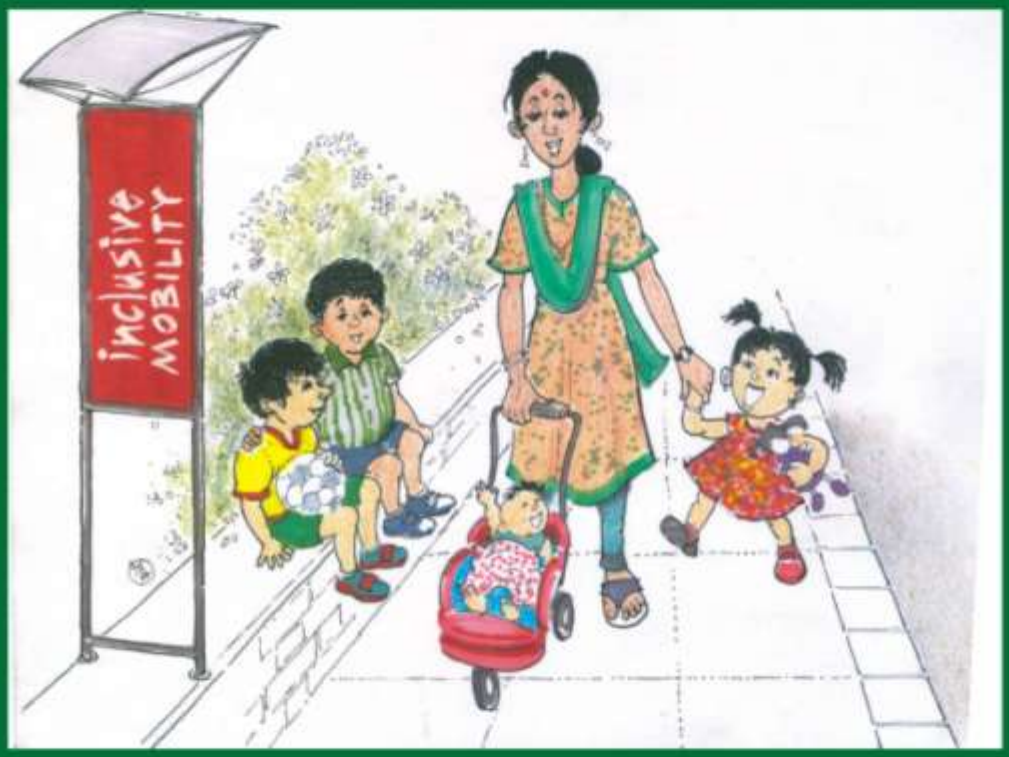
Universal Accessibility

Guidelines for Pedestrian, Non-motorized Vehicle and Public Transport Infrastructure



Guidelines by

Samarthyam
National Centre for Accessible Environments

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SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

Universal Accessibility

Guidelines for Pedestrian, Non-motorized Vehicle and Public Transport Infrastructure

About Shakti Sustainable Energy Foundation (SSEF)

Shakti Sustainable Energy Foundation (SSEF) works towards strengthening the energy security of India by aiding the design and implementation of policies that support energy efficiency, renewable energy and sustainable mobility. Shakti works in sectors with the maximum potential for energy and carbon savings: Power, Transport, Energy Efficiency and Climate Policy. Shakti provides technical assistance support for specific activities consistent with its organizational strategies to support public policy decisions. It convenes NGOs, universities, business, think tanks, and domestic and international experts to design and implement smart energy policies in India.

About Samarthyam

Samarthyam is civil society organization. It evaluates, develops, and promotes universal accessibility in internal and external environments, transportation systems and products. As Access Consultant with Government of India, Samarthyam has facilitated policy advocacy to make Incredible India = Inclusive India. Our vision is Inclusive Community: embrace the ideals of all peoples living together harmoniously in a barrier-free world without fear of exclusion and no-discrimination.

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Transport Disadvantaged Persons in India

400 million approx.

Persons with Reduced Mobility
33% of total population

Source: Global Action on Aging, 2006

180 million approx.

Persons with Disabilities
15% of total population

Source: World Report on Disability, 2011

Reduced mobility and disability is a reality in all levels of society and affects the family and community at both national and global levels

Disability and poverty at the global level: Of an estimated 600 million persons with disabilities worldwide, about 80% live in developing countries (The World Bank, 2007). World Bank studies estimated the global GDP loss due to disability from $1.71 trillion to $2.23 trillion annually (R. Berman Bieler, October 2006).

Disability and poverty at family and community level: It is estimated that one out of four persons has a family member with a disability; the lives of 25% of the population in the Asia-Pacific region are believed to be impacted by disability (Asian Development Bank (ADB), October 2002). Rates of poverty are known to be higher in households with a person with disability. Household members spend time and money taking care of their family member who needs personal assistance and has not had access to support services or rehabilitation, which would lead to independent living. Caring family members may also lose out on economic activities, education, etc. (The World Bank, 2007).

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Project Team:

Authors
Ms. Anjlee Agarwal, Accessibility Consultant
Mr. D. Chakravarti, Universal Design Consultant

Contributing Authors
Ms. Nidhi Madan, Architect & Landscape Architect
Ms. Simran Kaur, Transport & Physical Planner

Support Team
Ms. Seema Baquer, Project Assistant, Samarthyam
Mr. Prakash Chand Arya, Architect & Transport Planner, Samarthyam
Mr. Ashwani Kumar, Director, Samarthyam

Preface

Improved mobility is a crucial and necessary element in alleviating poverty for all including persons with disabilities. It provides opportunities for everyone to play an active role in society economically, socially and culturally. Developed countries have made significant progress in improving accessibility of transport systems for persons with reduced mobility and persons with disabilities by adhering to standards that are generally uniform (albeit with local variations). In developing countries, the situation is much more diverse where provision of the needs of persons with disabilities is still largely seen as a welfare function of the state instead as a matter of right.

There is a growing acceptance of a human-rights centric approach to accessibility for all, and the disabled in particular. With the larger recognition of every citizen's right to social, economic, cultural and recreational opportunities, a gradual effort is being made to remove barriers in the pedestrian and transport environment, which is a key element.

However, the slow and uneven progress in this direction is partly caused due to lack of awareness, will, good practice and paucity of guidelines/ codes and funding constraints. This will change when stakeholders realise that the same features that benefit persons with physical, sensory and cognitive impairments also benefit other commuters.

In view of the present scenario, the Universal Accessibility Guidelines for Pedestrian, Non-motorized Vehicle and Public Transport Infrastructure is aimed at improving accessibility for everyone for those who use the walking, cycling environment and public transport system. These Guidelines utilize principles of universal design to improve access to pedestrian and public transport systems for all users.

Anjlee Agarwal
Executive Director
Samarthyam

Glossary

Access Aisle- An accessible pedestrian space between elements, such as parking spaces, seating and desks that provides clearances appropriate for use of the elements.

Accessible- A site, building, facility, or portion thereof that complies with these guidelines and that can be approached, entered and used by all people.

Accessible Route- A continuous unobstructed path connecting all accessible elements and spaces in a building or facility that can be negotiated by a severely disabled person using a wheelchair and that is also safe for and usable by persons with other disabilities. Exterior accessible routes may include parking, access aisles, kerb ramps, walkways and ramps. Interior accessible routes may include corridors, ramps, elevators, lifts, and clear floor space at fixtures.

Accessible Signage- Any visual way finding system incorporates architecture, landscape design, lighting, landmarks and orientation points. Signage is one key element of an effective way finding system and should be accessible to all users.

Ambulatory Disabled- A person who is able, either with or without personal assistance, and who may depend on prostheses (artificial limbs), orthosis (calipers), sticks, crutches or walking aids to walk.

Automatic Door- A door equipped with a power operated mechanism and controls that open and close the door automatically upon receipt of a momentary signal. The switch that begins the automatic cycle may be photoelectrical device, floor mat, sensing device, or manual switch mounted on or near the door itself.

Beveled- Smooth, slanted angle between two surfaces; for example, a slant or inclination between two uneven surfaces to allow easy passage of a wheelchair.

Braille Signage- Is a specialist way-finding device that incorporates Braille as a primary source of information for people who are visually impaired and maybe aided with raised tactile lettering, maps or pictorial images (Ron Apelt, John Crawford and Dennis Hogan, 2007).

Braille- Braille system is a method that is widely used by persons with visual impairments to read and write.

Circulation Path- An exterior or interior way of passage from one place to another for pedestrians, including walkways, hallways, courtyards, stairways and stair landings.

Clear- Unobstructed

Color Contrast- The basic guidelines for making effective color choices are based on the hue value of the colors. The most commonly used methods of achieving color contrast incorporate either 'harmonizing' or 'contrasting' color combinations.

Disability- An umbrella term for impairments (WHO, 2004), activity limitations, and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors). Disability is neither simply a biological nor a social phenomenon but arises from the relationship between health condition and context.

Footpath (Sidewalk)- A footpath is a path for pedestrians that are situated alongside a road or a paved pathway. Footpaths should be regarded as a transportation system/network, which is connected and continuous, just like roadways and railways. They should not be sporadically placed where ever convenient, but instead should be provided consistently.

Grab Bars- A bar used to give a steadying or stabilizing assistance to a person engaged in a particular function.

Handrails- A rail used in circulation areas such as corridors, passageways, ramps and stairways to assist in continuous movement.

Hue- The perceptual attribute associated with elementary color names. Hue enables us to identify basic color categories such as blue, green, yellow, red and purple. Persons with normal color vision report that hues follow a natural sequence based on their similarity to one another. With most color deficits, the ability to discriminate between colors on the basis of hue is diminished.

Accessible Washrooms (toilets)- A compartment having the basic requirements of a water closet compartment, washbasin and other essential washroom accessories as required by persons with disabilities.

International Symbol of Accessibility- Also known as the wheelchair symbol, the International Symbol of Accessibility consists square overlaid with a stylized image of a person using a wheelchair. The symbol is often seen where access has been improved, and the symbol denotes a barrier free environment for persons with disabilities, older people, parents with prams, and travelers with luggage. The wheelchair symbol is "international" and therefore not accompanied by Braille in any particular language.

Kerb (curb)- A raised edge along a road with a footpath, road median or road shoulder.

Kerb Ramp- A short ramp cutting through a kerb or built up to it, with footpath, at a gradient no greater than 1:10 on both sides of necessary and convenient crossing points.

Knurled Surface- Brush texture, often in a crisscross pattern; used on either doorknobs or grab bars. On doorknobs, it is used to provide tactile clues to persons with visual impairments to indicate that passage leads to an area of danger. On grab bars, it is used to improve grasp and to prevent slipping.

LRV- Light Reflectance Value (LRV) is the total quantity of visible light reflected by a surface at all wavelengths and directions when illuminated by a light source.

Luminosity Contrast- Also known as tonal contrast is the most important element that assists persons with visual impairments to distinguish between two different surfaces. A minimum difference of 26 points in the LRV of colors of two architectural surfaces produces an adequate luminosity contrast that is perceivable by persons with visual impairments.

Lux- Standard unit of illumination. It is used as a measure of perceived intensity of light.

Operable Parts- A part of a piece of equipment or appliance used to insert or withdraw objects, or to activate, deactivate, or adjust the equipment or appliance (for example coin slot, pushbutton, handle).

Passing Places- A space on footpath, single track road or one lane road that permits two ways travels when it is not wide enough to allow wheelchairs/vehicles to pass one another.

Persons with Disabilities[1]**-** A person with disability is a person with any physical, mental, intellectual or sensory impairment which in interaction with various barriers may hinder full and effective participation in society on an equal basis with others. The term "persons with disabilities", consistent with the terminology used in the CRPD, is used throughout these guidelines.

Public Use- Describes interior and exterior rooms or spaces that are made available to the general public. Public use may be provided at a building or facility that is privately or publicly owned.

Ramp- An inclined way connecting one level with another.

Signage- Any room number, name tag, building directory, or similar object containing a printed message and/or symbol. Signage and signs are used synonymously in this document.

Space- A definable area (for example, toilet room, hall, assembly area, entrance, storage, room alcove, courtyard, or lobby).

Table Top- Road rose to footpath/ footway level at crossing or with leveled.

Tactile (CRC, 2007)**-** Means information and interpretations derived from the sense of touch. This involves sensory transfer through physical contact of the hands or feet with other surfaces, as well as sensory transfers received by contact with non-physical elements such as pressure, wind and temperature.

Tactile Paver/ Tiles (Tactile Ground Surface Indicators)- Provide a distinctive surface pattern of "strips" and "truncated domes" or cones (which are small domes or cones that have had their tops cut off, or truncated) detectable by long cane or underfoot which are used to guide/alert persons with visual impairments of their approach to

[1] Rights of Persons with Disabilities Act, 2012; http://www.disabilitystudiesnalsar.org/lawpolicy.php

facilities, streets and hazardous drop-offs. People who are blind or visually impaired are alerted of impending danger from vehicle impact or a grade change.

Tactile Signs (Refer also to Braille Signage)- Incorporates raised text or symbols to enable touch reading by people who are blind, and touch enhancement of visual perception for people who are visually impaired.

Traffic Island- Can be a median strip, a strip in the middle of a road. It can also be a narrow strip between roads that intersect at an acute angle. Some traffic islands may serve as refuge islands for pedestrians.

Universal Design (NCSU)**-** Defined as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design".

Vision Impairment- Is any significant loss of sight.

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Abbreviations

BRTS- Bus Rapid Transit System

CSO- Civil Society Organization

DIMTS- Delhi Integrated Multi Modal Transport System

DPO - Disabled Persons Organization

DTC- Delhi Transport Corporation

FOB - Foot Over Bridges

IPT- Intermediate Public Transport

JNNURM - Jawaharlal Nehru National Urban Renewal Mission

Km - Kilometer

m- Meter(s)

MCD- Municipal Corporation of Delhi

mm- Millimeters

MoUD – Ministry of Urban Development

MRTS- Mass Rapid Transit System

MSJ&E- Ministry of Social Justice& Empowerment

NDMC- New Delhi Municipal Council

NGO - Non Government Organization

NMT - Non Motorized Traffic

NMV- Non Motorized Vehicle

PRM- Persons with Reduced Mobility

PWD- Public Works Department

PwDs- Persons with Disabilities

RITES- Rail India Technical and Economic Services

ROW- Right of Way

TRB- Transport Research Board

ULB- Urban Local Body

UNCRPD- United Nations Convention on Rights of Persons with Disabilities

UTTIPEC- Unified Traffic and Transportation Infrastructure (PLG and ENGG) Centre

WwD(s)- Woman (en) with Disability (ies)

Executive Summary

Why were these guidelines developed?

Mobility is an integral part of our lives –we may need to go to school or work; see the doctor or meet friends; visit a restaurant, a gym or cinema; or simply fancy a walk or cycle ride. Universal accessibility is about making these trips easy, convenient, safe, comfortable and stress-free. The guiding principle of 'universal accessibility' is to create obstacle-free environments. It encompasses broad-spectrum ideas to create accessible streets, buildings and environment to the maximum extent possible. Accessibility here refers not only to persons with disabilities but to all possible users. It emphasizes inclusive environment in public spaces and infrastructure, accommodates the mobility needs of 'all individuals'.

Mobility without barriers – on foot, by bicycle, or by public transport

Improved accessibility allows for the greater use of non-motorized vehicles (NMV), reduces fatalities and promotes overall well-being. It will help prioritize walkability and NMV traffic over motorized traffic, a need that cannot be ignored for a safe and equitable commute. The guidelines will also facilitate better street design and facilities for people seeking better access, good connectivity and seamless journey.

Aim

These guidelines aim to fill the knowledge gap about universal access and act as a guide for practitioners and authorities to plan, design pedestrian environment and sustainable transportation.

Objectives

- To understand universal access and suggest application of its principles and standards to promote walkability, non-motorized vehicle and public transport usage;
- To highlight physical and environmental barriers in the public realm and recommend universal accessibility standards; and
- To highlight benefits of universal accessibility and sustainable transportation, and to promote a greater sensitivity and innovation in universal design beyond minimum requirements.

How these guidelines were developed?

Research, literature review, experience sharing and focus group discussions with a range of road users and expert planners contributed in the formulation of the present guidelines. The relevant information including best practices on walkability, non-motorized vehicles and public transport with universal accessibility standards from all over

the world were studied. A detailed review of the Pedestrians Preference Surveys; Walkability, Accessibility Audits and assessment from various cities of India have been used as indicators. Users (children, senior citizens, women groups, persons with disabilities and hawkers), NGOs, CSOs, INGOs, professionals and government personnel perspective was also taken through intensive focus group discussions. Additionally, the guidelines provide room for further refinement in the light of experience gained in its implementation.

Who are the intended users of these guidelines?

- Transport and urban planners, professionals (architects, road and transport engineers), practitioners, Road Safety & Accessibility Auditors, researchers and implementing agencies, etc.;
- Municipal corporations, urban development authorities and urban local bodies;
- Academic institutions and schools of engineering, architecture, planning and design.

Who benefits: Everyone, including:

- Persons with reduced mobility such as senior citizens; families with young children; unescorted children; persons with temporary ailments, medical conditions and hidden diseases; pregnant women; persons carrying heavy luggage and people with communication problems (including different linguistic and ethnic groups like migrants, tourists etc.). They are commonly referred to as transport disadvantage group.
- Persons with diverse disabilities

Other benefits:

Enhanced opportunities to access health, education, employment and socialization for all, including the transport disadvantage group and persons with disabilities:

- Reference guide based on Indian conditions, terrain, environment, culture and indigenous material for use by professionals, practitioners, academic usage, etc;
- Reduce dependence on depleting fossil fuels; and
- A segment of population using personal vehicles will be encouraged to walk, use NMVs and shift to public transport, which will help to reduce alarming levels of pollution in Indian cities. Hence, add to environment and economic benefits. Public transport usage will lead to decongestion and reduce carbon emissions.

Embracing these guidelines may have direct influence on the carbon agenda as this will help adopt high quality walkability, enhanced public transport usage and provide for a better interface between the buildings and streets.

Chapter- 1
Introduction

1. Introduction

Every day a vast majority of the population encounters barriers in public spaces and in public transport. Many travelers, particularly persons with reduced mobility and persons with disabilities often depend on a car for all their daily trips, due to the barriers they encounter in public spaces and public transport. Persons with reduced mobility include senior citizens; families with young children; unescorted children; persons with temporary ailments, medical conditions and hidden diseases; pregnant women; persons carrying heavy luggage; those with communication problems, etc.

Universally accessible design will help increase the number of people walking and the number of people using public transportation. To ensure this, pedestrian environment and all transit systems – buses, bus shelters, bus rapid transit (BRT), metro, rail terminuses and stations, etc. should be accessible.

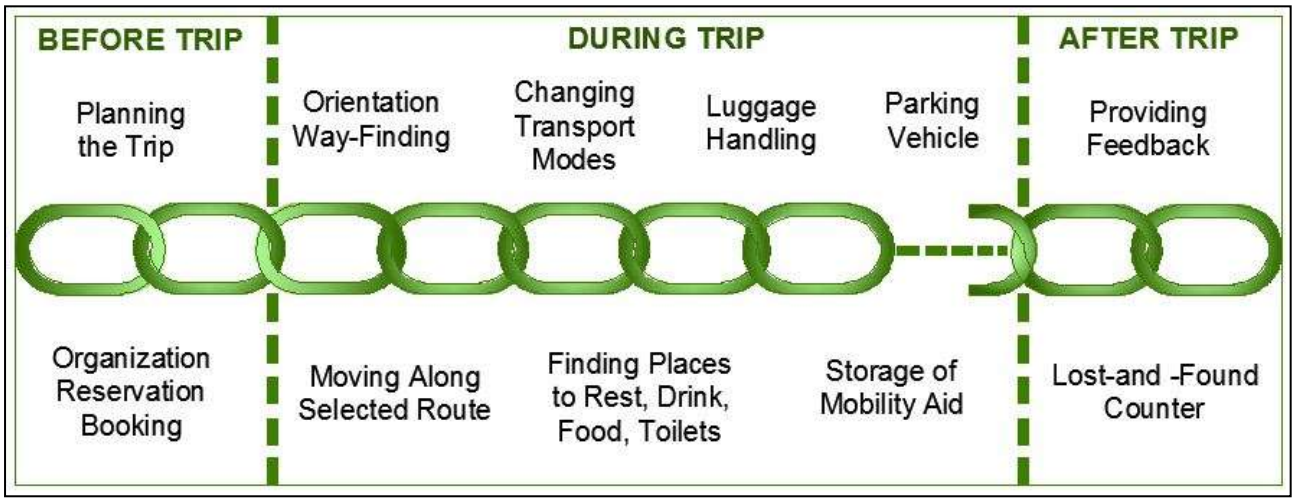
By improving the accessibility of the entire travel journey, local and regional authorities can enable persons with reduced mobility to adopt a less car-dependent lifestyle and use sustainable modes (walking, cycling, and public transport) instead. Furthermore, local and regional authorities can also achieve fuel and energy savings and promote independent mobility, which will increase the quality of life and the attractiveness of the city or region for inhabitants and visitors.

1.1 Universal Accessibility Guidelines for Pedestrian, Non-motorized Vehicle and Public Transport Infrastructure

Universally accessible infrastructure benefits everyone irrespective of age, gender and disability. Thus, improving the accessibility of door-to-door mobility-chains.

A complete trip chain (connectivity and seamless journey) starts from the point of origin to the walk/ commute, cycle and/or wait for transport, boarding, travel and alighting followed by the walk/ commute to the final destination (Figure 1-1). Each trip chain must ensure pedestrian safety for all including persons with and without disabilities.

In India, there is no document or code that requires that all elements of the trip chain be universally accessible nor any that mandate training, implementation, maintenance and monitoring. Any break in the trip chain results in lack of access and independent mobility. Inaccessible links require taking an indirect route, increasing travel times, fatigue, uncertainty and potential modal conflicts. The goal must be for people to have access to all vehicles and the full service area, as well as the pedestrian environment (WHO, 2011).



Source: (www.isemoa.eu, 2010)

Figure 1-1: Trip chain

1.1.1 Aim

These guidelines aim to fill the knowledge gap about universal access and act as a guide for practitioners and authorities to plan, design pedestrian environment and sustainable transportation.

1.1.2 Objectives

The objectives of these guidelines are:

i. To understand universal access and suggest application of its principles and standards to promote walkability, non-motorized vehicles and public transport usage;
ii. To highlight physical and environmental barriers in the public realm and recommend universal accessibility standards; and
iii. To highlight benefits of universal accessibility and sustainable transportation, and to promote a greater sensitivity and innovation in universal design beyond minimum requirements.

By doing so we:

- Ensure safe and independent commute between place of origin and destination, including first and last mile connectivity;
- Provide convenient, quick access & exit and usage of all areas;
- Implement inclusive design and achieve social inclusion; and
- Increase energy-efficiency in transport by improving the trip chain of all citizens (including persons with reduced mobility and persons with disabilities).

1.1.3 Scope

The focus of the guidelines is mobility and access in urban and semi-urban areas. For rural areas these can be implemented in principle based on regional site specific and local conditions. These guidelines assume that many useful lessons can be exchanged between different cities/countries. Local, cultural and physical factors will certainly shape the form and the detail of mobility solutions in each locale, but the basic needs of people who walk/ use assistive devices/ mobility aids, children and women are similar. Hence, what is considered good practice in one part of the world can be relevant to another.

