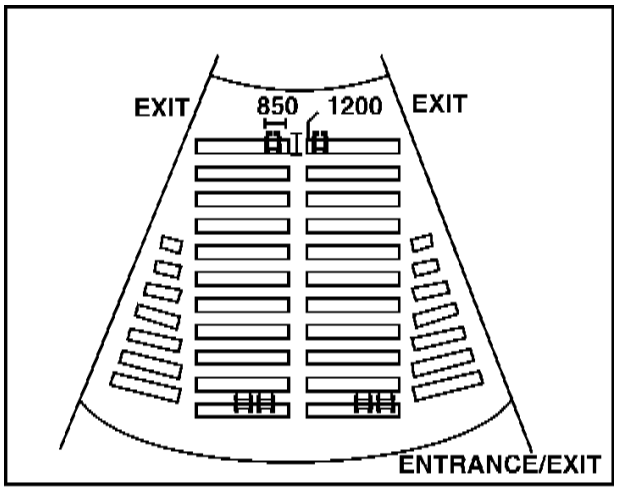


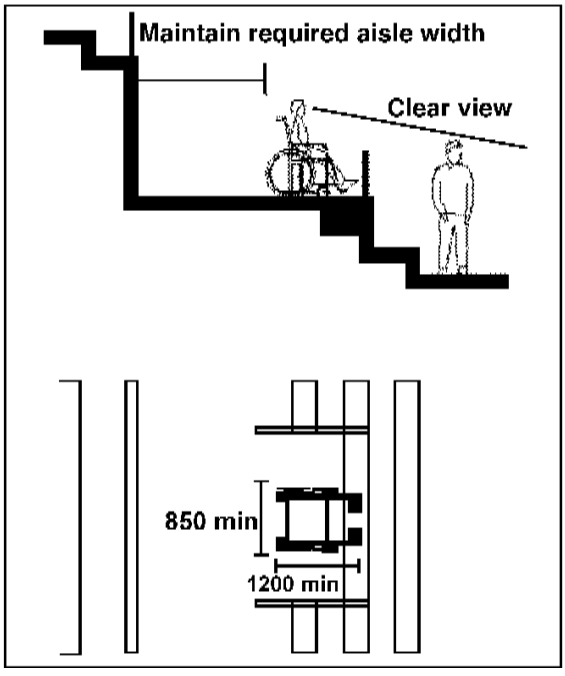
Chapter 3

Places of Recreation (Theatres, Auditoriums, Parks, etc.)

Wheelchair Seating

- Applies to wheelchair spaces in auditoria, assembly halls, theatres and similar facilities.
- Accessible seating space should be provided in a variety of locations to persons with physical disabilities.





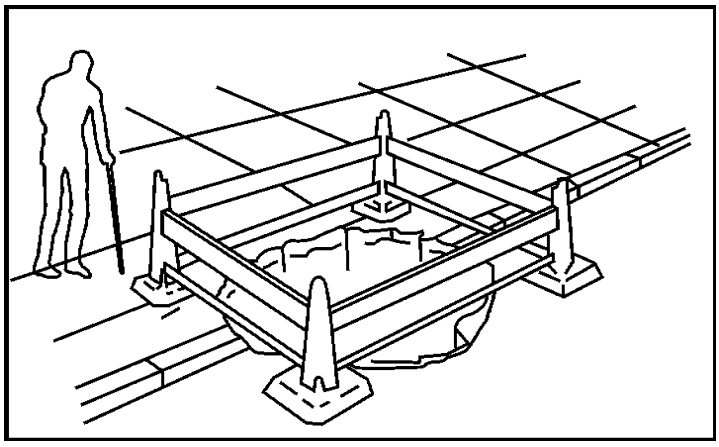
Space allowance in the auditoria, assembly halls, theatres.

Parks

- There should be no difference in level around an approach to park and/or park roads. If a level difference is unavoidable, a ramp or a staircase plus a ramp are needed.
- A level landing should be provided before and after the change in level.