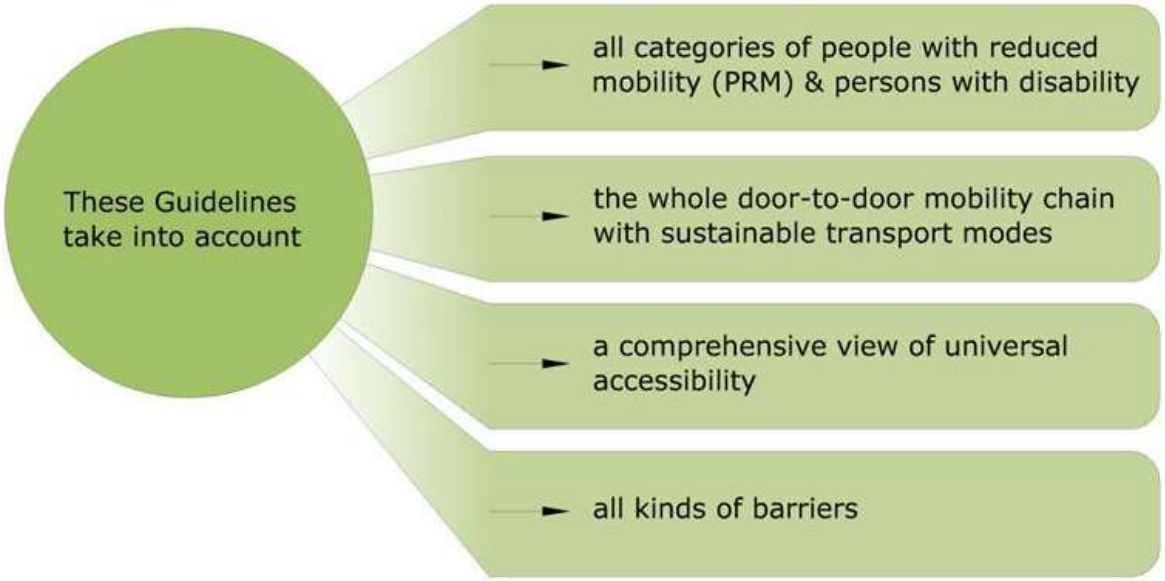


Figure 1-2 Scope of the guidelines

Figure 1-2 highlights the following:

- Categories of persons with reduced mobility and persons with disabilities;
- Sustainable transport modes include: walking, cycling, public transport (which carry more commuters and occupy less road space), multi-modal mobility and non-motorized vehicles;
- Comprehensive view of accessibility include: geographical perspective (distances, location and weather conditions), and service and network issues, as well as barrier-free design and construction of facilities, services and information; and
- Barriers include: physical conditions, organizational aspects, attitudes of people, etc.

1.1.4 Structure/ Methodology

These guidelines introduces the concept of public transport accessibility and its importance in the Indian context. It focuses on the evaluation of accessibility in existing public transport facilities and the relevant planning and designing principles to improve the same. It introduce concepts of walkability, non-motorized vehicles and public transport; the existing transport infrastructure available; and, the requirements of a diverse demographic that includes persons with reduced mobility, persons with disabilities, children, the elderly and other marginalized groups.

Using data from an extensive literature survey, existing legislation, a study of best practices across the world, focus group discussions with diverse users, advocacy groups, architect, planners and civic agencies, recommendations have been made. Prerequisites have been listed to guide practitioners, policy makers and implementing agencies and stress has been laid on the collaborative approach required to achieve the recommended level of access and each step in this direction.

Subsequent chapters provide practical guidance towards evaluating and improving accessibility through a comprehensive approach. Each of these chapters highlights barriers and other prohibitive elements, raise pertinent issues and illustrate remedial strategies for universal access.

Unless otherwise specified, all dimensions shown in the figures in these guidelines are in millimeters (mm). Where "shall" is used, it refers to mandatory design requirements.

Unless the context otherwise requires --
(a) Words importing the singular shall include the plural and vice versa; and
(b) Words importing the masculine gender shall include the feminine gender and vice versa.

1.2 Impetus for the Guidelines

As mandated by the law of India, Ministry of Urban Development has taken up the agenda of incorporating recommendations on universal accessibility in the revised National Urban Transport Policy (NUTP), 2006. The NUTP intends "to recognize that people occupy center-stage in our cities and all plans would be for their common benefit and well-being."

NUTP has emphasized that "the approach of universal accessibility should be adopted in all the plans and projects related to urban transport being implemented in the city. This can be done by integrating certain elements with the existing urban transport infrastructure elements". The review process of NUTP held by the Institute of Urban Transport (IUT), Ministry of Urban Development listed universal accessibility as the priority element in the list (Institute of Urban Transport, 2013). These guidelines must be referred to in conjunction with the revised NUTP and shall be disseminated for use by city authorities and planners.

Projected Benefits

1: Physical Connectivity

Visual and physical continuity of footpaths makes navigation and orientation easier and saves time and energy. Choices in the accessible environment with coherent, direct, safe, and comfortable features attract pedestrians, cyclists and tri-cycle users. By providing a safe walking environment, the footpath will also provide opportunities for a healthy environment. Public transport within reach, integration with other modes and availability of accessible feeder modes too, is an important link in the travel journey/trip chain.

2: Social Inclusion

A safe walking environment particularly for women, children and persons with disabilities promotes social interaction in different public spaces that the walkways connect. Well designed and maintained pedestrian infrastructure benefit persons with diverse disabilities, including users of wheelchairs and tricycles, elderly, temporary ailments, carrying packages/luggage, hawkers etc. by providing a safe alternative to sharing the roadway with fast-moving traffic. Public transport allows all commuters the opportunity to explore more and experience better, the environment that surrounds them. It promotes enhanced opportunities to livelihood & employment, access to health, education and leisure for all.

3: Ecological

Pedestrianisation and increased use of public transportation encourages walking and require less road allocation for personalized vehicle traffic or parking spaces. Fewer vehicular use results in reduction of carbon emissions. Also, the continuity of footpath promotes the continuity of the other elements along the footpath such as planting strips, which can be used to link green spaces and plant street trees. Below is the list of added benefits with green spaces:

1. Tree planting zones with native street trees are essential for shade, lowering Heat Island Effect and giving comfort to pedestrians and vehicles on the road;
2. Street trees dampen noise, providing health and psychological benefits;
3. Act as Integrated Natural Drainage Systems;
4. Native plantation helps water conservation and soil resilience; and
5. Vegetation also helps to mitigate air pollution and improve environmental health.

Chapter- 2

Walkability & Pedestrian Infrastructure

2. Walkability and Pedestrian Infrastructure

"Walkability is the phenomena related to walking in the spaces around origin-transit-destination linked with the pedestrians" (CAI Asia, 2011). Walkability is the measure of connectivity for pedestrians including quality of walkways and footpaths in cities. Walkability is linked to the availability and perception of safety elements; accessibility of infrastructure; quality of built environment; connectivity and reliability. Health benefits of walking are extensive and should not be neglected. In a recent Lancet Article (James Woodcock, 2009) health effects on alternate transport scenarios were evaluated in London and Delhi. It was found that for Delhi, the lower-carbon-emission motor vehicles and increased active travel scenarios (walking and cycling) resulted in a greater health gain from reduced air pollution, than for London (a city with extensive & well connected network of public transportation).

Figure 2-1 illustrates the importance of "complementary benefits." "People from different sectors (elected officials, business leaders, developers, funders and social equity advocates) with different missions must embrace walking as a solution. When you resolve for walking and walkability, you solve many problems because walking to a destination instead of driving reduces carbon emissions" (Walljasper, 2013).

Source: (Walljasper, 2013)

Figure 2-1: Benefits of walking/walkability

Walking provides mobility to a large segment of society including those without access to private vehicles, persons with reduced mobility and those with disabilities; yet pedestrian infrastructure remains poor. Reports suggest that roads with pedestrian footpaths are barely 30% of all roads in most cities (Ministry of Urban Development, 2008). Therefore, there is an urgent need for a paradigm shift in planning and development of public transportation infrastructure with emphasis on pedestrians and walkability.

National Urban Transport Policy (NUTP) promotes the need to "move people and not vehicles". Universal accessibility in the pedestrian environment is a necessary step in an enlightened urban transport policy, which was missing in the 2006 version of the NUTP**.**

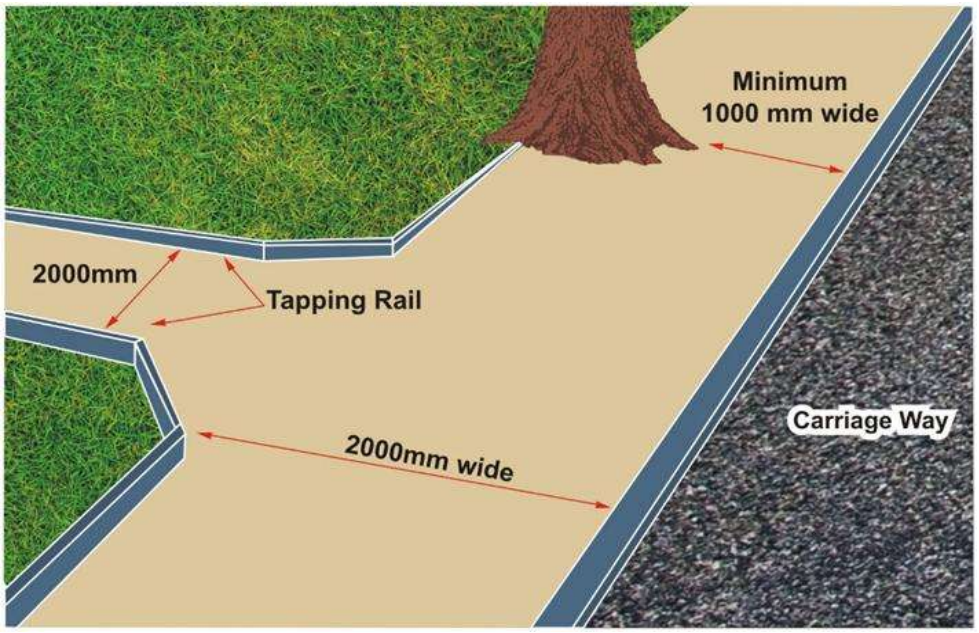
2.1 Design Standards

2.1.1 Footpath

Footpath should be regarded as a transportation system, which is connected and continuous, just like roadways and railways. They should be provided consistently between all major origin/destinations, trip generator activities, and other locations where people walk.

A footpath should:

- Be along the entire length of the road;
- Have height of a standard public step riser i.e. 150 mm maximum;
- Be at least 2 m wide, where there are trees on the footpath spacing of 1 m should be maintained (Figure 2-2);
- Have non-slip surface;
- Have tactile paver for persons with visual impairments;
- Preferably have well defined edges of paths and routes by use of different colors and textures;
- Gratings gaps should be less than 10 mm wide, oriented at right angles to the path centreline;
- Have no obstacles or projections along the pathway. If this is unavoidable, there should be clear headroom of at least 2200 mm from the floor level;
- Have kerb ramps complying with Section 2.1.2, where ever a person is expected to walk into or off the pathway; and
- Have tactile warning paver installed next to all entry and exit points from the footpath.



Modified: (Mitchell, 2006)

Figure 2-2: Tactile warning paver installed in footpath

Design standards for footpath are given in Table 2-1 (UTTIPEC, DDA, 2009), (Indian Road Congress, 2012) with footpath widths along different land-use areas and hierarchy of roads. Footpath width along residential areas and arterial roads should be of minimum 1.8 m, whereas for commercial areas along arterial roads it should be of minimum 2.5 m. It also highlights the surfaces and lighting levels required.

Table 2-1 Footpath features

Required footpath height	**Arterial**	**Collector**	**Local**
	100 mm (150mm max.)	150 mm	150 mm
Required footpath width (as per adjacent land-use)			
Residential Areas	1.8 m (min.)	1.8 m (min.)	1.8 m (min.)
Commercial/ Mixed Use Areas	2.5 m	2.5 m	2.5 m
Shopping frontages	3.5 m to 4.5 m	3.5 m to 4.5 M	3.5 m to 4.5 m
Bus Stops	3.0 m	3.0 m	3.0 m
High intensity Commercial Areas (Commercial Nodes)	4.0 m	4.0 m	4.0 m
Surface			
	Anti-skid surface with proper draining. Cobble stone and interlocking pavers should NOT be provided		

Lighting	Arterial	Collector	Local
Light source-height			
Lux level	35-40	35-40	35-40

Table 2-2 shows footpath widths required for people to cross comfortably and/or using mobility devices.

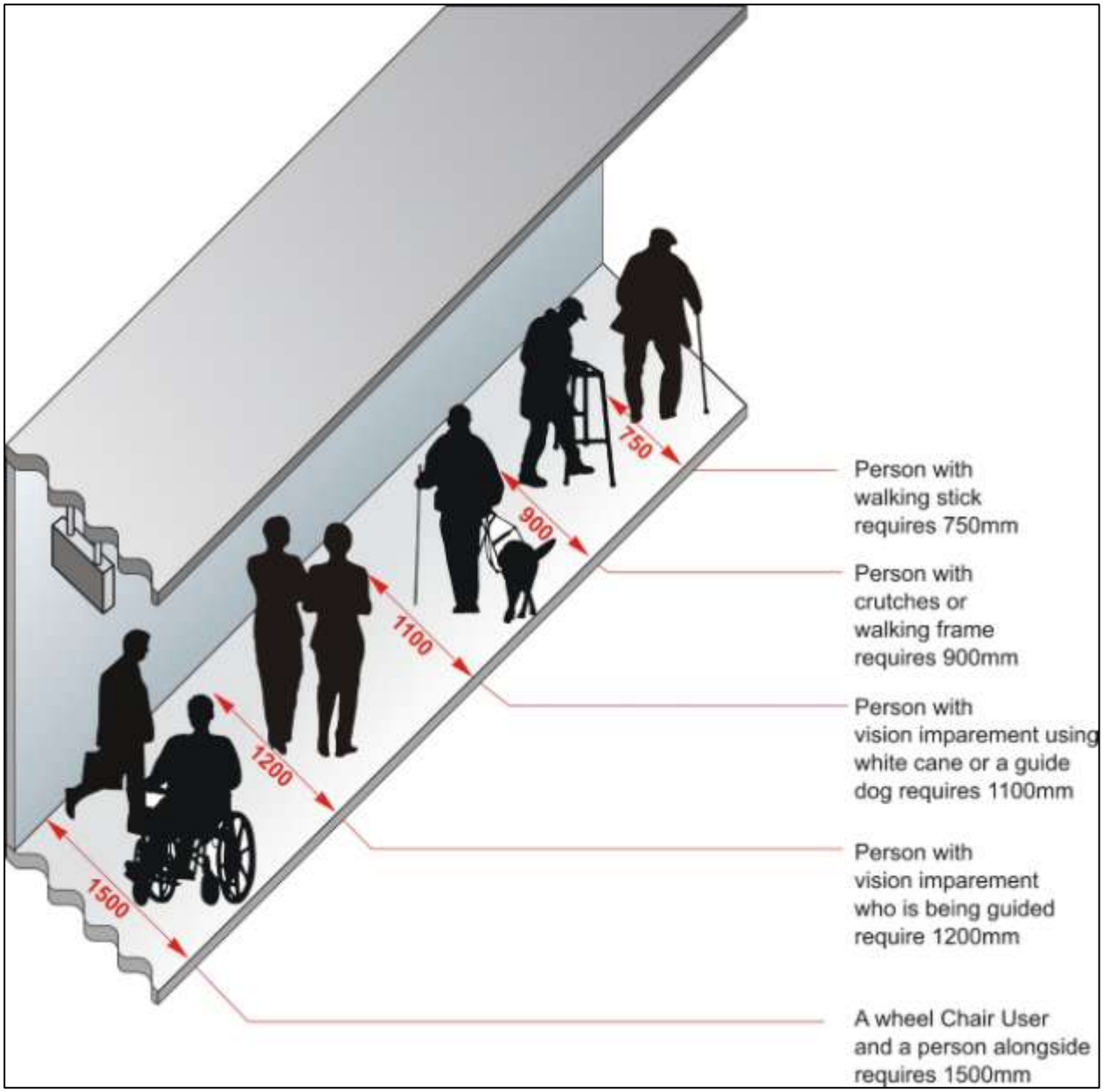
Table 2-2 Walking conditions

Walking Conditions	Footpath width
Minimum width for two people to cross each other comfortably	1.8 m (min.)
Minimum width for maneuvering wheelchair	900 mm
Minimum width required for a wheelchair and a person to cross each other comfortably	1200 mm
Minimum width required for two wheelchairs to cross each other comfortably	1800 mm

The lengths, widths and visual height of people using assistive devices/equipment are given in Table 2-3 and Figure 2-3.

Table 2-3: Clear passage widths needed by people with/without equipment

Minimum passage width – stick/walker user	750 mm
Minimum passage width - double crutch user	920 mm
Minimum passage width - adult and child	1100 mm
Minimum passage width - adult plus helper	1200 mm
Minimum passage width - adult plus guide dog	1100 mm
Minimum passage width – wheelchair user plus ambulant person	1500 mm
Minimum passage width – single stroller	610 mm
Minimum passage width – person using white cane (visual impairment)	1500 mm
Length of pram plus pusher	900 mm
Length of 95th percentile wheelchair	1250 mm
Length of wheelchair plus pusher	1750 mm
Length of adult plus guide dog	1500 mm
Length of powered scooter	1270 mm
Length of electric footpath vehicle (average)	1400 mm
Eye level of wheelchair user	1265 mm
Seated height of wheelchair user	1300-1400 mm
Turning circle - manual wheelchair (also small electric)	1575 mm
Turning circle - outdoor electric wheelchair	2420 mm
Turning circle - electric footpath vehicle	4350 mm

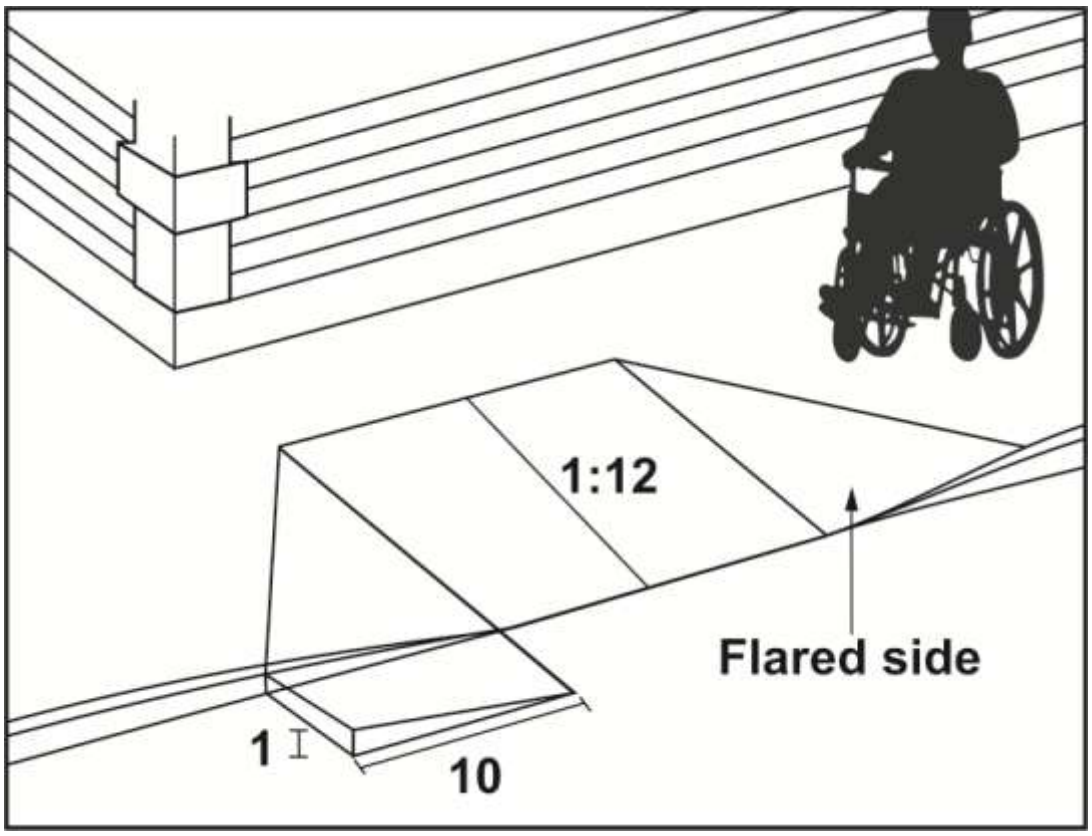


Modified: (Department for Transport, 2002)

Figure 2-3: Clear passage widths needed by people and equipment

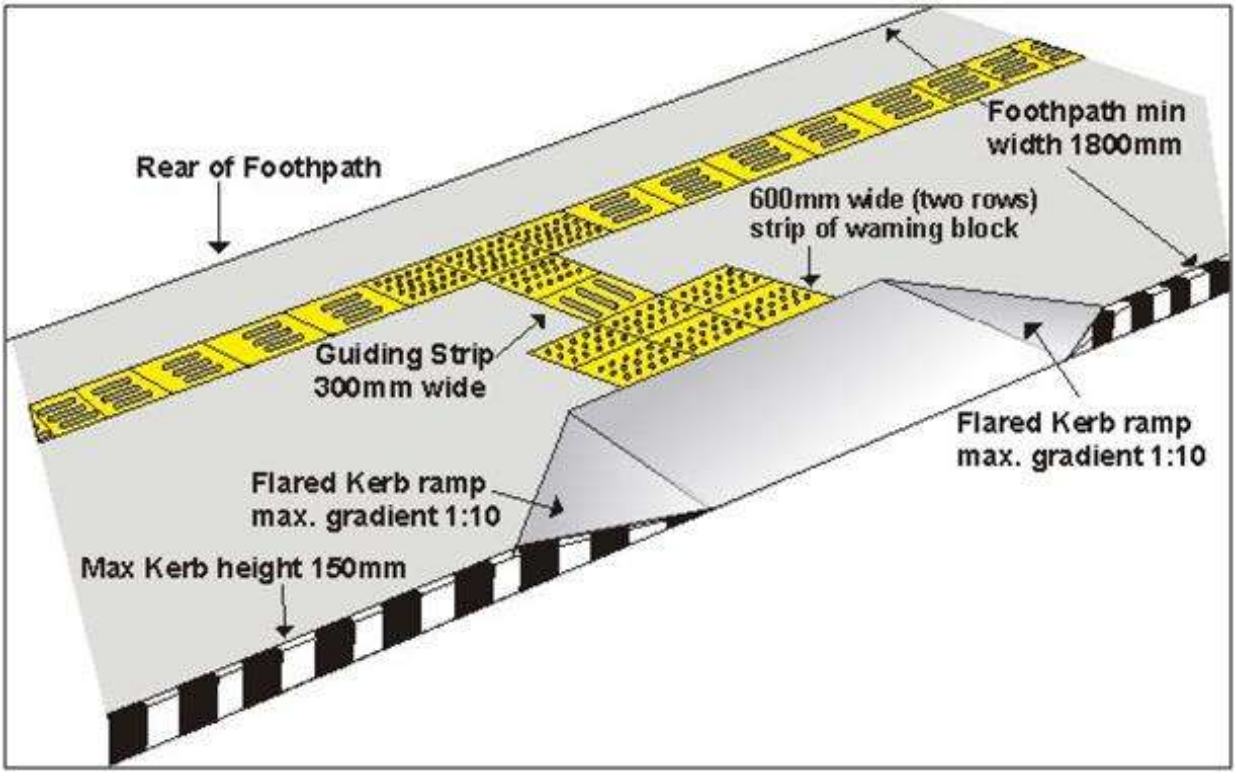
2.1.2 Kerb Ramp

- Kerb should be dropped, to be flush with walkway, at a gradient no greater than 1:10 on both sides of necessary and convenient crossing points (Figure 2-4). Width should not be less than 1200 mm. If width (X) is less than 1200 mm, then slope of the flared side shall not exceed 1:12;
- Floor tactile paving- Guiding & Warning paver shall be provided to guide persons with visual impairment so that a person with visual impairment does not accidentally walk onto the road (Figure 2-5); and
- Finishes shall have non-slip surface with a texture traversable by a wheel chair.



Source: (Samarthyam, 2010)

Figure 2-4: Kerb ramp location



Source: (Samarthyam, 2012)

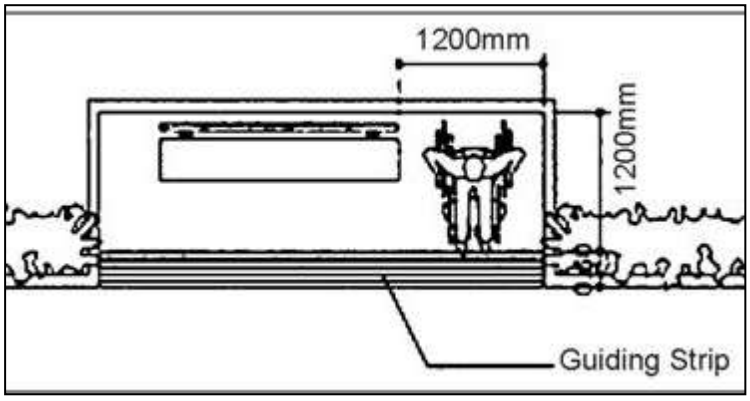
Figure 2-5: Kerb ramp with tactile pavers

2.1.3 Wayfinding and Signage

To be provided as per the detailed design standards given in Chapter 6.

2.1.4 Resting Areas and Hawker Spaces

- Seating area / benches under sheds/shady trees should be provided along the circulation path at regular intervals so that passengers do not need to walk more than 50 to 60 meters before being able to sit and rest;
- Public transit operators should provide seating in passenger service areas where there may be long waiting lines or times, including at ticket sales counters, check-in counters, secured screening and during inter-country travel in customs areas and baggage retrieval areas;
- In outdoor settings, seating should be provided along with the planned hawker spaces (Figure 2-6, 2-7 and Photo 2-1);
- The spaces for hawkers should have provisions for their seating, loading and unloading of goods and nearby parking spaces for their assistive devices such as wheelchair, tri-cycles, etc; and
- General and accessible toilet facilities should be provided near resting areas and hawker spaces, especially near the markets, bus stops and terminals.



Source: (Indian Roads Congress, 2012)

Figure 2-6: Resting areas for wheelchairs users

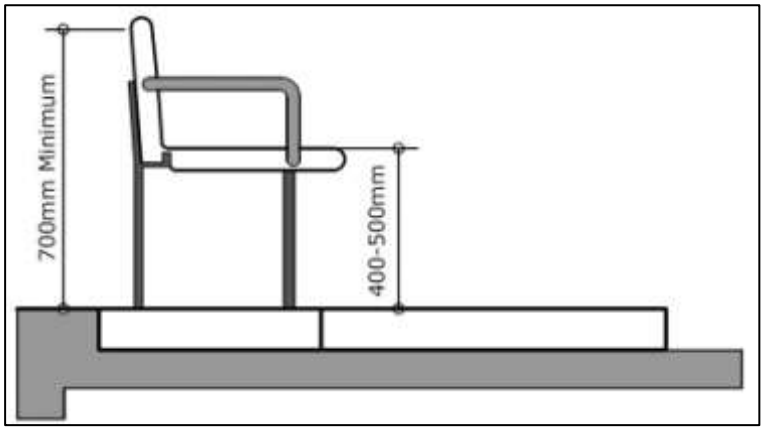


Figure 2-7: Recommended dimensions for seat

Photo 2-1: Resting areas near hawker spaces, Bus Rapid Transit, Delhi (Left) and resting benches with backrest, IP Marg, Delhi. (Right)

2.1.5 Road Intersections

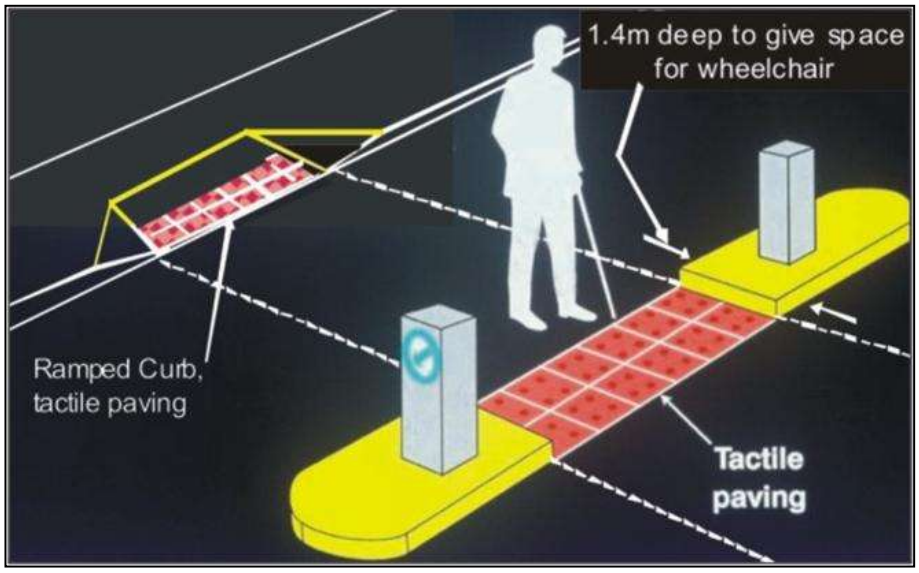
Clear markings, signage and/or traffic calming measures to warn motorists of the crossing and to slow down vehicles; in other cases high pedestrian volumes and high vehicle speeds may require traffic signals to be installed if affordable. Without signal control, many persons with visual impairment will be unable to use crossings on busy roads without help.

- Pedestrian crossings should be equipped with traffic control signal;
- Traffic islands to reduce the length of the crossing are recommended for the safety of all road users;
- Warning pavers should be provided to indicate the position of pedestrian crossings for the benefit of persons with visual impairments; and
- Tabletops (raised road level to the footpath height) are helpful in reducing the speed of traffic approaching the intersection (Photo 2-2).

Photo 2-2: Table top, Connaught place, New Delhi

2.1.6 Median/ Pedestrian Refuge

- Pedestrian refuge is required for safe and barrier free road crossing, as many persons with reduced mobility cannot cross the road in one stretch as they feel exhausted;
- Uniformity in crossing distance should be maintained;
- It is essential to have pedestrian refuge (islands) in crossings with following standards:
  - Cut through and level with the street (Figure 2-8 and Figure 2-9); or
  - Have kerb ramps on both the sides and have a level area of not less than 1500 mm long in the middle; and
  - A coloured tactile marking strip of warning pavers at least 600 mm wide should mark the beginning and end of a median/ pedestrian refuge to guide pedestrian with visual impairments to its location.



Source: (Indian Roads Congress, 2012)

Figure 2-8: Median refuge

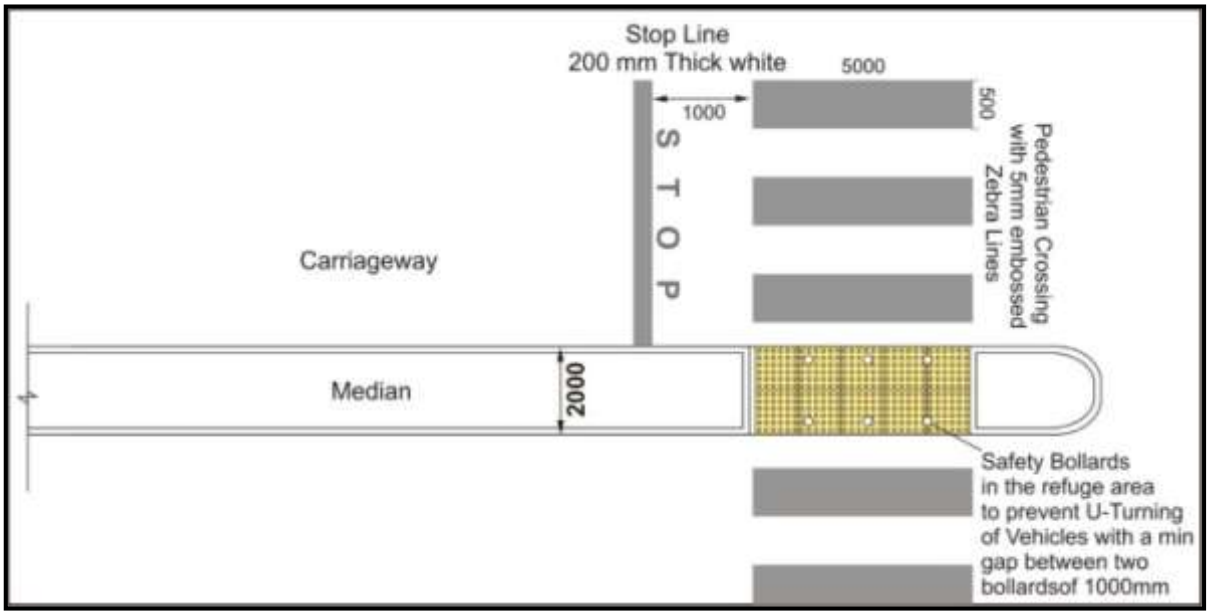


Figure 2-9: Pedestrian refuge on two-way road

2.1.7 Traffic Signals

- Signal timings should be controlled as per the pedestrian volume and time interval allowed for crossing should be programmed according to the slowest crossing persons;
- Pedestrian traffic lights should be provided with clearly audible signals for the benefit of pedestrians with visual impairments (Photo 2-3);
- Acoustic devices should be installed on a pole at the point of origin of crossing and not at the point of destination. In noisy areas, any spoken information should be repeated at least once. Audible traffic signals should operate at least 15dB over the prevailing sound level, with a maximum of 140dB;
- The installation of two adjacent acoustic devices such as beepers is not recommended in order to avoid disorientation; and
- Acoustical signals encourage safer crossing behavior among children as well.

Audible signals which beep when light is green

Source: Aqueel Kureshi, GAATES, USA

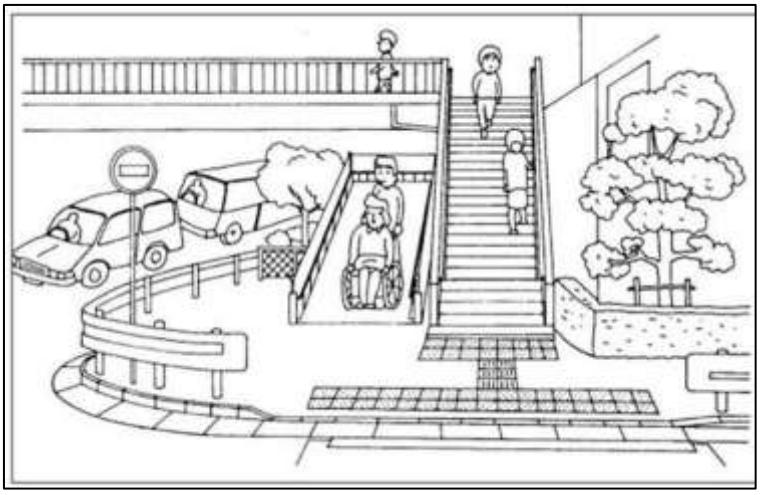
Photo 2-3: Traffic signal, bus rapid transit, Delhi (left) and audio signal*(right)

**Note:* Minimum dB human ear can hear is 0db and from 85dB the damage begins to start, whereas sound traffic noise can go from 100db up to 130db and for that auditory signals require 15db above the background noise. (McCartey, 2009), (Moore, 2012), (Franks, 1998), (Dangerous Decibels, 2014)

2.1.8 Subway and Foot Over Bridge

Subways and foot over bridges should be provided alongside at-grade crossings (Figure 2-10) and should have following accessibility features:

- signage at strategic location;
- ramps or lifts at both the ends to enable wheelchair accessibility;
- connecting footpaths should be as per Section 2.1.1; and
- tactile paver for steps, ramp and lifts should be as per Chapter 5 and 6.



Source: (Central Public Works Department, 1998)

Figure 2-10: Foot over bridge with ramp and steps

2.1.9 Other Public Amenities

Public toilets

All toilet blocks should have general and unisex accessible toilets with directional signage guiding towards its location. Refer Section 5.1.16 and 5.1.17.

2.2 Implementation

Communication: Inform and educate stakeholders in the implementation process (planners, architects, engineers, contractors, civic agencies, and Government departments that construct and maintain public facilities and outdoor environment).

Integrated multimodal agency collaboration: Inter-departmental convergence and collaboration is required to avoid piecemeal implementation of accessibility features. For example, tactile pavers laid on the footpaths are dug for maintenance and repairs by electricity department. However, these are usually not replaced by them after repairing the cables.

Capacity building: Training of professionals and practitioners are a pre-requisite to ensure implementation of universal accessibility standards. Contract documents must include specific instructions and training modules to ensure that universal accessibility is executed as per design.

Implementation of designs and services: must be done as intended. Any change based on real-time conditions needs to be addressed as they come up in consultation with the planning and design agencies for the best possible solution.

Constant monitoring and sensitized planning: Temporary information desks, permanent accessible features and signage must be located within easy reach. For e.g., an accessible ramp at the rear of a building will be hard to find, considered unsafe and require a great deal of effort resulting in fatigue. Such a feature needs to be close to the main entrance of a building and easily located.

Accessibility audits: Audits identify deficiencies in road/street infrastructure and developing strategies to overcome them in the most effective, practical and aesthetic way at an early stage.

2.3 Maintenance and Monitoring (Operations)

Integrated management: Synchronized coordination of services and facilities is critical for the complete trip chain to function well. Critical coordination between agencies needs to be done, often quickly. As in the case of traffic management and traffic signals, coordination of services during breakdowns, construction, road closure etc. needs to be clarified and alternate accessible routes and services provided.

Continued access: Ensure that access to accessible facilities is available for all to use at all times. For e.g., consistency in street furniture should be maintained so that pedestrians can access footpaths, which are not obstructed by trees, poles, manholes, kiosks, etc.

Flexibility: Every service/ space needs to have flexibility inherent in it such that it can be revised/ changed or replicated at a future time to reflect changes required at the time. Permanence and longevity must be balanced with flexibility and adaptability to change. For e.g., signal timings should be controlled as per the pedestrian volume and time interval allowed for crossing should be programmed according to the slowest crossing persons.

Maintenance: Regular maintenance of the infrastructure is essential for safety, accessibility and reliability. Poor and degraded infrastructure is a hazard and can lead to accidents, high financial considerations and poor connectivity. Funding for maintenance should be available and timeline for refurbishment clearly defined.

Safety management: Some critical issues that need to be addressed are included here but the list is exhaustive but only illustrative. Streetlights must be operational during the night with good illumination and no dark spots. Low hanging branches of trees often create a safety hazard. Similarly, in waterlogged conditions no pavements are accessible. Lack of women staff at women's toilets (often manned by male cleaners).

User outreach and sensitization: People's unwillingness or inability to give help in appropriate ways, whether because of attitude or of ignorance of the needs of persons with reduced mobility and persons with disabilities, is often felt to be a social barrier to mobility. An awareness campaign for the general public needs to be conducted to raise awareness about access and barriers inadvertently caused due to insensitivity. This may be done through a media campaign, social media, radio advertisements and also through schools and colleges.

Funding: The cost issues of improved accessibility should be resolved by legislation and the progressive application of universal design. Achieving sustainability will depend on developing the right mix of services and creating innovative funding schemes.

Walkability audits: Is a strategic planning effort that involves all relevant stakeholders (persons with reduced mobility, persons with disabilities, government agencies, consultants including planners, architects, engineers, implementing and maintaining agencies including contractors and vendors). It provides local stakeholders with the understanding of the attitudinal, social and physical challenges that confront persons with disabilities of different ages and gender, and, need for creating seamless travel chains. Conducted by a team of qualified access auditors, design professionals (architect, transport planner and urban planner), persons with diverse disabilities and senior citizens, it provides information for effective implementation of the audit recommendations.

Audits are important means of ensuring accessibility and must cover all stage of the process- planning, design, construction, maintenance, monitoring and evaluation.

Audit implies measures that "enable everybody to live comfortably, regardless of age, sex, disability, perception and ability to move".

2.4 Enforcement

Disallow temporary barriers and encroachments: Overflowing garbage dumps, open urination along pavements, construction debris, open manholes and parking often create barriers for walkability. These need to be penalized and enforced. Accessibility should not be compromised even during public gatherings, social events, festivals and emergencies.

Security from harassment: is essential for hawkers and young visitors. Space allocation is an urgent requirement for them, which must be provided by local agencies.

Penalties: Penalties for non-conformance must be enforced for efficacy of the guidelines. Similarly, a strategy for lauding good practice should be emphasized, such as awards and incentives. Penalties should be in place for shoddy service, rash driving, pavement encroachment and other such grievances.

Central complaint and grievance mechanism: Each civic agency and service provider must have one point of contact for complaints/ concerns and information that is functioning at all times. These persons must be sensitized to the needs of diverse user groups and must have the resources to address their requirements. In addition, a required response time must be enforced to address each issue raised.

Staff allocation: To enforce any service/ plan it is imperative that adequate staff is allotted to the task with capacity and mandated to enforce the guidelines.

Chapter- 3

Non- Motorized Vehicles

3. Non-Motorized Vehicles

Non-motorized Vehicles (NMV) includes cycles, tri-cycles, cycle rickshaws, pushcarts, and any other forms of mobility that is powered by humans. These users are also called 'captive cyclists' (Non Motorised Transport Planning and Design Guideline, 2014). NMV plays an important and unique role in efficient transport systems. They provide basic mobility, affordable transport, access to public transport (providing first mile and last mile connectivity), as well as significant benefits for public health, recreation and delivery of freight. Improving conditions for NMVs reduces the demand for travel by motorized vehicles, and addresses the multitude of problems that are a result of rapid motorization.

In the context of environmental conservation, economic development and social justice, walking and cycling have many advantages. They do not emit pollutants. They are safe modes when properly separated from fast moving motor vehicles. They are low cost and they increase physical fitness. Indian cities traditionally have large number of people walking and cycling, yet the majority of destinations are not easily accessible by non-motorized modes. High density development and mixed land use provide many advantages to NMVs and public transport.

Modal share in medium and large cities show that 13-21% of people cycle. It is the most affordable mode of transport for groups of all ages and income groups covering diverse accessibility needs.

In India, usually persons with disabilities from low economic groups use tri-cycle for employment/ livelihood and/or essential activities such as education, health and socialization purposes.

Tricycles are a neglected, invisible mode of transportation. There are no guidelines that specify the standards of non-motorized lanes that include tri-cycles. As a result, persons with disabilities using tricycles (individually or with families) are excluded due to their unique mobility and accessibility needs. Tri-cycle users at times commute long distances ranging from 10-20 kms (Samarthyam, 2012). This mode provides access to opportunities and is the most affordable means of transport for the disabled.

As per the data from Artificial Limbs Manufacturing Corporation of India (ALIMCO) Annual Report 2011-12, 58,543 tri-cycles were distributed to persons with loco-motor disabilities in India in 2011. In addition, as per Census 2011 report on Madhya Pradesh Mode of Transportation, tricycles used by persons with disabilities were also considered as bicycle. Improved facilities for this mode will benefit other user groups as well.

3.1 Design Standards

3.1.1 Infrastructure for NMV Users

- Provide adequate space—such as slow-speed shared spaces, footpaths, cycle tracks, and greenways—for NMV users;
- Accommodating NMV involves two simple techniques:

  - Systematic traffic calming to ensure that smaller streets are safe places for the mixing of pedestrians and other modes "shared lanes".
  - Pedestrian and cycle infrastructure be physically separated from motor vehicle traffic (by raised kerbs, vehicle parking lanes, bollards, landscaping, etc.) on larger streets.
- Non-motorized transport infrastructure must be unobstructed, continuous, shaded, be well drained and well lit;
- Dedicated non-motorized transport infrastructure also includes walkways and cycle paths that utilize an independent right-of-way (ROW), such as in a park or along a transport corridor;
- Avoid the construction of foot over bridges or subways since they are inconvenient and potentially unsafe for women with regard to sexual assault and eve teasing, and general crimes;
- Cycle stations (parking, sharing and hiring) should be arranged in a closed space network so that a station is always within walking distance from any point in the coverage area;
- Adopt building control regulations that encourage street frontage with many shop fronts, doors, windows and patios that open directly to pedestrian environments create a feeling of safety (eyes-on-street), while producing a more active and vibrant atmosphere. Discourage the construction of compound walls at the edge of public rights-of-way;
- Provide adequate street furniture for people to sit, rest, and interact with each other. Street furniture also includes services-related infrastructure, such as dustbins, street vending, toilets, and signage. Street furniture can help make a street an attractive place to spend time. When positioned on narrow shared streets, benches, tables, street vending spaces, and other furniture can also function as traffic calming elements. Vending stands, tables, roofs, and water taps can support the formalization of street vending and promote better sanitary conditions;
- Employ traffic calming elements (including speed humps, raised speed tables, bollards, roundabouts, and textured pavements) to ensure pedestrian and vehicle safety by reducing the top speed of motor vehicles. Traffic calming elements are particularly important in places where large numbers of children are present, such as schools, parks, and residential areas;
- Provide street lighting of 35-40 lux level to ensure visibility by persons with low vision and safety on NMV facilities (CPWD & MoUD, 1998); and
- Avoid high, uneven and unmarked speed breakers, as these are hazardous.

Comprehensive standards for infrastructure for NMV are given in Table 3-1 (IUT Code Part I- Cross Section and International Guidelines) adapted for use by persons with reduced mobility and persons with disabilities, particularly tri-cycle users (tri-cycle width range from 800 mm-1000 mm as per ALIMCO).