Garden of Five Senses, New Delhi

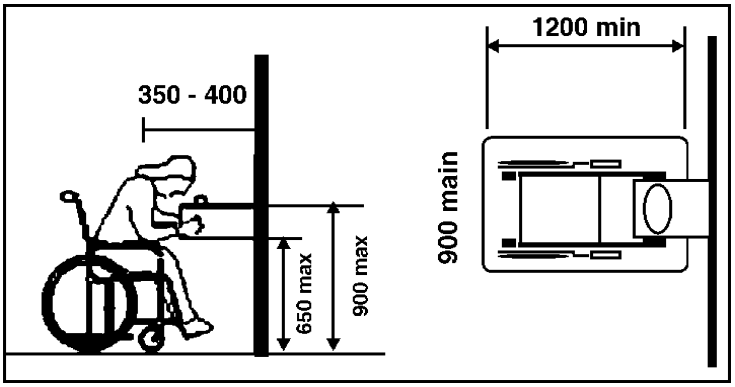
- Paved surfaces should be made of a non-slip material.
- At locations where there is a difference in level, such as stairs, the surface material should be changed using a color contrast scheme and guiding blocks.
- Approaches and pathways should be 1800 mm. (minimum) wide.
- Drainage ditches should not be constructed in park road areas. If a drainage ditch has to be constructed, a ditch cover should be provided.



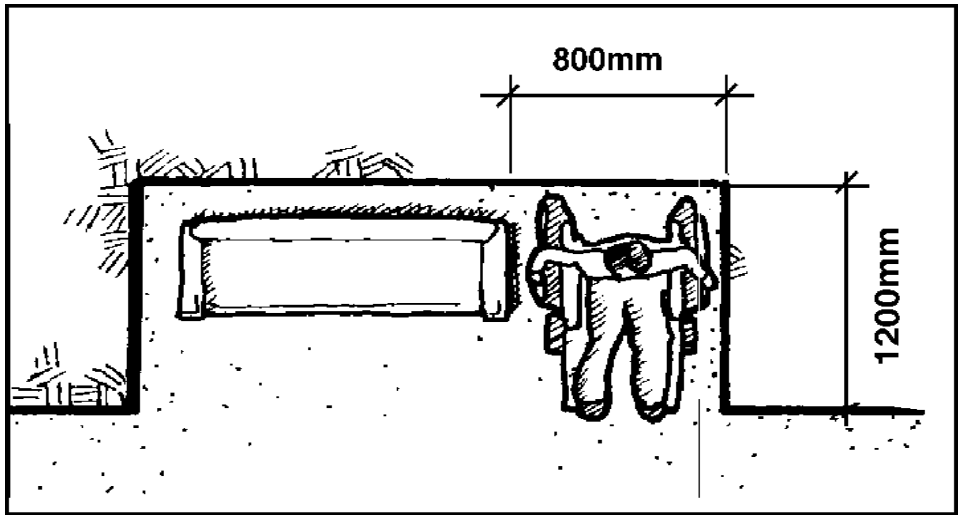
Slots in ditch/drain covers must be narrow enough so as not to risk crutches or the wheels of wheelchairs being stuck.

- An information board should be provided. The board should be designed to be easily legible by using sufficiently large text size, distinct contrast and illumination. The information should also be in Braille.

- Benches, dustbins and drinking fountains should be installed with adequate space around them for wheelchair users to maneuver.
- Benches should be installed along the side of park roads.
- There should be space 900 mm x 1200 mm, provided for wheelchair.



Photographs : Garden of Five Senses, New Delhi



- Guiding blocks should be provided for persons with a visual impairment.
- Handrails should be provided in places of recreation, where necessary.
- WCs should be provided in places of recreation.
- For parking in places of recreation.
- Signs should be in contrasting colours and preferably be embossed in distinct relief to allow visually impaired persons to obtain the information they contain by touching them.
- Simple symbols and contrasting colours, which are universally recognized, should be used, e.g., green for safety or go, yellow or amber for risk or caution, and red for danger.