Table 3-1: Infrastructure for NMV

Elements	Arterial roads	Sub-arterial roads	Distributor/ collector roads	Access/l ocal roads
Non-motorized vehicle	Segregated cycle track	Segregated cycle track	Cycle lane	Mixed traffic
Location	Between carriage way or street parking and footpath on either edge of the carriageway	Between carriage way or street parking and footpath on either edge of the carriageway	On edge of the carriageway, adjacent to the footpath or parking	
Gradient	1:12- 1:20	1:12	1:20	1:12
Height	Should be 50 mm lower than footpath height	Should be 50 mm lower than footpath height		
Lane width (TRIPP, IIT, 2014)	2.2-5 m	2.2-5 m	1.5-2.5 m	Mixed with motorized vehicular traffic
Minimum width	2.5 m for a two lane cycle track and 2 m (1.9 m as per IUT code) for a common cycle track and footpath	2 m for a two lane cycle track and 1.7 m for a common cycle track and footpath	1.5 m (painted)	1 m (painted)
Surface	Smooth surface-concrete (broom finish)	Smooth surface-concrete (broom finish)	Concrete (broom finish).	Concrete (broom finish)
Lighting	20 lux at 20 m spacing of light pole 6m	20 lux at 20 m spacing of light pole 6m	20 lux at 20 m spacing of light pole 6 m	20 lux at 20 m spacing of light pole 6 m
Marking	Cycle symbol on surface	Cycle symbol on surface	Should be painted in contrast color to surface	
Signage	Cycle symbol Size- 600 mm diameter Background color: blue symbol/ text: white for easy identification by persons with low vision	Cycle symbol Size- 600 mm diameter Background color: blue symbol/ text: white for easy identification by persons with low vision	Should be painted in contrast color to surface	

Source: (IUT, 2012)

The following table gives the capacity of cycle by width of cycle tracks, which is required standard.

Table 3-2 Capacity of cycles by width of cycle tracks

Capacity		**Capacity in no. of cycles per hour**	
Width of cycle tracks in meters		**One way traffic**	**Two way traffic**
Two lanes	3 m	250-600	50-250
Three lanes	4 m	Over 600	250-600
Four lanes	5 m	-	Over 600

Source: (IUT, 2012)

3.2 Implementation

Communication: Inform and educate stakeholders about the critical constituency of NMVs the diverse users, vehicles, specific requirements, public and support facilities required, potential conflicts and their resolutions to integrate them in the city.

Public awareness: It is very important for all road users to understand the use and access of facilities for NMVs and the need to maintain the integrity of the system. The absence of this understanding leads to motorists in NMV lanes, and the lack of parking space for NMVs, among other such problems.

Integrated multimodal agency collaboration: Piecemeal implementation cannot be effective till the intermediate links are not established. For example, creating a NMV lane without resolving the conflicts at intersections with BRT, private transport vehicles and pedestrians will not be safe for the user. At grade crossings with appropriate signals and/ or manned crossings would help ease congestion, yet it requires coordination across agencies.

Capacity building: Everyone, who are involved - designer /architect, planner, contractor, mason and civic agencies of the site should be made aware of creating designated spaces for NMVs. Furthermore, monitoring mechanisms need to be built up in contracts to ensure that faulty designs are not created. Training of professionals and practitioners is a pre-requisite to ensure proper implementation of universal accessibility standards.

Implementation of designs and services: must be done as intended. Any change based on real-time conditions needs to address as they come up in consultation with the planning and design agencies for the best possible solution.

Constant monitoring and sensitized planning: Traffic management is an evolving service. It is important to constantly reassess the needs of all users and respond to them. This will enable the complete system, including NMV users, usually neglected, to have safe, continuous and stress free access.

Innovative solutions: Creating opportunities for maximum benefit using creative mechanisms can be learnt from international best practices. For e.g., implement cycle sharing systems in business districts, mixed-use neighborhoods, and educational areas.

Cycle sharing refers to the shared use of a common cycle fleet: with a smart card or other form of identification, a user can check out a cycle from a station on an "as needed" basis and return it to any other station, giving the user options and last mile connectivity from transit terminals for short trips and reducing congestion.

Accessibility audits: Audits identify deficiencies in road/street infrastructure and developing strategies to overcome them in the most effective, practical and aesthetic way at an early stage.

3.3 Maintenance and Monitoring (Operations)

Integrated management: Synchronized coordination of services and facilities is critical for the complete trip chain to function well. Critical coordination between agencies needs to be done, often quickly. For e.g., during events and festivals, NMV lanes are used for parking or as an alternate route, thereby inhibiting use by NMVs. During such times, designating alternate traffic routes and parking locations and coordination between local and transport agencies is required to avoid compromising the integrity of the NMV lane.

Continued access: Ensure that access to accessible facilities is available for all to use at all times. For e.g., if segregated lanes are provided, but not maintained, encroached, or used by motorized vehicles; it will discourage the cycle and tricycle users from using NMV lanes.

Flexibility: Every service/ space needs to have flexibility inherent in it such that it can be revised/ changed or replicated at a future time to reflect changes required at the time.

Maintenance: Regular maintenance of the infrastructure is essential for safety, accessibility and reliability. Poor and degraded infrastructure is a hazard and can lead to accidents, high financial considerations and poor connectivity. Funding for maintenance should be available and timeline for refurbishment clearly defined.

User outreach and sensitization: An awareness campaign for the general public needs to be conducted to raise awareness about access and barriers inadvertently caused due to insensitivity. This may be done through media campaign, social media, radio advertisements and also through driving schools, schools and colleges.

Funding: The cost issues of improved accessibility should be resolved by legislation and the progressive application of universal design. Achieving sustainability will depend on developing the right mix of services and creating innovative funding schemes.

3.4 Enforcement

Disallow temporary barriers and encroachments: Overflowing garbage dumps, construction debris and parking often create barriers for NMVs. These need to be penalized and enforced. Accessibility should not be compromised even during public gatherings, social events, festivals and emergencies. Reduce the number of private vehicle encroachments and access ways that disrupt cycle and pedestrian pathways.

Security from harassment: on the streets also becomes an important consideration for hawkers and NMV users including vendors, tricycle users, rickshaws and cyclists. Space allocated for their use must have support required by local agencies to be free from harassment.

Penalties: Penalties for non-conformance must be enforced for efficacy of the guidelines. Similarly, a strategy for lauding good practice should be emphasized, such as awards, incentives. Strict penalties should be in place for motorists in NMV lanes, lane encroachment and other such grievances.

Central complaint and grievance mechanism: Each civic agency and service provider must have one point of contact for complaints/ concerns and information that is functional at all times. These persons must be sensitized to the needs of diverse user groups and must have the resources to address the requirements. In addition, a required response time must be enforced to address each issue raised.

Staff allocation: To enforce any service/ plan, it is imperative that adequate staff is allotted to the task with capacity and mandated to enforce the guidelines.

Chapter- 4

PUBLIC TRANSPORT

4. Public Transport

Public transport occupies less road space and transports more passengers with less pollution per passenger-km than personal vehicles. Public transport is sustainable, cost effective and environment friendly. However, if the public transport systems- approach, vehicles, terminals and boarding/alighting locations are not designed to suit the needs of passengers, they are not user-friendly and not viable. As a result promoting shift from private vehicles to public transport may not be successful.

Improvements that benefit people with impairments should be viewed as improvements that benefit all passengers (S. Ling Suen). Integrated public transport systems should be promoted as affordable mobility alternatives in urban areas. It is one of the most cost effective environmental friendly solutions in the Indian context. Offering 'Mobility for All' in buses, BRTS, and MRTS is the first big step towards inclusion and improved quality of life in cities.

It is necessary that the system provided is universally accessible for its users, so that its full potential is realized. The system must be affordable and available to the community and connected with the remaining transportation system.

"Accessible transportation is the passport to independent living for everyone. Mobility means having transport services going where and when one wants to travel; being informed about the services; knowing how to use them; being able to use them; and having the means to pay for them. For people with mobility, sensory, or cognitive impairments—many of whom are elderly—such a goal offers many challenges". (S. Ling Suen)

New Constructions and Existing Facilities

Standards for mobility improvement shall be applied when a facility is being planned/ under construction or remodeled on a large scale. Infrastructure such as new rail and bus stations and pedestrian facilities can be made accessible at negligible additional cost, if they are correctly designed from the beginning. A good example is the Delhi Metro Rail system, which was designed to be inclusive and accessible. Timely implementation of access standards has made the system credible and replicable in other states of India.

"Mobility is important for daily living, but people increasingly will have to stop driving because of health problems such as dementia and strokes. This shift will lead to greater pressure for alternatives to the car." (S. Ling Suen)

4.1 Design Standards

4.1.1 Road Transport

4.1.1.1 Bus Stand/Stop

General

- At least one accessible route should be provided from the alighting and boarding point of the bus stand to the walkway that leads to the accessible bus stand;
- Directional signs should be installed to direct persons with disabilities to an accessible entrance;
- Tactile guiding paver should be provided along the accessible walkway from the bus stand to the building entrance to aid persons with visual impairments; and
- The bus stand must have minimum illuminations level of 35 to 40 lux.

Location

- Bus stand should be located nearest to an accessible entrance; and
- Where transfer is made from a vehicular surface to a pedestrian surface, the driveway, pathway or walkway should be blended to a common level or be ramped.

Passage width

- A clear passageway with a minimum width of 1200 mm should be provided.

Handrails

- Comply with Section 5.1.12.

Seats

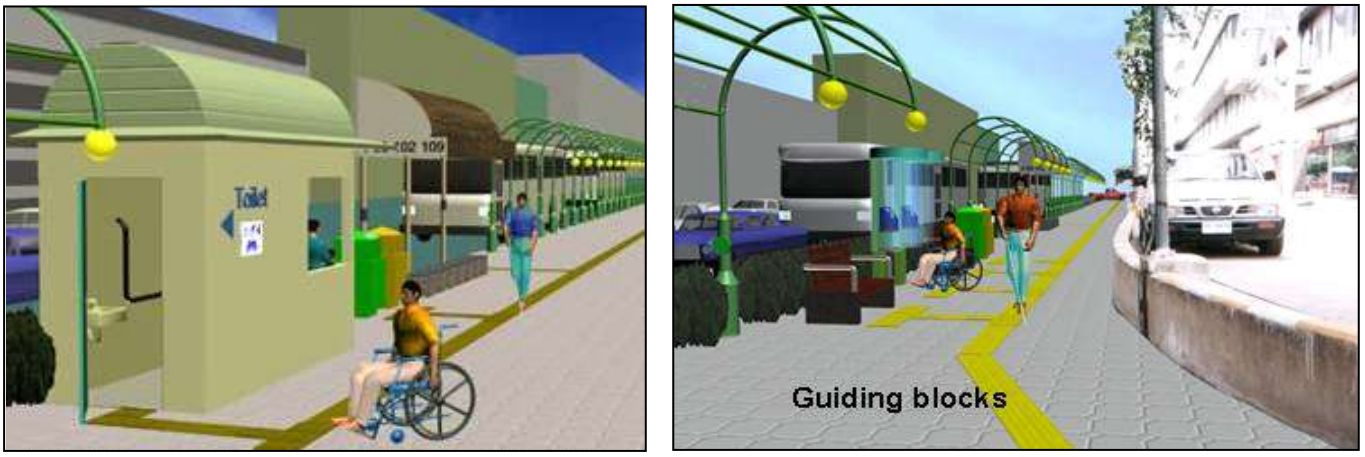
Seats should be provided at the bus stand for persons with ambulatory disabilities and persons with reduced motilities. These seats should be positioned such as not to impede the movement of wheelchair users. Tactile paving should be provided to guide passengers with visual impairments to the seating areas.

Shelter

- A shelter should be provided at the bus stand for protection against adverse weather conditions.

Ramps

- Where a bus stand is not on the same level with the walkway or pathway, it should have two separate ramps for boarding and alighting; and
- Where there are kerbs between the access aisle and the vehicle pick-up space, it should have a kerb ramp.



Source: (ESCAP, 2002)

Figure 4-1: Accessible amenities on bus stand

4.1.1.2 Low Floor Buses

Studies in the past show that the low floor buses are the most accessible, friendly and safe to use (Agarwal A. , 2010). Low floor buses should have the following accessible features:

- International symbol of accessibility displayed at the front windscreen and rear entrance door (Photo 4-1);
- Illuminated destination and route signs;
- Bus doors at least 1200 mm wide;
- Floor (chassis) level at 380 mm-400 mm and should have kneeling mechanism (vertical gap not more than 250 mm) for convenient embarking and disembarking;
- Have internal illumination of 150 lux level;
- Handrails/ grab rails and stanchions would be in contrast color (preferably red/ yellow) for the benefit of persons with low vision (Photo 4-2);
- Sufficient turning and maneuvering space for mobility aid users;
- Passenger Information Dynamic Display systems and audio address system;
- Seats with adequate leg space and swing up arm rest;
- Manual hinged transit ramp, which is easy to operate and require less maintenance;
- Designated wheel chair space to be free from any obstruction and cordoned off by a belt restraint when in use, to prevent other passengers from occupying this space;
- Headrest and seat belts for wheelchair passengers; and
- Priority seat signage with pictogram.

Photo 4-1: Access symbol on bus

Photo 4-2: Stanchions in contrast color

Level boarding and ramps

Buses should have apparatus such as a foldable/ pull out ramp installed in the doorway for mobility aid/ pram users. Preferred gradient of ramp for buses 1:12; maximum. There is kneeling mechanism in the buses to reduce the vertical gap. However, if the ramp is opened on road, assistance is required for wheelchair maneuvering (Photo 4-3 and Photo 4-4). Hence, precision docking of buses at the bus stop is required so that there is no/ minimal horizontal gap and no vertical gap, which facilitates independent, safe and comfortable boarding/ alighting of all passengers.

Photo 4-3: Low floor bus with hinged ramp

Photo 4-4: Assistance required for boarding, if the ramp is opened on road

Wheelchair space

- Space for a wheelchair should be provided in an appropriate position (preferably near the door), without preventing other passengers from getting on and off;
- It is preferred to have a wheelchair designated space near the emergency exit door for quick and safe evacuation purposes;
- The location of this space should be indicated outside and inside the bus, using the international symbol of accessibility;
- There should be headrest at the rear side of the wheelchair seating area to safeguard wheelchair users from jerks/ head injuries; and
- Wheel stoppers and wheelchair safety belts should be provided.

Buzzers (stop request button)

- An appropriate number of alighting buzzers should be provided in positions that are easily accessible for seated or standing passengers;
- The push button of an alighting buzzer should be clearly visible; of adequate size, installed at 800 mm to 1000 mm from the bus floor level and display the information in Braille/raised numbers as well; and
- Girls and women can also use these buzzers as panic buttons during emergencies and in unsafe situations (Photo 4-5 and Photo 4-6).

Photo 4-5: Designated space in low floor bus, Delhi

Photo 4-6: Stop request button

Information signs

- Information on a route and its final destination should be displayed outside the bus in large text, especially on the front and near the door. This information should be in good color contrast and be well illuminated by an external light to make it readable in the dark (Photo 4-7); and
- Information on the names of all stops along a bus route should be indicated inside the bus by displaying the text at a strategic location.

Photo 4-7: Route information indicated outside the bus

Photo 4-8: Improper arrangement of handrails

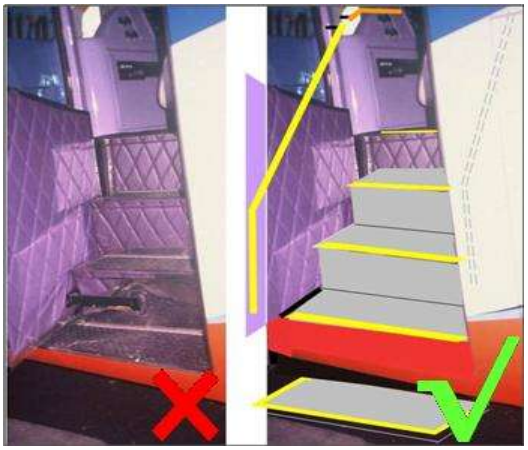


Photo 4-9: Color contrast at steps and side handrail

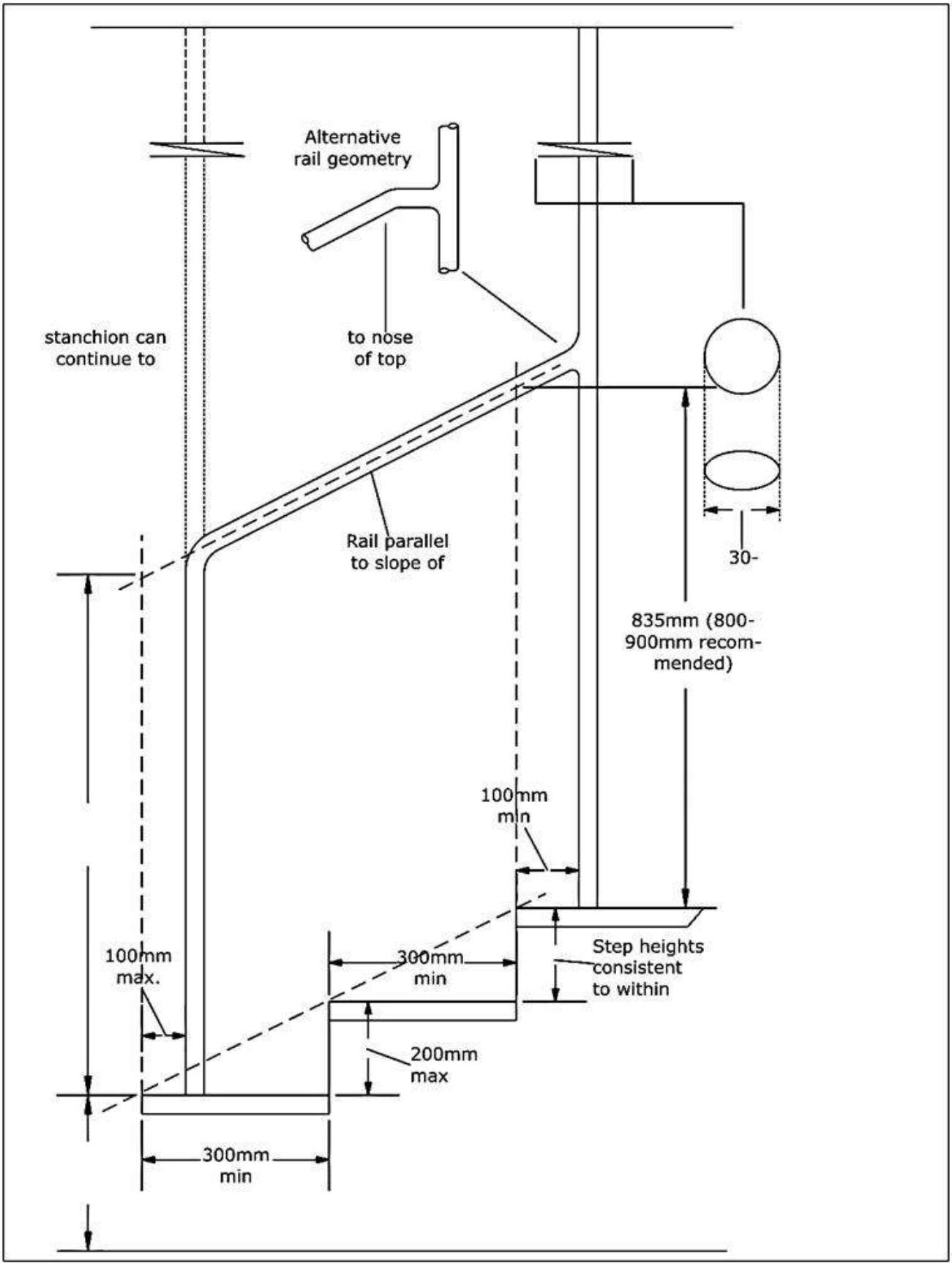
4.1.1.3 High Floor Buses

As per the NUTP, high floor buses should be replaced by low floor buses in given time frame, so as to allow universal usage of these buses to improve accessibility in these buses. Some essential design components in high floor buses are as follows:

Provision of handrails:

- Knuckle clearance between the rail and the surface to which it is attached should be between 45-50 mm; and
- Handrails fixed to the doors, or at the side of the doorway, may be oval in section with a major axis between 30 and 35 mm.

Photo 4-10: Extended handrails and retractable lower step



Modified: (Mitchell, 2006)

Figure 4-2: Handrail design for high floor buses

Provision of seating (Mitchell, 2006)**:**

Seat spacing

- The distance between the front surface of the seat back and the back of the seat in front, measured horizontally at cushion level, should be not less than 680 mm (pitch 737 mm);
- The longitudinal distance between and a vertical plane through the rearmost point of the seat in front of it should be not less than 230 mm; and
- The horizontal distance between seats, which face one another should not be less than 600 mm (preferably 700 mm). The minimum width of a seat per passenger should be 450 mm.

Seat height and headroom

- The height of any part of the top surface of a cushion from the floor should be between 430 mm and 460 mm. Seat cushions should not slope by more than 30 mm over their depth; and
- There should be clear minimum headroom (including luggage racks, etc.) of 1,000 mm above the top surface of the cushion of each seat.

Photo 4-11: Seating spaces in buses

4.1.2 Rail Transport (Metro and Sub-Urban)

General

- All new railway/ metro stations should be designed to be fully accessible and should have extra wide turnstiles and wheelchair accessible doorways complying with Section 5.1.10;
- Every train should contain fully accessible carriages;
- Staff should be trained and be at hand on request to assist persons with disabilities and elderly to enter or exit through convenient gates;

- For persons with hearing impairments, an electronic signboard (digital display) should be displayed on each platform, at strategic locations for all announcements made by the railways; and
- For details regarding accessible railway/ Metro stations, refer Section 5.1

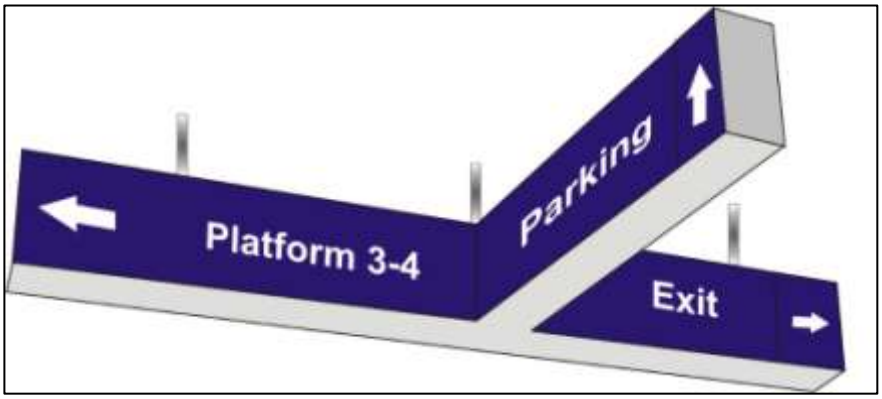
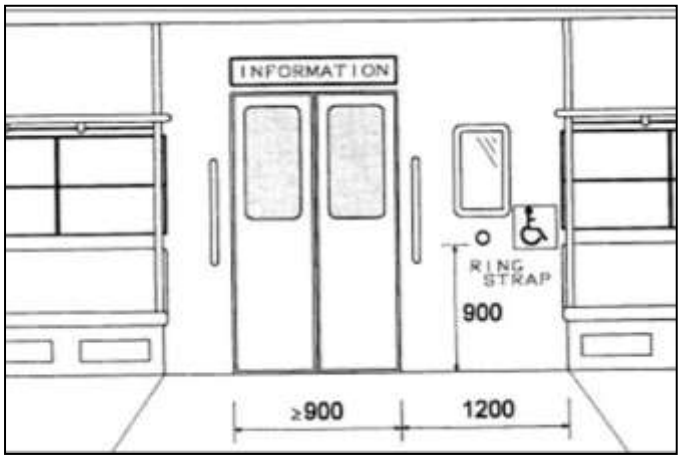


Figure 4-3: Information boards on platform/concourse

Accessible Coaches

- Doors should be at least 1200 mm wide;
- Identification signage on the door for wheelchair accessible coach (Figure 4-4 and Photo 4-12);



Source: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 4-4: Rail/Metro door and signage

Photo 4-12 Symbol of accessibility on rail coach door, Delhi Metro, India

- Transfer from platform to rail coach:
  - If leveled boarding is not provided at rail platforms, then mechanism for transfers should be provided by means of hydraulic lift/ pullout transit ramp installed in the doorway for wheelchair users. These ramps should be provided for sub-urban railways also (Photo 4-13); and
  - Transit ramps are used for merging vertical heights more than 25 mm (Photo 4-14).

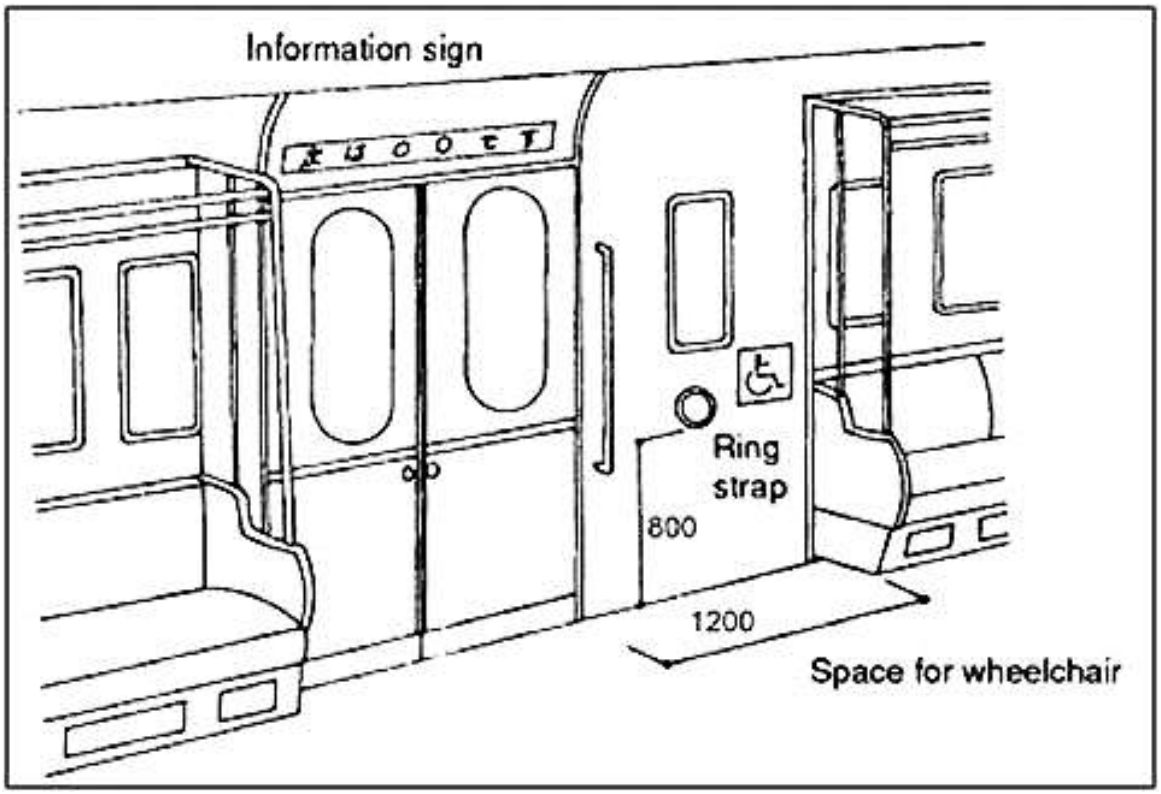
Photo 4-13: Foldable ramp for rail coach, Tokyo Metro, Japan

Source: (Passengers Accessibility of Heavy Rail Systems, COST 355)

Photo 4-14: Retrofitting of telescopic ramp in rail coaches in sub-urban rails

Wheelchair Space

- The space should be indicated inside and outside the car by using the international symbol of accessibility;
- Space for a wheelchair should be available at the side of the door (Figure 4-5); and
- Wheel stoppers and ring-strap or other appropriate safety grip should be provided for wheelchair users (Photo 4-15).



Source: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 4-5: Space for wheelchair

Photo 4-15: Reserved wheelchair space, Bangalore Metro, India

Priority Seats

- An appropriate number of designated seats for passengers with disabilities and persons with reduced mobility should be provided near the doors;
- The seats should have signage for priority seating (Photo 4-16) and be marked "FOR USE BY ELDERLY OR PASSENGERS WITH DISABILITIES";
- The distance ahead to the bulkhead from the foremost point of such seats should be not less than 450 mm and there should be adequate space under each of these seats for a guide dog to lie down; and
- Longitudinal inward facing seats are not generally recommended.

Photo 4-16: Signage for priority seating

Aisles

- Aisles should be at least 900 mm wide.

Information Signs and Announcements

- A map of train routes should be installed. This should also be in Braille/raised numbers; and

- In each coach, there should be an announcement and provision of a visual display of the names of stations route. This display should be in GOOD contrast from the background.

Approach

- Passenger walkways, including crossings to the bus stops, taxi stands, terminal / station building, etc. should be accessible;
- Uneven surfaces should be repaired and anything that encroaches the corridors or paths of travel should be removed to avoid creating new barriers. Any obstructions or areas requiring maintenance should be detectable by a white cane, which is used by persons with visual impairments (Transport Canada);
- Access path from plot entry and surface parking to terminal entrance shall have even surface without any steps;
- Slope, if any, shall not have gradient greater than 5%. The walkway should not have a gradient exceeding 1:20. It also refers to cross slope;
- Texture change in walkways adjacent to seating by means of tactile warning paver should be provided for persons with visual impairments; and
- Avoid gratings in walks.

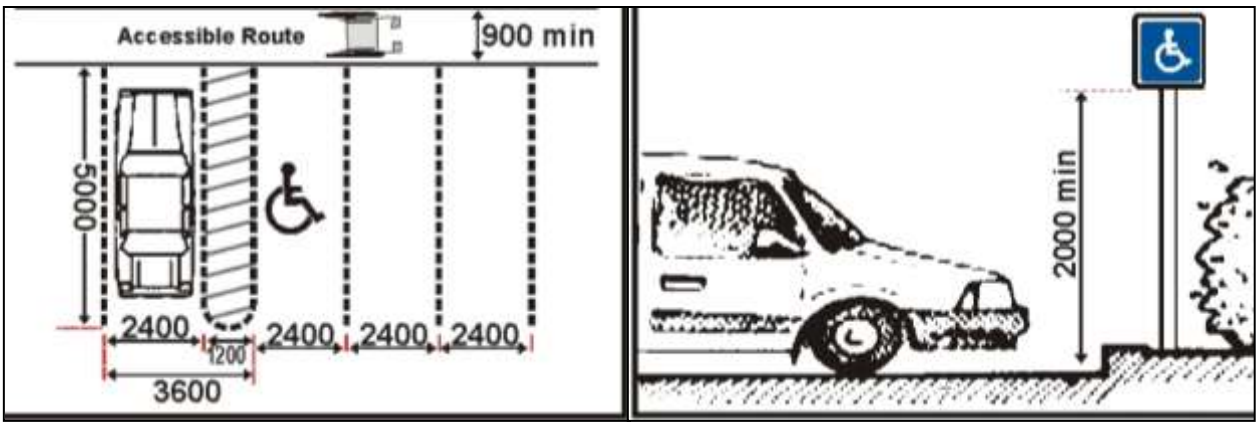
4.1.3 Parking (BRT/MRT/Sub-urban Railway)

Accessible Signage and Wayfinding

- Comply with Chapter 6.

Accessible Car Parking

- Accessible parking lots should be located within 30 m to an accessible entrance and/ or lift lobby;
- The accessible route of 1200 mm width is required for wheelchair users to pass behind vehicles;
- The accessible car parking lot should:
  - Have minimum dimensions 5000 mm × 3600 mm;
  - Have a firm, level surface without aeration slabs;
  - Wherever possible, be sheltered. Where there are two accessible parking bays adjoining each other, then 1200 mm wide transfer bay to be shared by the two parking bays. The transfer zones, both on the side and the rear should have yellow and while cross-hatch road markings; and
  - Two accessible parking lots shall be provided for every 25 car parking spaces.



Source: (Samarthyam, 2010)

Figure 4-6: Accessible parking standards

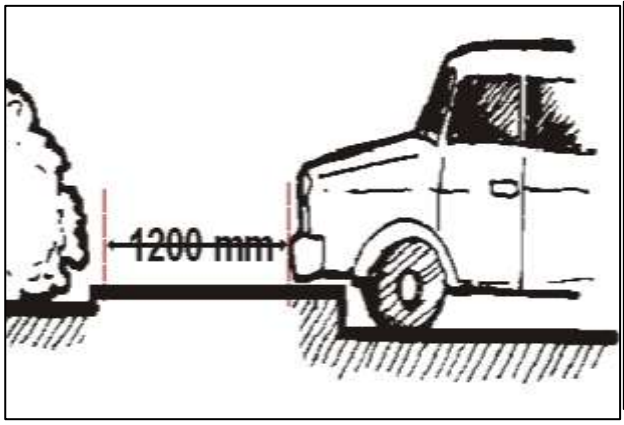


Figure 4-7: Minimum standards for walkway along parking

Photo 4-17: Reserved accessible parking

Photo 4-18: Designated accessible parking bay– floor marking

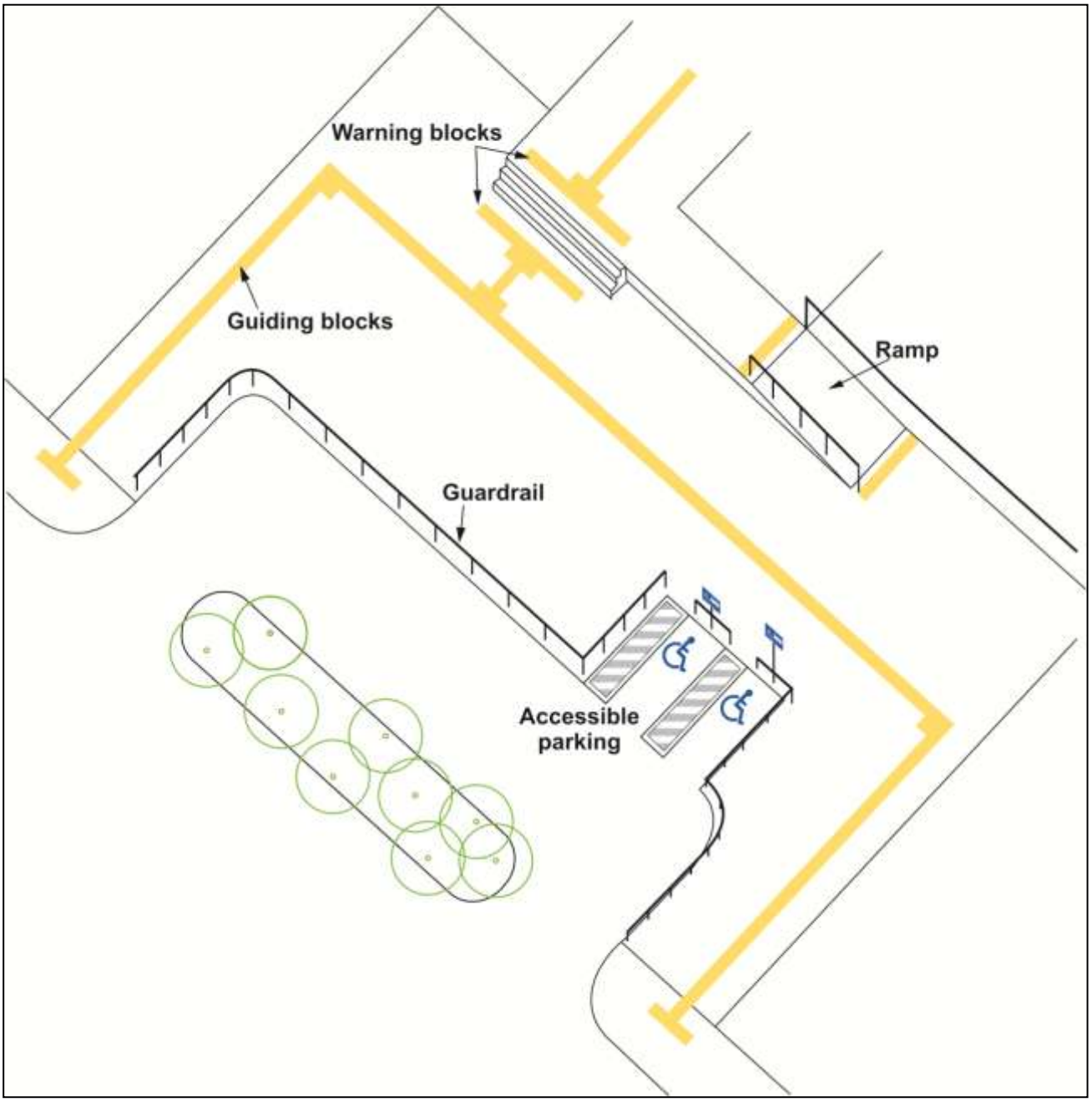


Figure 4-8: General plan of accessible parking

4.1.4 Taxi/Auto Rickshaw Stand

General

- At least one accessible route should be provided from the alighting and boarding point of the taxi stand to the walkway that leads to the accessible building entrance;
- Directional signs should be installed to an accessible entrance;
- Guiding pavers should be provided along the accessible walkway from the taxi stand to the building entrance to guide persons with visual impairments;
- The sign indicating the presence of a taxi/auto stand shall be on a vertical pole and the sign should be visible after dark- illumination of 35 – 40 lux level is required; and

- Where transfer has to be made from a vehicular surface to a pedestrian surface, the driveway, pathway or walkway should be blended to a common level or be ramped.

Passage Way

- Continuity of the pedestrian pathway shall have minimum width of 1200 mm behind the taxi stand.

Ramps

- Where a taxi stand is not on the same level with the walkway or pathway, it should have two separate ramps for boarding and alighting; and
- Where there are kerbs between the access aisle and the vehicle pick-up space, it should have a kerb ramp (comply with Section 2.1.2).

Seats

- Seats should be provided at the taxi stand for persons with reduced mobility and disabilities; and
- These seats should be positioned such as not to impede the movement of wheelchair users and persons with visual impairments.

Shelter

- A shelter should be provided at the taxi stand for protection against adverse weather conditions.

4.2 Implementation

Understanding the guidelines: Create awareness, sensitization and capacity building of all stakeholders, architects, designers, builders, contractors, policy makers, government functionaries, NGOs, etc.

Integrated multimodal agency collaboration: Piecemeal implementation will not be effective till the intermediate links are not established. For example, if the metro stations are accessible, and pedestrian environment marking the stations are not, the effectiveness of an accessible metro system will be incomplete. Similarly, if the coaches have level difference or there are no designated spaces for wheelchair users, the MRTS will not be fully accessible to its users.

Implementation of designs and services: must be done as planned. Site specific changes needs to addressed as they come up in consultation with the users, planning and design departments for the best possible solution.

Constant monitoring and sensitized planning: Permanent accessible features and wayfinding signage needs to be provided. For e.g., provision of tactile pavers inside the metro station will not be effectively used unless it is connected with tactile paving in the external areas.

Access audits: Audits and survey are important to understand and analyze quality of the implementation process and find and rectify problems that come up at an early stage. Regular safety, accessibility and vehicle audits are crucial for upscaling and making the public transportation modes and infrastructure friendly and attractive to the users. Cost for audits should be included in the general budget for building construction for maximum benefit.

4.3 Maintenance and Monitoring (Operations)

Monitoring: Require quality-control / commissioning of buildings and infrastructure with mandatory accessibility features. An understanding of the requirement and implementation of universal access must be mandatory for all planning agencies, designers and implementing contractors and vendors through education, sensitization and monitoring. For e.g., the docking of buses at bus stops needs to be enforced. Buses stopping away from the pavement inhibit level boarding and are dangerous due to oncoming traffic.

Continued access: Ensure that access to accessible facilities is available for all to use at all times. Many a time it has been found that accessible toilets are locked or access to them is blocked. As a result, the accessible feature becomes inaccessible and fails to serve the purpose it is intended for. Similarly, public terminals and kiosks for persons with disabilities must be functioning at all times, even if they need to be manned flexibly with another counter/ terminal.

Flexibility: Every service/ space needs to have flexibility inherent in it such it can be revised/ changed or replicated at a future time to reflect changes required at the time. Permanence and longevity must be balanced with flexibility and adaptability to change. For e.g., if an accessible low floor bus is discontinued, it must be replaced with another same type of bus. A high floor bus replacement in this case will not allow diverse users to access this service, breaking the seamless trip chain.

Deployment of accessible buses on prioritized lines with integrated phase-in of pedestrian access to prioritized bus stops should be done with prioritized seats for seniors, persons with disabilities. Constant monitoring of service is required.

User outreach and sensitization: Due to structural barriers, many people need assistance either from an escort or from drivers and other passengers. Awareness and sensitization campaigns for the public should be conducted to raise awareness. Media campaigns, social media, community radio, advertisements, schools and colleges can be used for raising such awareness.

Access audits: Periodic Audits by diverse user groups is beneficial to constantly assess the changing needs of users, environmental and infrastructure conditions and quality. This will go a long way in ensuring continued seamless access and avoiding compounded hazards later on. Regular safety, accessibility and vehicle audits are crucial for up scaling and making the public transportation modes and infrastructure friendly and attractive to the users.

Funding: The cost issues of improved accessibility should be resolved by legislation and the progressive application of universal design. Achieving sustainability will depend on developing the right mix of services and creating innovative funding schemes.

Driver and staff training (similar for other service providers): An understanding of universal accessibility standards will help promote equity and reliability for people who assist persons with disabilities and facilitate their occasional or regular travelling/commuting. For e.g., information of bus number and route should be accessible to all users; in one language they are not legible to other language speakers or the illiterate; and persons with visual impairments cannot see them. In such a case, graphic displays in addition to conductor calling out the same, or an audio announcement is most effective.

Driver training to include courteous and appropriate treatment of seniors and passengers with disabilities as well as smooth operation (avoiding abrupt starts and stops, driving slowly at curbs). It must include training for emergencies and policies regarding disabled passengers. Training should be mandatory for all service providers and staff including but not limited to bus drivers, conductors, traffic police, civic agency representatives, contractors, etc.

Drivers and conductors can greatly increase the usability of bus services to passengers with reduced mobility and disabilities by observing some simple operational guidelines (Overseas Road Note 21, 2004). Accessible design features will not help much if passengers are required to run after or jump to board a moving vehicle or to cross lanes of moving traffic before boarding.

Photo 4-19: Passengers have to cross lanes to board buses and hinged ramp not open while alighting

Photo 4-20: A bus stopped at a distance from the passenger with disability so that he cannot board the bus

Recommendations

- Reliability of the service is very important to many persons with disabilities including persons with visual and intellectual impairment;
- Providing appropriate information and employee education/training;
- Precision docking of the buses is extremely crucial. Thus, stopping the vehicle close to the kerb and next to the bus pole at stops will enable opening of the hinged ramp in the buses to be used for transfers by mobility aid users;
- Drivers should call out major stops, transfer points, or the end of the line, sometime before arriving at the stop. This greatly assists passengers with visual impairments for whom the need to identify the correct stop at which to alight is a major barrier. The practice also benefits occasional users and tourists. If no amplification system is available, the announcement should at least be audible in the front of the bus (where prioritized seating should be provided);
- Driving behavior is also very important: a well-driven bus with smooth acceleration and deceleration (i.e. without sudden jerks and hard braking) increases safety and comfort for all passengers; and
- The driver should also wait until all passengers (and specifically frail, older and passengers with disabilities) are seated before starting to move from a standing position (Photo 4-21).

Photo 4-21: Conductor helping in precision docking under trial run of prototype buses in Delhi, 2006

4.4 Enforcement

Carrots and sticks approach: Penalties for non-conformance must be enforced for efficacy of the guidelines. Similarly, a strategy for lauding good practice should be emphasized, such as awards, incentives, tax benefits, etc.

Central complaint and grievance mechanism: Each service provider must have one point of contact, which is functional all times for complaints/ concerns and information. People manning the counters must be sensitized to the needs of diverse groups.

Staff allocation: To enforce any service/ plan it is imperative that adequate staff is allotted to the task with capacity and mandate to enforce the guidelines.

Monitoring agency: Allocate responsibility to specific agency. Posting of safety, hazard information to be maintained and enforced by agency in-charge. All construction area/ diversions to have alternate routes with signage marked appropriately.

Periodic evaluation must be done, and up-gradation of facilities and their purpose explained.

Chapter- 5

Access Features inside Transit Terminals

5. Access Features inside Transit Terminals

People-focused approach, incorporated into transport planning and adoption of universal design in perspective planning of facilities promotes independent travel and sustainable mobility, not just for few people but also to trans-generational passengers. The National Urban Transport Policy (NUTP) explicitly promotes "moving people not vehicles". However, existing codes/ guidelines neither specify essential design elements inside transit terminals, viz. dimensions, standards and measures for improving universal accessibility nor do they address user diversity and equality of access. Detailed design standards and access features for transit terminals (suburban railway and mass rapid transit) are given in this chapter.

5.1 Design Standards

5.1.1 Level Approach

- Approach route should not have level differences. If the station is not on the same level as the walkway or pathway, it should have a ramp;
- Walkway surfaces should be non-slip; and
- Approach walkway should have tactile pavers for persons with visual impairments.

5.1.2 Entrances and Exits

- Wayfinding and signage to comply with Chapter 6; and
- Should be 2000 mm minimum wide and be leveled or ramped.

5.1.3 Interiors

- There should be a tactile layout map of the station placed at the entrance;
- The lobby/corridor width should be at least 2000 mm;
- The floor surfaces should be non-slip and leveled;
- There should be directional signs indicating all the facilities and the various platform numbers;
- The signage should also be displayed in Braille/ raised numbers for persons with visual impairments;
- Guiding and warning paver should be installed in the corridors and concourse;
- Stairs should comply with Section 5.1.11;
- Lifts should comply with Section 5.1.14;
- All the audio announcements should be supplemented with visual information displays for persons with hearing impairments; and
- Seating areas should be provided at regular intervals for persons with ambulatory disabilities. Designated seating should be provided at boarding gates and departure areas within viewing distance of communication boards, and within hearing range of audio announcements as well. Such seating areas should be identified by the symbol of accessibility and shelter should be provided where this seating is

outdoors. At waiting lounges for persons with reduced mobility and disabilities, chairs should have armrests and backrest.