Chapter 4

Fire Evacuation Needs

I. Means of Escape (In An Emergency)

Efforts to integrate people with disabilities into mainstream society may result in new or increased challenges to raise standards regarding safety in the event of fire. This section describes the important aspects of fire safety to be considered by designers, engineers, fire safety personnel, building managers, as well as non-disabled and disabled facility users.

(a) Fire

Unless there are items in a room, which are especially flammable, fire at its initial stage, spreads slowly. As the fire gets bigger, toxic gases are given off; these quickly rise to the ceiling and spread under doorways. If there is enough material in the room, the fire will eventually develop very rapidly with flames and smoke engulfing the entire room or building.

If fires are discovered while they are still very small, they can usually be easily extinguished. However, untrained persons cannot extinguish a well-established fire and trying to stop such a fire could be extremely dangerous and waste valuable escape time.

(b) Fire-emergency safety

(i) General principles

(a) Safety is important for everyone.

(b) Persons with disabilities should be helped to protect themselves.

(c) Persons with disabilities should be included in fire safety training.

(ii) Design elements and safety measures

(a) Fire-safety codes make it essential for buildings to be designed with safety features. Fire-safety design elements are directed towards three objectives:

i. Detecting the fire.

ii. Separating people from the fire either by enabling prompt evacuation of the building, or by providing a refuge area within the building where occupants may safely await rescue.

iii. Controlling or extinguishing the fire.

In many cases, disabled persons do not require specific design features. However, adequate fire-safety education is a necessary preventive measure. In a fire-emergency situation, non-disabled persons can become

handicapped. Everyone is effectively disabled in the case of a fire. Smoke and toxic gases can obscure vision; bells and alarms can impair hearing and create panic and fear, thus limiting the judgmental abilities of everyone.

The ideal situation is for everyone to be as aware and capable of self-preservation as much as possible during an emergency. This often involves modification of the built environment. For example, flashing lights could be activated simultaneously with an audible alarm system to alert persons with hearing impairments. Tactile maps showing alternative escape routes could be installed for persons who are visually impaired. Persons with mobility impairments require little, and sometimes, no assistance from others if areas of refuge have been pre-established and are clearly indicated.

Large public buildings could introduce voluntary registration in the main lobby so that persons with disabilities may easily be located in case of an emergency. Persons with disabilities need to be included in all fire drills.

(c) Refuge

An alternative to immediate evacuation of a building via staircases and/or lifts is the movement of disabled persons to areas of safety within a building. If possible, they could remain there until the fire is controlled and extinguished, or, until rescued by fire fighters. Some building codes require the provision of a refuge area, usually at the fire-protected stair landing on each floor that can safely hold one or two wheelchairs.

II. Alarm Signals

Alarm Systems

Concerning vocal alarms, vibrating alarms and instructions for escape from danger:

- If emergency warning systems, e.g., vibrating alarms or vocal alarms, are installed, they should include a means of warning for visually impaired persons.
- Visual alarm devices should be provided for persons with hearing impairments.
- Sockets should be provided near beds to allow alarm systems, including vibrating under pillow devices, to be connected easily.

Alarm signals such as flashing lights, vibrating beds or variable velocity fans can alert deaf or deaf and blind residents. Emergency exit lights and directional signals mounted near the floor have been found to be useful in cases where a lot of smoke is present. Pre-recorded messages and on-the-spot broadcasts from a central control center would be of great benefit.

Raising the Alarm

Special devices, e.g., fire alarm boxes, emergency call buttons and lighted panels may be needed by persons who are deaf or blind. Telecommunication devices for deaf persons (TDD) are practical for typing in conversations. A pre-recorded message installed in the telephone would be useful for notifying the fire department.