5.1.4 Reservation and Information Counters

- Should have clear floor space of at least 900 mm x 1200 mm in front of the counters;
- There should be at least one low counter (Figure 5-1) at a height of 750 mm to 800 mm from the floor with clear knee space of 750 mm high by 900 mm wide by 480 mm deep;
- At least one of the counters should have an induction loop unit to aid persons with hearing impairments; and
- The counters should have pictographic maps indicating all the services offered at the counter and at least one of the counter staff should be sign language literate.

Modified: (ESCAP, 2002)

Figure 5-1: Accessible counters

5.1.5 Toilet Facilities

- There should be at least one unisex accessible toilet comply with Section 5.1.17.

5.1.6 Ticket Gates

At least one of the ticket gates should:

- Be minimum 900 mm wide to allow a wheelchair user cross through; and
- Have a continuous line of guiding paver for persons with visual impairments.

5.1.7 Platforms

- There should be no gap or difference in level between the train entry door and the platform (Photo 5-1);
- Have a row of warning paver installed 800 mm before the track edge (Figure 5-2 and Photo 5-2);
- Have non-slip and level flooring;
- Have seating areas for persons with ambulatory disabilities and reduced mobility;
- Be well illuminated having 35 to 40 lux level minimum;
- All platforms should inter-connect by means of an accessible route or lifts; and
- Provide accessible level entrance to the train coach.

Photo 5-1: Level boarding in DMRC

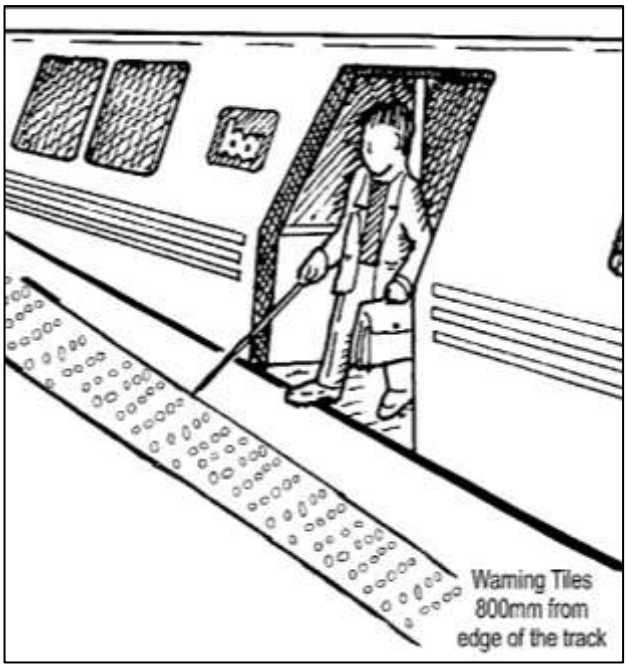


Figure 5-2: Tactile warning before platform edges

Source: (Passengers Accessibility of Heavy Rail Systems, COST 355, 1999)

Photo 5-2: Warning strip on platform

5.1.8 Automated kiosks

- Automated kiosks should be accessible for wheelchair users;
- Should be clearly marked with international symbol of accessibility;
- Should have Braille buttons and audio announcement system for persons with visual impairments; and
- Operations should be easy to understand and operate for persons with learning disabilities, intellectual disabilities, and elderly persons.

5.1.9 Public Dealing Counters

Ticketing, Information, Check-in, Help desk, Shops, etc. should have accessible public dealing counters.

- Information or help desks should be close to the terminal entrance, and highly visible upon entering the terminal. In addition, they should be clearly identified and accessible to passengers those who use wheelchairs and those who stand. It should provide information in accessible formats, viz. Braille leaflets for persons with visual impairments;
- Ideally, these desks should have a map of the facility that desk attendants can view with passengers, when providing directions;
- Staff manning the counters should know sign language;
- Information desk acoustics should be carefully planned and controlled as a high level of background noise is confusing and disorienting to persons with hearing impairment;
- Height of the counters should not be more than 800 mm from the floor, with a minimum clear knee space of 650mm high and 280 mm- 300 mm deep (Figure 5-3, Photo 5-3);
- Lighting should be positioned to illuminate the receptionist/person manning the counter and the desk top without creating glare (Photo 5-4) to help persons with hearing impairments in lip reading; and
- There should be a hearing enhancement system such as a loop induction unit, the availability of which is clearly indicated with a symbol.

Photo 5-3: Automated kiosk, Hong Kong Metro

Photo 5-4: Counters at two heights

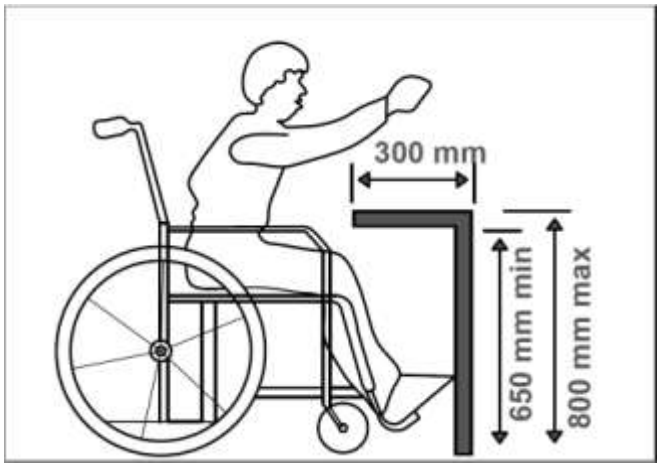


Figure 5-3: Accessible counter

5.1.10 Audio-visual Displays

- Terminal maps should be placed so that they are readily visible to persons who are standing and persons using wheelchairs. They should also be accessible to persons with visual impairments i.e. tactile maps should be provided. Other alternatives include electronic navigation systems or audio maps (Photo 5-5);
- Enable captioning at all times on all televisions and other audiovisual displays that are capable of displaying captions and that are located at strategic locations in the terminal; and
- The captioning must be in high contrast for all information concerning travel safety, ticketing, check-in, delays or cancellations, schedule changes, boarding information, connections, checking baggage, individuals being paged by bus or railway, vehicle changes that affect the travel of persons with disabilities, and emergencies (e.g., fire, bomb threat).

Photo 5-5: Lowered information display boards for short stature persons and wheelchair users

5.1.10 Doors

Whatever the type of entrance door, it must be wide enough to accommodate passenger traffic comfortably.

- The recommended minimum clear opening width of an internal door is 900 mm;
- Where doors comprise two leaves (i.e. double doors), each leaf should be 900 mm minimum wide, so that persons carrying large items and people using wheelchairs do not have to open both leaves (Figure 5-4);
- Manual doors should incorporate kick plates 300-400 mm high to withstand impact of wheelchair footrest (this is especially important where doors are glazed):
  - Also be fitted with vision panels at least between 900 mm and 1500 mm from floor level.
  - Be color contrasted with the surrounding wall and should not be heavier than 20N to open.
  - Lever handles and push type mechanisms are recommended (Photo 5-6).
  - When a sliding door is fully open, handles should be usable from both sides.
- Where revolving doors or turnstiles are used, an alternative wheelchair-accessible entrance must also be provided; and
- Glazed doors and fixed glazed areas should be made visible by using color and tone contrasted warning or decorative feature that is effective from both inside and

outside and under any lighting conditions. For e.g., a logo, of minimum dimensions 150 mm by 150 mm (though not necessarily square), set at eye level is useful.

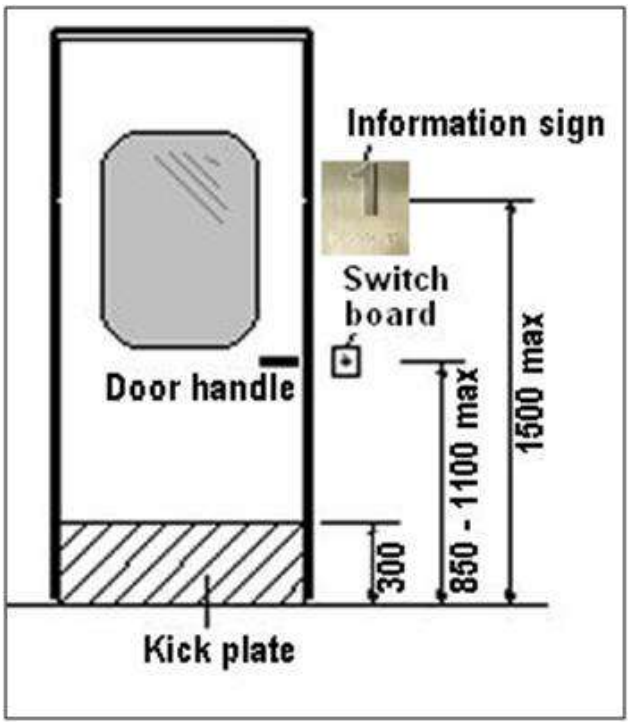


Figure 5-4: Position of door hardware

Photo 5-6: Lever handle

5.1.11 Steps & Stairs

- Steps should be uniform-tread not less than 300 mm and the risers 150 mm minimum;
- The risers should not be open;
- The steps should have an unobstructed width of 1200 mm minimum (preferred 2000 mm);
- All steps should be fitted with a permanent color and tone contrasting at the step edge, extending the full width of the step, reaching a minimum depth of 50 mm on both tread and riser (Figure 5-5 and Photo 5-7);
- Have continuous handrails on both sides including the wall (if any) at two levels complying with Section 5.1.12;
- Warning paver to be placed 300 mm at the beginning and at the end of all stairs (preferred two rows of warning pavers) (Figure 5-6);
- Nosing to be avoided;
- The staircase should be adequately and uniformly illuminated during day and night (when in use). The level of illumination should preferably fall between 100-150 lux;
- The rise of a flight between landings must be no more than 1200 mm;
- There should be no more than 12 risers in one flight run;
- The stair covering and nosing should be slip-resistant, non-reflective, firmly-fixed and easy to maintain; and

- Soffit (underside /open area under the stairs) of the stairs should be enclosed or protected.

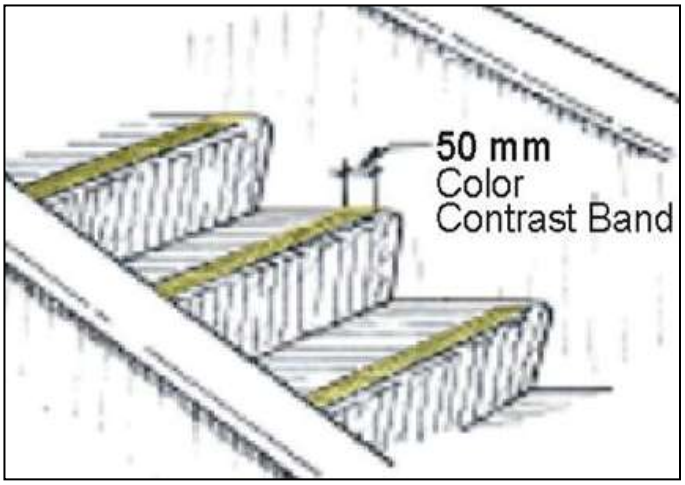
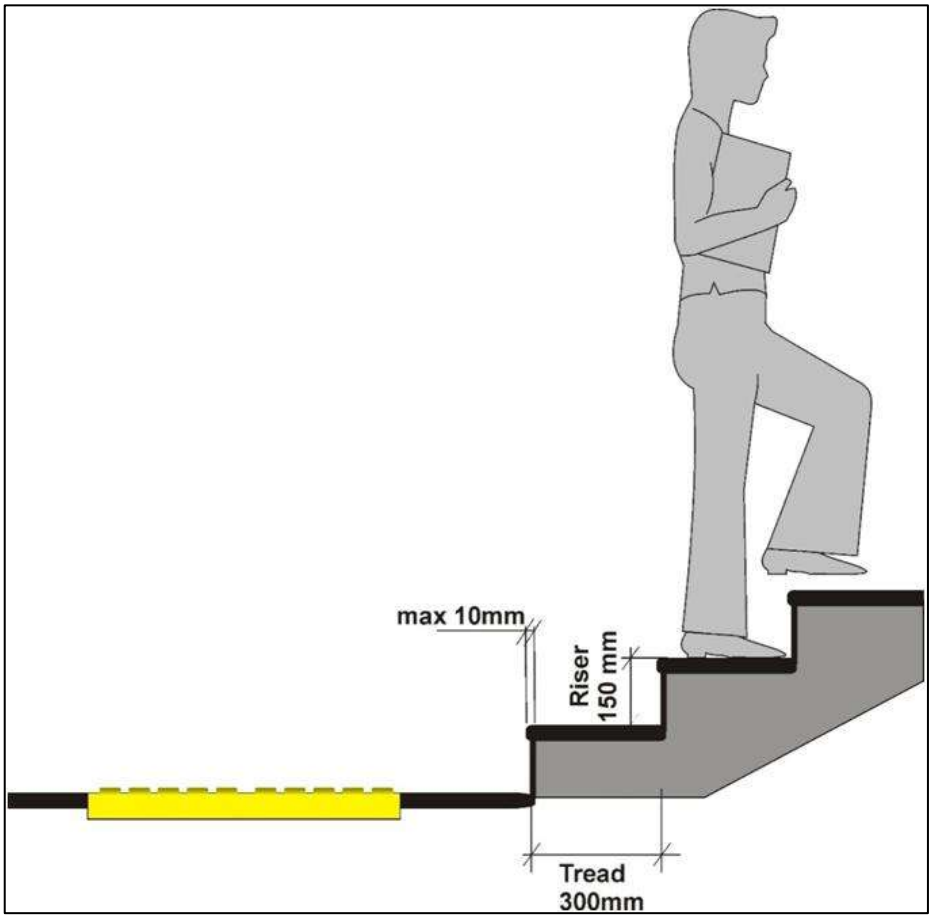


Figure 5-5: Step edges in contrast color

Photo 5-7: Contrast color step edges



Modified from: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 5-6: Placement of tactile paver before first step

5.1.12 Handrails

- The handrail should be positioned at two levels- 760 mm and 900 mm above the pitch-line of a flight of stairs (Figure 5-7 and 5-9); and
- Handrails should be circular in section with a diameter of 38-45 mm (Figure 5-8) and formed from materials, which provide good grip such as timber, nylon or powder coating, or matt finish metal finishes;
- Handrail at foot of the flight of stairs should extend 300 mm beyond the stairs in the line of travel and returning to the wall or floor or rounded off, with a positive end that does not project into the route of travel. Rounded handrails ends reduce risk of catching clothes or injury from the exposed handrail end (Figure 5-9).
- The handrail should contrast in color (preferably yellow/orange) with surrounding surfaces (Photo 5-8);
- These should be at least 50 mm clear of the surface to which they are attached and should be supported on brackets, which do not obstruct continuous hand contact with the handrail;

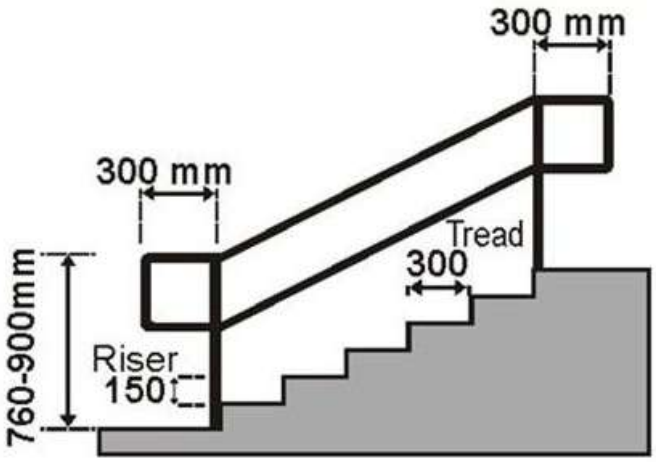


Figure 5-7: Stairs with handrails

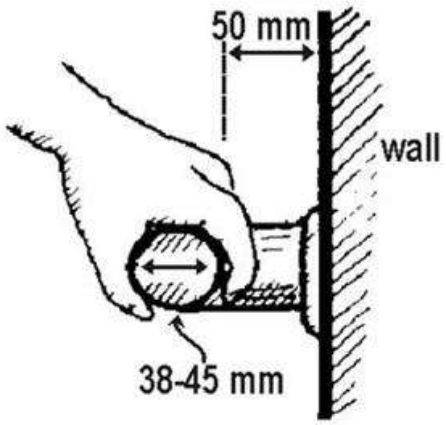
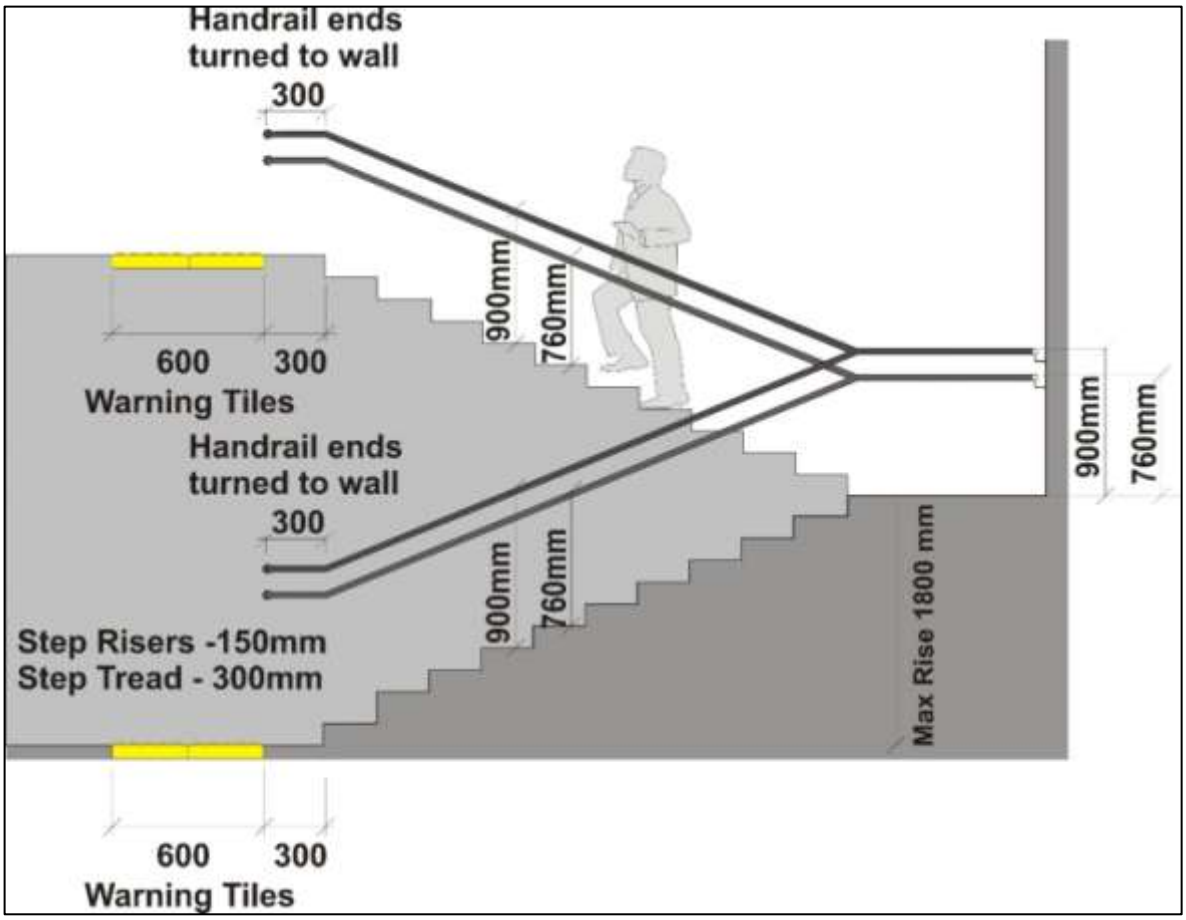


Figure 5-8: Knuckle clearances

Photo 5-8: Wide staircase with handrails in good color contrast



Modified from: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 5-9: Handrail and tactile paver placement standard

5.1.13 Ramps

- Ramps gradient should ideally be 1 in 20 and no greater than 1 in 12;
- Width of the ramp should not be less than 1200 mm and preferred width is 1800 mm;
- The steeper the gradient, the shorter the length of ramp between landings;
- On long ramps, a horizontal resting space should be provided every 6 meters;
- Surface materials should be slip-resistant, non-reflective, firmly-fixed and easily maintained;
- The edge of the ramp should have an edge protection with a minimum height of 100 mm;
- Landings every 750 mm of vertical rise;
- A tapping or lower rail should be positioned so that its bottom edge is no higher than 200 mm above ground level;
- Handrails on the ramps should be on both sides at two levels: upper at 900 mm and lower at 760 mm; both end to be rounded and grouted; extend 300 mm beyond top and bottom of ramp (Figure 5-10);
- A row of tactile warning paver should be placed 300 mm beginning and end of each run; and
- Landings should be provided at regular intervals as indicated in the Table 5-1.

Table 5-1: Specification for ramps

Level difference	Min. gradient of Ramp	Ramp Width	Handrail on both sides	Comments
≥ 150 mm ≤ 300 mm	1:12	1200 mm	√	
≥ 300 mm ≤ 750 mm	1:12	1500 mm	√	Landings every 5 m of ramp run.
≥ 750 mm ≤ 3000 mm	1:15	1800 mm	√	Landings every 9 m of ramp run.
≥ 3000 mm	1:20	180 mm	√	Landings every 9 m of ramp run.

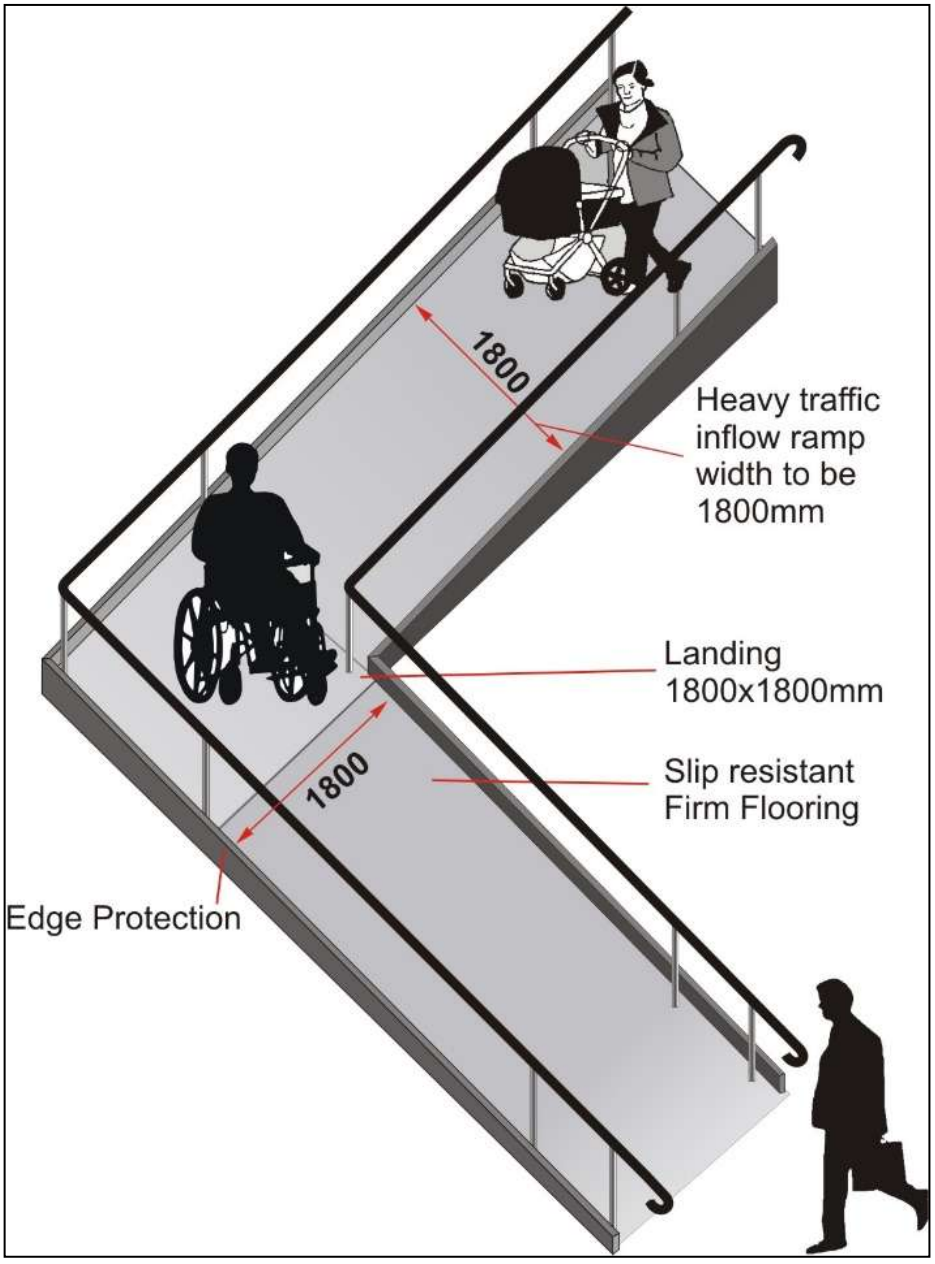


Figure 5-10: L-Shape ramp

5.1.14 Lifts/Elevators

A carefully designed lift makes a huge contribution to the accessibility of a multi-storied terminal building.

- Lift locations should be clearly signposted from the main pedestrian route and recognizable through design and location;
- The lift lobby shall be of an inside measurement of 1800 mm X 2000 mm or more. A clear landing area in front of the lift doors of minimum dimensions 1500 mm x 1500 mm should be provided (Figure 5-11);
- The color and tone of the lift doors should contrast with the surrounding wall finish to assist in their location (Figure 5-12). Lift doors with metallic finishes such as steel grey and silver should be avoided as they are difficult to identify by persons with low vision;
- Changes in floor finish must be flushed. There should be no level difference between lift door and the floor surface at each level; the gap if unavoidable should not be more than 10 mm; and
- The floor level/location should be indicated on the wall adjacent to or just above the call buttons, and opposite the lift doors where possible.

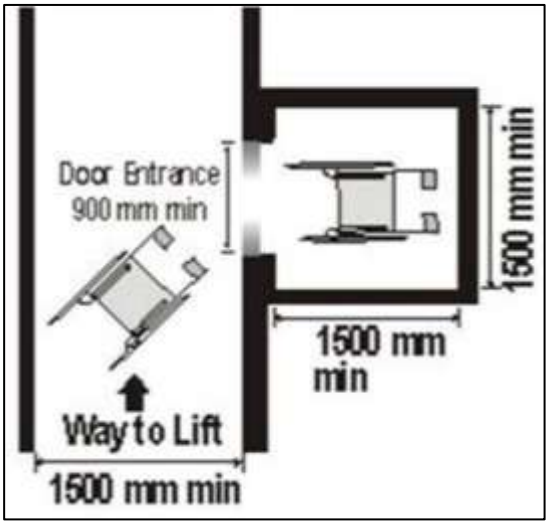


Figure 5-11: Lift lobby

Figure 5-12: Lift signage in Braille

Lift Dimensions

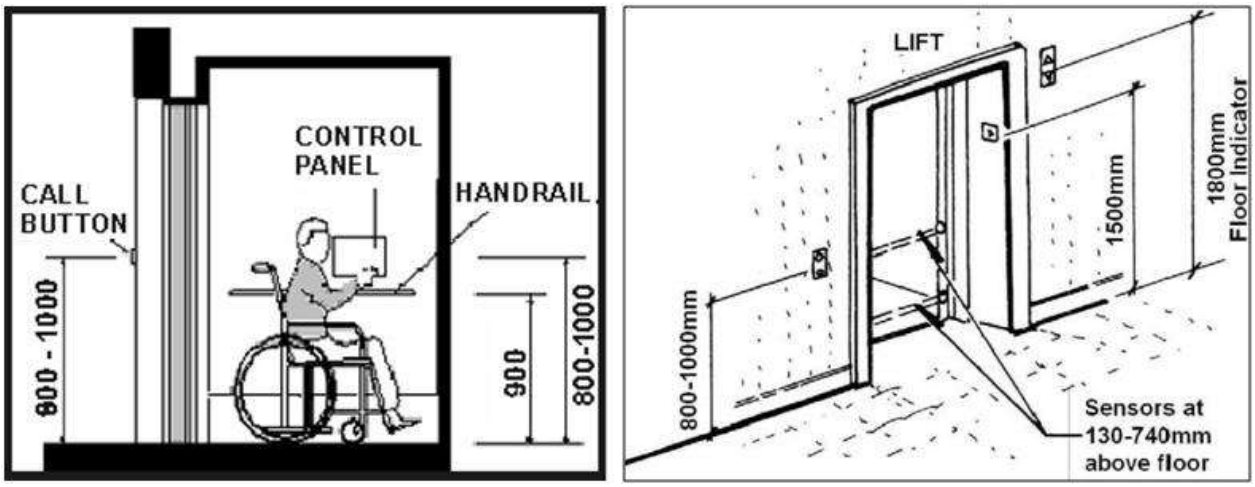
- Provisions of at least one lift shall be made for people using wheelchairs with the following car dimensions (minimum):
  - Clear internal depth & width -1500 mm x 1500 mm minimum
  - Where ever possible 13 passenger lift to be provided, which allows easy maneuverability of wheelchair user
  - Entrance door width - 900 mm minimum

Lift Controls

- The lift call button should be wall-mounted adjacent to the lift and should contrast with wall finish, either by using a contrasting panel, or a contrasting border around the button panel;
- The call buttons should be located within the range 800-1000 mm above floor finish;
- The control buttons should contrast with their surroundings and illuminate when pressed and should incorporate highly visible tactile embossed (NOT engraved) characters and in Braille;
- Time of closing of an automatic door should be more than 5 seconds and there should be a provision of censor enabled closing; and
- In larger lifts, controls should be positioned on both side walls, at least 400 mm from front wall and between 800-1000 mm above floor level (Figure 5-13).

Lift Car Design

- A mirror (750 mm above floor level) on the rear wall can be useful to persons using wheelchairs and other mobility aids should they need to reverse safely out of the lift car or view the floor numbers;
- Internal lighting should provide a level of illumination of minimum 100 lux (approximately 50-75 lux at floor level), uniformly distributed, avoiding the use of spotlights or down lighters; and
- A grab bar should be provided along both sides and the back wall, 900 mm above floor level. It should be of tubular or oval cross section, in order to be easily gripped and capable of providing support. Grab bar should be positioned so that there is a clear space behind the handrail to allow it to be grasped i.e. knuckle space should be 50 mm.



Modified from: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 5-13: Lift car design

Information Systems

- Lifts should have both visual and audible floor level indicators (Photo 5-9);
- Audible systems are also usually capable of incorporating additional messages, such as door closing, or, in the case of an emergency, reassurance (with manual over-ride allowing communication with lift occupants);
- Announcement system should be of 50 decibel; and
- The display could be digital or segmented LED, or an appropriate alternative. A yellow or light green on black display is preferred to a red on black display, as it is easier to read.

Photo 5-9: Lift information systems

5.1.15 Platform/Stair Lift

In older buildings where there is no space to provide access by a ramp and to accommodate a regular elevator, platform or stair lift can be provided. This is feasible only where the payload and the travel distance is not too much.

- No lift well/ shaft required, available with both manual (Photo 5-10) and mechanical system (Photo 5-11). Size 900 mm x 1200 mm minimum; and
- Provision of handrails, edge protection and emergency stop buttons makes it a safe and comfortable option.

Photo 5-10: Automatic platform lift

Photo 5-11: Stair lift

5.1.16 General and Accessible Toilets

- All signage of general toilets should be in bold and contrasting colors;
- For persons with low vision and visual impairments, male pictogram in triangle and female pictogram in circle (Figure 5-14) should be given. These symbols should be marked on plates along with Braille & raised alphabets; be mounted on wall next to door near the latch side and at a height between 1400 mm-1600 mm;
- Warning strip/ thin rubber doormat should be provided 300 mm before and after the toilet entrance.

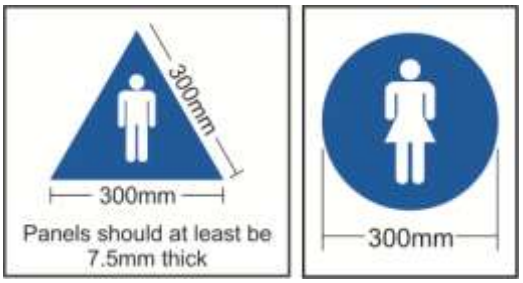


Figure 5-14: Pictogram and embossed toilet signage

5.1.17 Unisex Accessible Toilets

5.1.17.1 Signage

- All unisex accessible toilets to have access symbol in contrast colors (Figure 5-15); and
- A distinct audio sound (beeper/clapper) may be installed above the entrance door for identification of the toilets.

Figure 5-15: Signage for accessible washroom

5.1.17.2 Door

- The toilet door should be an outward opening door or two-way or a sliding type and should provide a clear opening width of at least 900 mm; and
- It should have a horizontal pull-bar, at least 600 mm long, on the inside of the door, located so that it is 130 mm from the hinged side of the door and at a height of 1000 mm (Photo 5-12).

Photo 5-12: Unisex accessible toilet

5.1.17.3 Compartment Dimensions

- The dimensions of a unisex toilet should be at least 2200 mm and 2000 mm. This will allow use by both manual and motorized wheelchair users; and
- Layout of the fixtures in the toilet should be such that a clear maneuvering space of 1500 mm x 1500 mm in front of the WC and washbasin is provided.

5.1.17.4 Water Closet (WC) Fittings

- Top of the WC seat should be 450-480 mm above finished floor level, preferably be of wall hung or corbel type, as it provides additional space at the toe level;
- An unobstructed space 900 mm wide should be provided to one side of the WC for transfer, together with a clear space 1200 mm deep in front of the WC;
- WC should be centered 500 mm away from the sidewall, with the front edge of the pan 750 mm away from the back wall;
- Have a back support. The WC with a back support should not incorporate a lid, since this can hinder transfer;
- L-shape grab bar at the adjacent wall and on the transfer side (open side) swing up grab bar shall be provided; and
- The cistern should have a lever flush mechanism, located on the transfer side and not on the wall side and not more than 1000 mm from the floor.

5.1.17.5 Grab Bars

- Grab bars should be manufactured from a material which contrasts with the wall finish (or use dark tiles behind light colored rails) and provide good grip;
- It is essential that all grab bars are adequately fixed, since considerable pressure will be placed on the rail during maneuvering. Grab bars should sustain weight of 200 kgs minimum;
- A hinged type moveable grab bar should be installed adjacent to the WC on the transfer side (Figure 5-16). A distance of 320 mm from the centre line of the WC between heights of 200-250 mm from the top of the WC seat. It should extend 100-150 mm beyond the front of the WC; and
- A fixed wall-mounted L- shape grab bar (600 mm long horizontal and 700 mm long vertical) on the wall side should be provided. It should be placed at a height of 200-250 mm above the WC seat level.

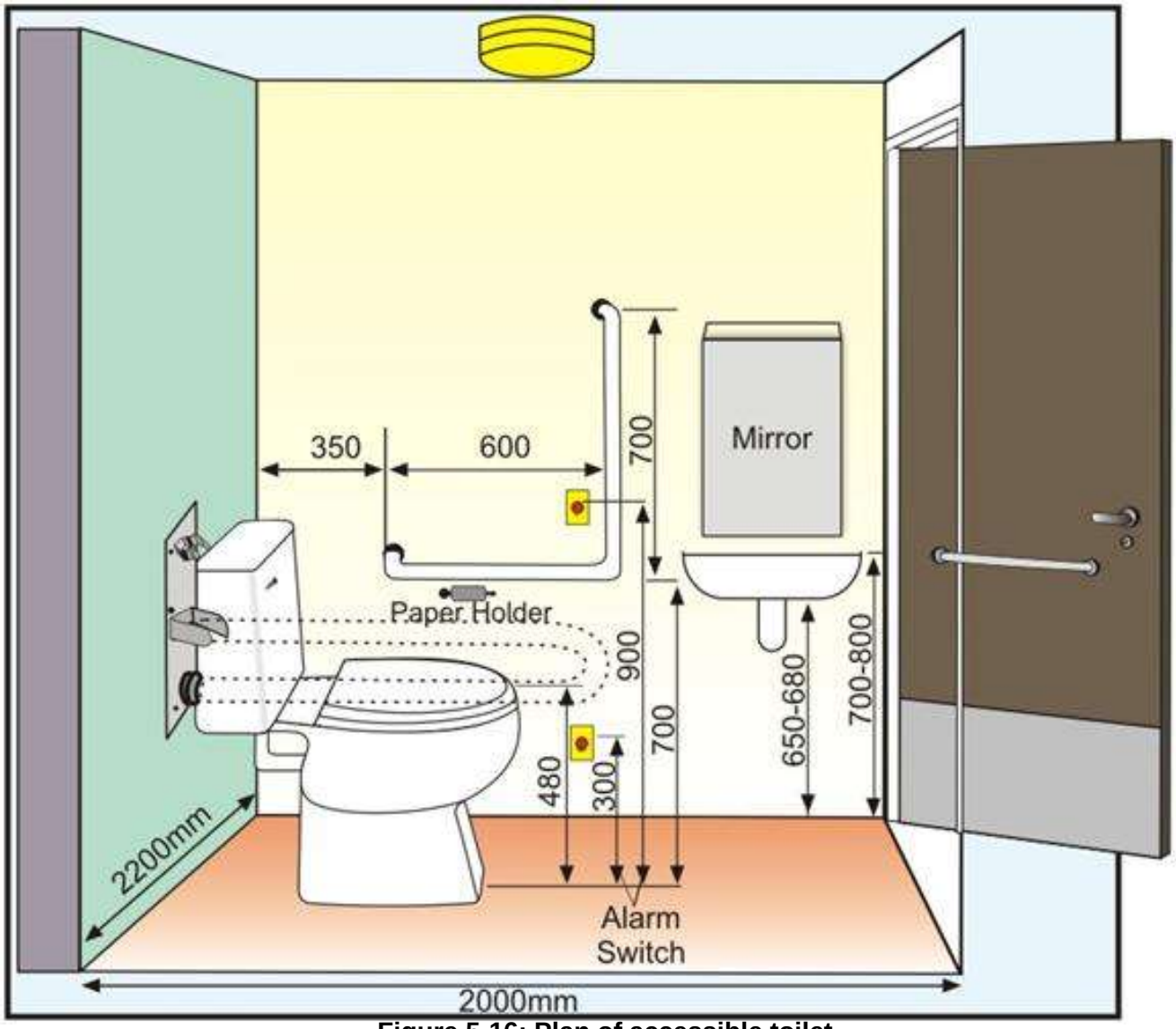


Figure 5-16: Plan of accessible toilet

5.1.17.6 Washbasins

- Washbasin should be fixed no higher than 750 mm above the finished floor level (Photo 5-13);
- Be of dimensions 520 mm and 410 mm, mounted such that the top edge is between 800- 900 mm from the floor;
- have a knee space of at least 760 mm wide by 200 mm deep by 650-680 mm high (Figure 5-17);
- The position of the basin should not restrict access to the WC i.e. it should be located 900 mm away from the WC; and
- The hand drying facilities should be located close to the hand washbasin between 800-1000 mm.

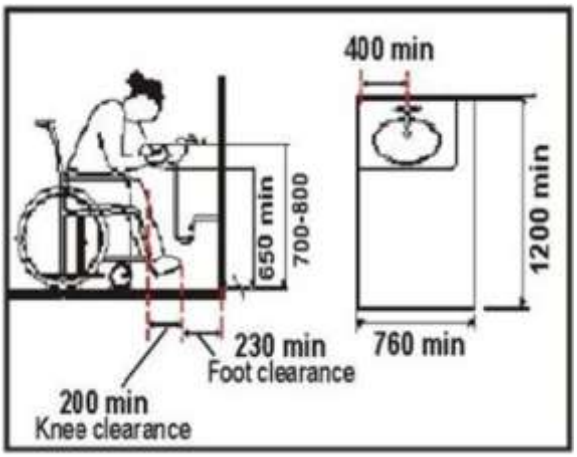


Figure 5-17: Washbasin standards

Photo 5-13: Washbasin with leg space

8.1.17.7 Fixtures and Fittings

- Contrast between fittings and fixtures and wall or floor finishes will assist in their location. Towel rails, rings and handrails should be securely fixed to the walls and positioned at 800-1000 mm from the floor;
- The mirror should be tilted at an angle of 30^0 for better visibility by wheelchair users.
- It should have lower edge at 1000 mm above floor finish and top edge around 1800 mm above floor finish;
- Hooks should be available at both lower-1200 mm and standard heights-1400 mm, projecting not more than 40 mm from the wall;
- Large, easy to operate switches are recommended, contrasting with background to assist location, at a maximum height of 1000 mm above floor finish; and
- All toilet facilities should incorporate visual fire alarms that can be summoned both when on the toilet pan i.e. at 900 mm height and lying on the floor i.e. at 300 mm, from floor surface.

5.1.18 Accessible Urinal

- At least one of the urinals should have grab bars to support ambulant persons with disabilities (for example, people using mobility aids like crutches);
- Urinals shall be stall-type or wall-hung, with an elongated rim at a maximum of 430 mm above the finish floor. This is usable by children, short stature persons and wheelchair users;
- Grab bars to be installed on each side, and in the front, of the urinal (Figure 5-18);
- Urinal shields (that do not extend beyond the front edge of the urinal rim) should be provided with 735 mm clearance between them; and
- The front bar is to provide chest support; the sidebars are for the user to hold on to while standing.

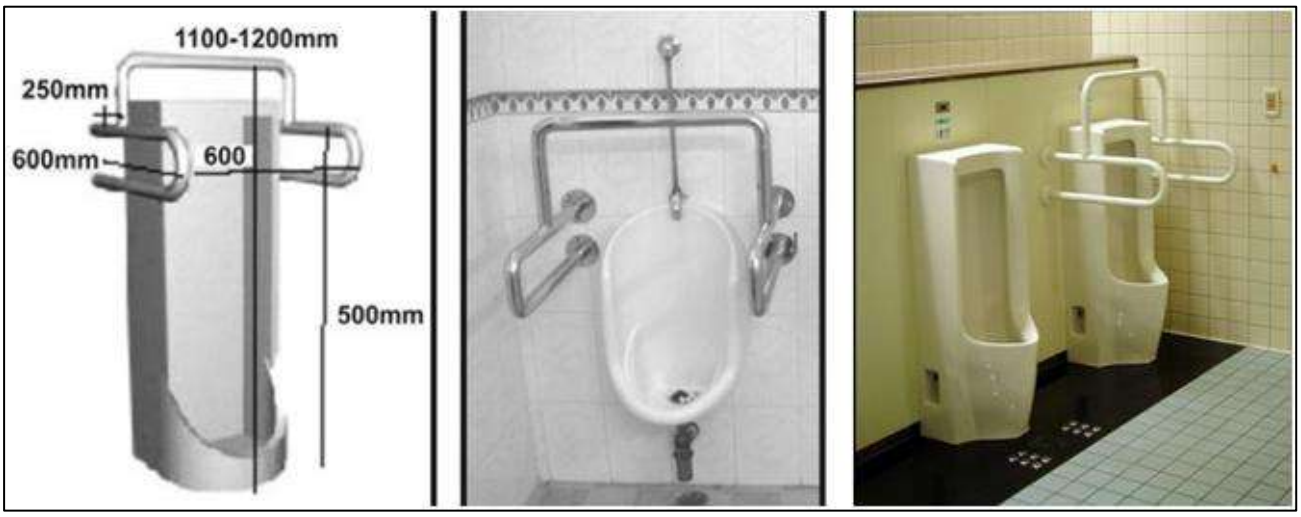


Figure 5-18: Urinal with chest support bar

5.1.19 Drinking Water Units

- Drinking water fountains or water coolers shall have up front spouts and control;
- Conventional floor mounted water coolers should be mounted on the side of the cooler 800 mm above the floor;
- Fully recessed drinking water fountains are not recommended; and
- Leg and knee space to be provided with basin to avoid spilling of water (Photo 5-14). This allows both front and parallel access to taps for persons using mobility aids like wheel chair, crutches etc.

Photo 5-14: Lowered water fountain with leg and knee space

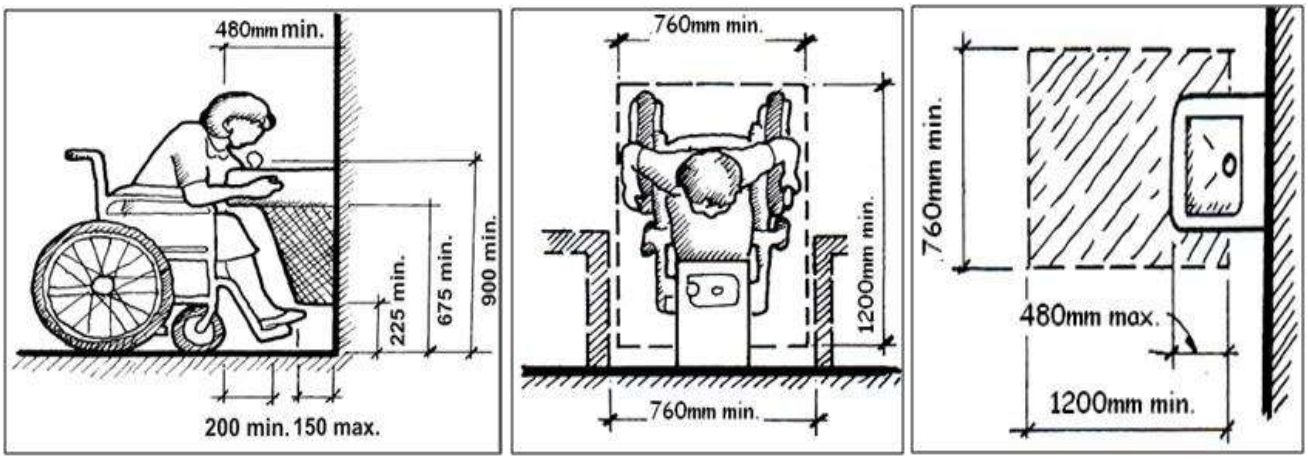


Figure 5-19: Accessible drinking water unit

5.1.20 Emergency Egress/Evacuation

Placement (accessibility) and visibility of such devices is very important. The following is to be considered for the installation of such alarm devices; fire alarm boxes, emergency call buttons and lit panels should be installed between heights of 800 mm and 1000 mm from the furnished floor surface. These should be adequately contrasted from the background wall, be labeled with raised letters and should also be in Braille.

Alerting Systems

In emergency situations, it is critical that people are quickly alerted to the situation at hand. Consider having audible alarms with 'voice instructions' that can help guide them to the nearest emergency exit. As an alternative to the pre-recorded messages, these alarms may be connected to the central control room for on-the-spot broadcasts.

Non-auditory alarms (visual or sensory) to alert persons with hearing impairments should be installed at visible locations in all areas that the passengers may use (including toilet areas, etc.). For e.g. flashing beacons helps in raising alerts.

Written Evacuation Procedure

A written evacuation procedure that details the egress plan should be installed behind the entrance door in the accessible rest rooms. The evacuation procedure should be detailed in large print letters that contrast strongly against the background. Where possible, it should also incorporate raised letters and Braille. The evacuation route should be displayed on a high contrast tactile map for benefit of persons with visual impairments.

Emergency Evacuation Route

- Designate routes that are at least 1200 mm wide, to ensure that a person using a wheelchair and a non-disabled person are able to pass each other along the route. The route should be free of any steps or sudden changes in level and should be kept free from obstacles such as furniture, coolers, AC units, and flowerpots etc.

- Use 'Exit' signage along the route. Orientation and direction signs should be installed frequently along the evacuation route and these should preferably be internally illuminated. The exit door signage should also be internally illuminated.

- A 'way guidance lighting system' consisting of low mounted LED strips to outline the exit route (with frequent illuminated direction indicators along the route) should be installed along the entire length of the evacuation route. Way guidance systems allow persons with visual impairments to walk significantly faster than traditional overhead emergency lighting. Moreover, emergency exit lights in green color and directional signals mounted near the floor have been found to be useful for all people in cases where a lot of smoke is present.

Way Guidance System

- Luminance on the floor should be 1 lux minimum provided on along the centre line of the route and on stairs.
- Install clear illuminated sign above exit and directional signage along the route.
- The directional exit signs with arrows indicating the way to the escape route should be provided at a height of 500 mm from the floor level on the wall and should be internally illuminated by electric light connected to corridor circuits.

Fire Resistant Doors

Fire resistant doors and doors used along the emergency evacuation route are generally heavy and the force required to open these is much higher than 20 Newton, making it difficult for persons with disability to negotiate these doors independently. There are, however, magnetic and other types of door holders available that can be connected to fire alarms so that they will hold the doors open normally but will release the doors when the fire alarm is activated.

Chapter- 6
Wayfinding and Signage

6. Wayfinding & Signage

Universal Wayfinding Signage outlines a practical and comprehensive design methodology to use signage with an inclusive design approach. Signage guides and enables the person to reach a given destination on time without any mishaps. Way finding signage to be considered as an integral part of the design whenever a new facility is being planned. Markings are used complementary to signage and comprehensive information regarding signage type, height, etc. is provided in Annexure IV. The inclusive design principles, techniques, strategies and solutions given in this chapter will help resolve problems associated with signage systems and wayfinding.

6.1 What can be done

Wayfinding: Way finding references should be available at decision points. While providing way finding cues, following checks and measures (Samarthyam, 2013) should be taken care of:

- Users need clear instruction regarding the purpose and layout of the space to maintain a sense of direction and independent usage.
- Color can be used to identify routes and provide assistance in locating doors, walls and hazards. Proper color contrast between different elements greatly improves visibility for all users and is critical for persons with low vision. For example, color contrasting of doorframes can assist in locating doors, and likewise floors should be contrasted with walls. In addition, furniture should contrast with walls and floors so as not to create an obstacle.
- Structural elements such as columns should be color contrasted or brightly marked so as to be visible to those who may have a visual disability.
- Generally, patterns on flooring should be avoided or else should be minimal and small to avoid visual confusion.
- In addition to identifying hazards or warnings, tactile floor surfaces can also be used to inform that there is a change in area (e.g. leaving a corridor and entering a boarding area).
- Tactile systems should be consistent throughout the building. For example, terminals should not have mats/carpeting in some areas and tile in others as this may create confusion for those who rely on tactile surfaces to guide them to their destination.
- Good lighting assists those with a visual disability to see better and allows people who have a hearing impairment to lip read easier. However, care should be taken to properly direct lighting and to use matte finishes on floors, walls and signage, so as not to create glare, which may create difficulties for all travelers.
- Blinds can be used to adjust lighting levels in areas where the natural lighting changes significantly throughout the day.

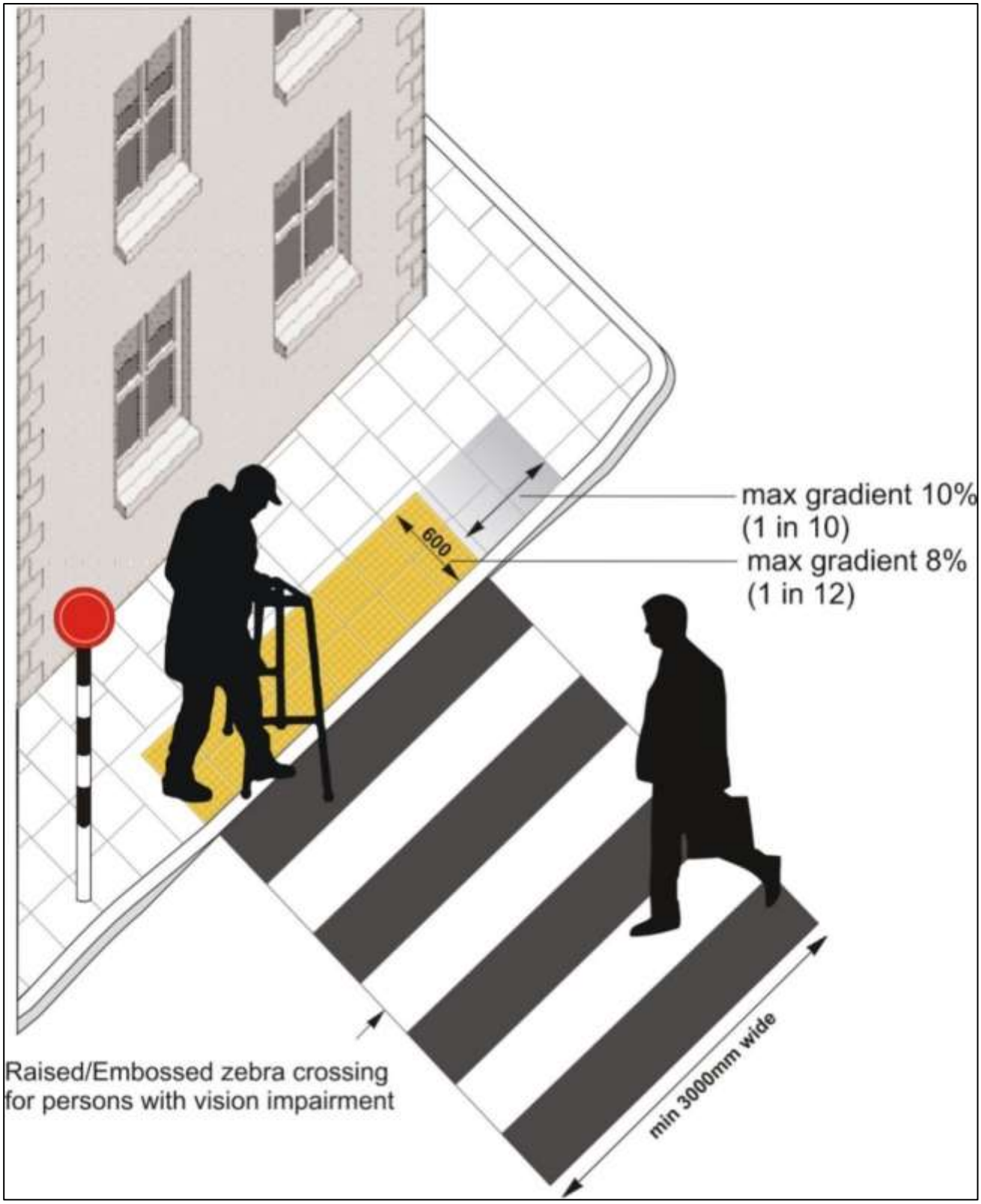
Signage:

- Signs should be mounted between 1400 mm and 1800 mm from floor level. Braille signboards should be located between 1400 mm to 1600 mm for accessibility and touch for persons with visual impairments;
- The surface of the sign should not be placed behind glass nor should it be reflective.
- Signs should be raised wherever possible so that they can be read by touch;
- Contrasting colors should be used to differentiate the signage content from the background of the sign. Typically white if used for the content and blue for the background. The colors must contrast with the surrounding surface to be clearly distinguishable. The color combinations red/green and yellow/blue should not be used in order to avoid confusing persons who are color blind;
- Audio signals should be installed at entry, exit and important movement junctions such as entrance lobby, lift, stairways, escalators etc;
- Illumination levels on the sign surface should be in 100 - 300 lux range and shall be uniform. Signs should be located such that the illumination level on the surface is not exceeded by the ambient light or a visible lighting source from behind or in front of it;
- Sign typefaces must be standard, legible and clearly discernible. Only Sans serif family of fonts are recommended such as Arial, Helvetica Medium, Futura etc. Usage of too many type sizes on any one sign should be avoided. Italics or script texts should be avoided. The size of the letters must be in proportion to the viewing distance. Character width – to height ratio should be between 3:5 and 1:1 and the character stroke width-to-height ratio should be in between 1:5 to 1:10;
- The smallest letter type should not be less than 15 mm. All building entrances, house numbers and similar signage should be 150 mm; identification or directional signs should be 50-100 mm; while symbols should be at least 100 mm in height;
- Maps and information panels at building entrance, along roads and on public buildings should be placed at a height between 900 mm and 1800 mm; and
- Overhanging signs should allow a minimum clearance of 2300 mm to allow person with visual impairment to pass safely.

6.2 Design Standards

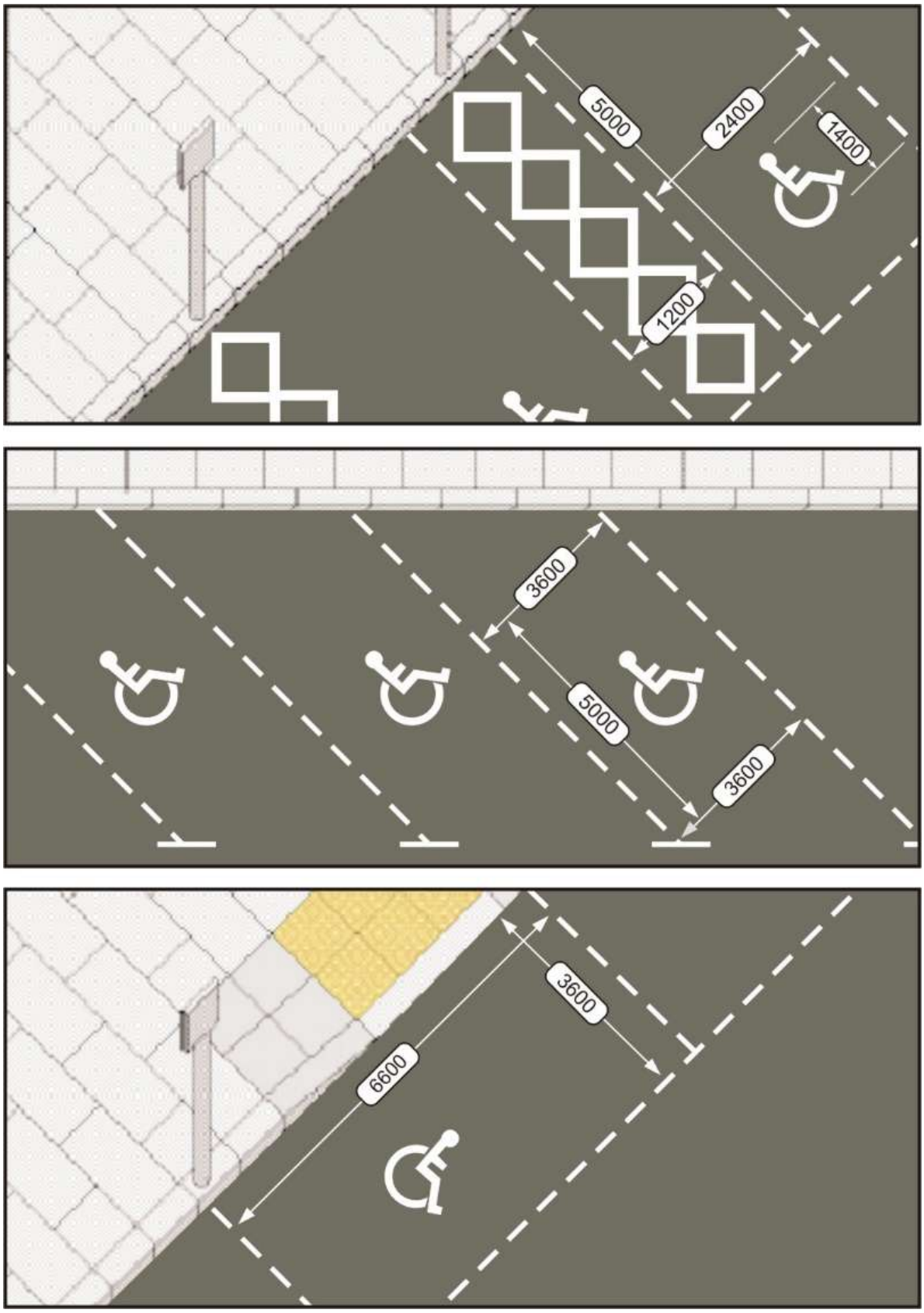
6.2.1 Road Marking

Figure 6-1 show raised/embossed zebra crossing for persons with visual impairment, which is detectable by white cane and shoe sole. Figure 6-2 shows markings and measurements of accessible parking bays reserved for persons with disabilities.



Recreated: (Department for Transport, 2002)

Figure 6-1 Raised/ embossed zebra crossing



Recreated: (Inclusive Mobility- A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure, 2002)

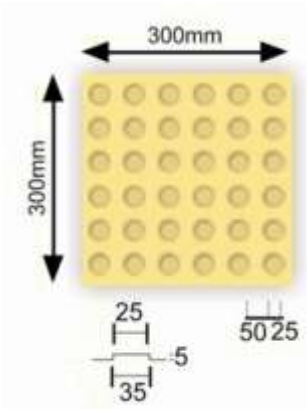
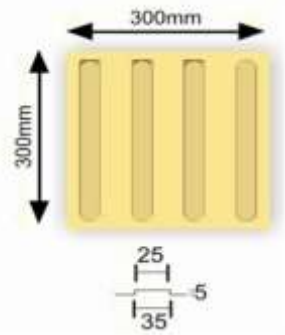
Figure 6-2 Parking bays for persons with disabilities

6.2.2 Tactile Markings and Wayfinding

Way finding systems incorporate a range of alternatives to traditional signs. These can include Geographic Information Systems (GIS), Global Positioning Systems (GPS), as well as personal devices used by persons who are blind or visually impaired. In some applications a traditional sign may not be the most effective method of conveying relevant information. Common alternative formats can be used to assist people who are best able to interpret information through hearing or touch (Samarthyam, 2014).

Some common alternative methods for consideration include:

Tactile ground surface indicators (DFID and Samarthyam , 2011)**–** A system of raised domes and stripes placed in patterns on the ground to provide tactile information. This arrangement of tactile ground surface indicators (TGSI) directional and warning (decision-making) tactile tiles, provides a direction of travel to what is commonly referred to as a 'shoreline', the building's edge or a physical property edge. The color and luminance contrast of the TGSIs provide information to people who are blind or visually impaired about direction and potential hazards. They are able to read these tactually though the soles of their shoes, with a cane and any remaining residual vision that they may have. These are readily available in the domestic Indian market.

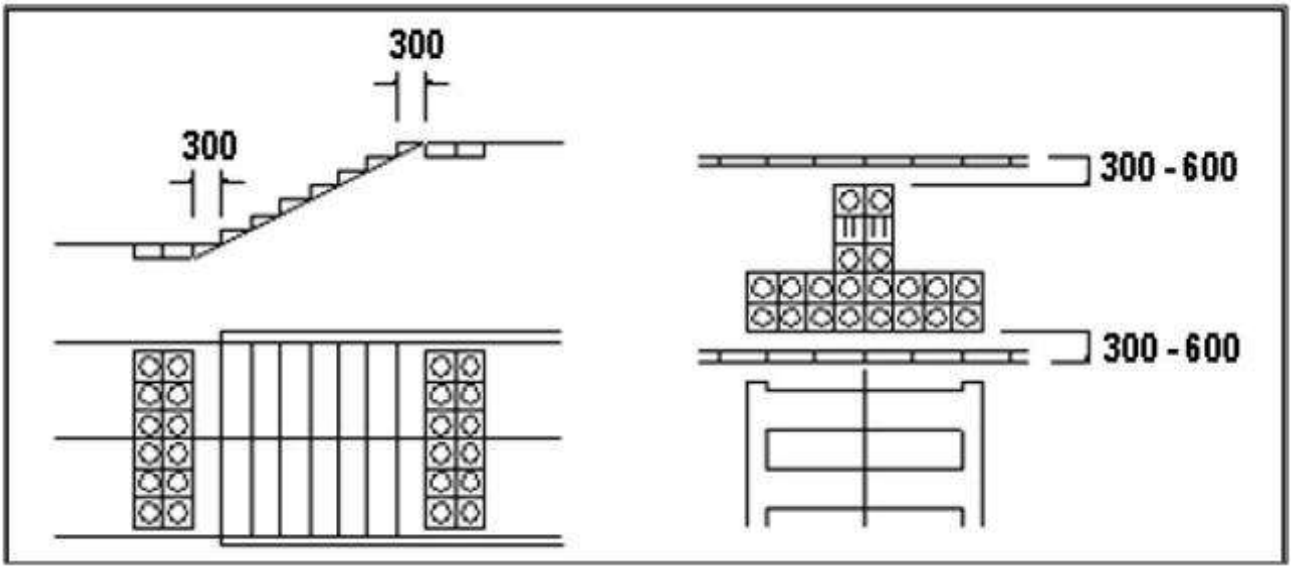
Tactile Guiding Blocks	Tactile Warning Blocks
These are 300 x 300 mm tiles that incorporate flat topped bars that are 5 mm (± 0.5 mm) high, 25 mm wide and spaced 50 mm from the centre of one bar to the centre of the next. They are used externally to guide persons with visual impairments along the circulation path (Figure 18). They may also be used internally in large busy areas such as railway stations and airports. 	These are 300 mm x 300 mm tiles that incorporate rows of 5 mm (± 0.5 mm) high flat-topped blister like domes. These indicate a potential hazard or change in direction installed within or on a ground surface in both the internal and external environment. In order to warn persons with visual impairments of the approaching danger, along the approach path to unavoidable obstacles and hazards, warning blocks are used. 

Source: (CPWD & MoUD, 1998)

Places to install warning paver as given in Figure: 6-3, 6-4 and 6-5:-

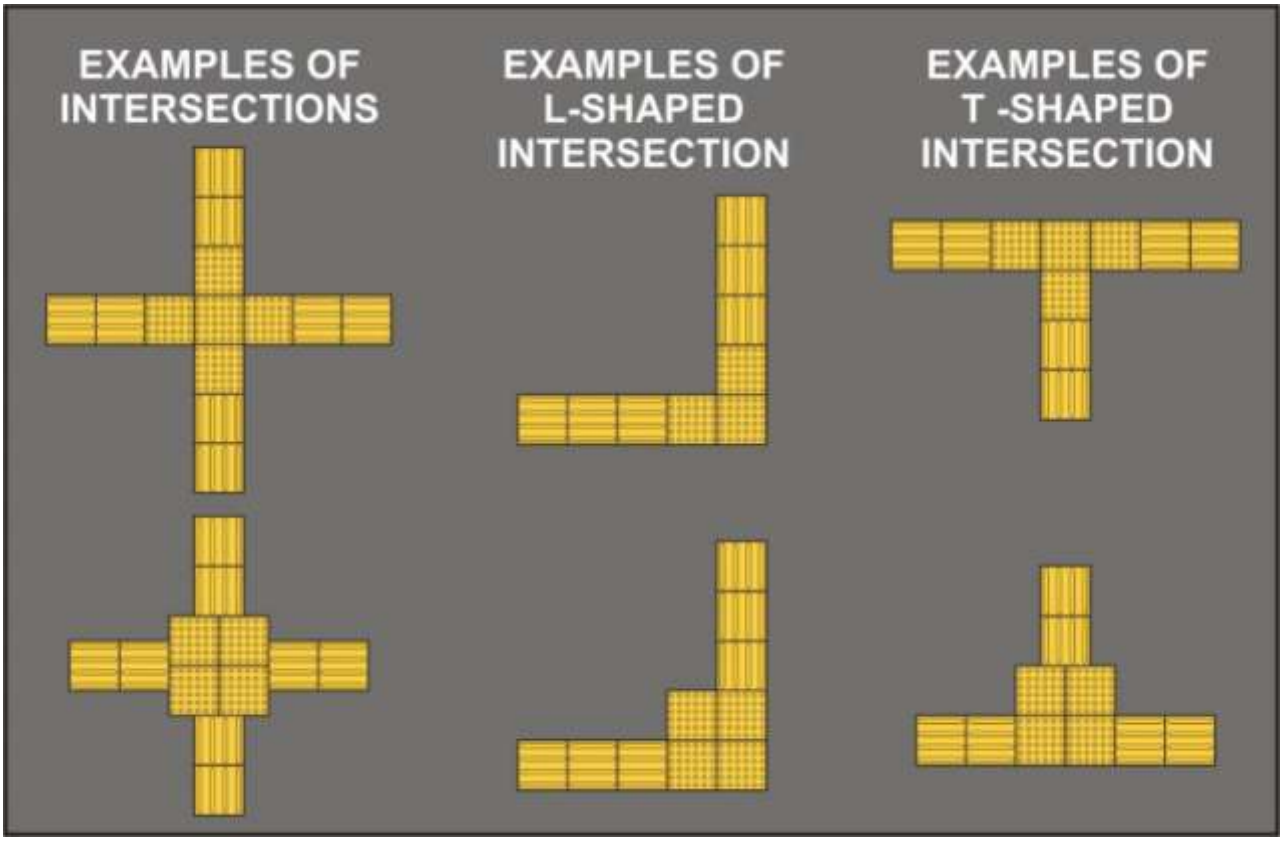
- In front of an area where traffic is present;

- In front of an entrance/exit to and from a staircase or multi-level crossing facility; and
- Entrances/exits at public transport terminals or boarding areas.



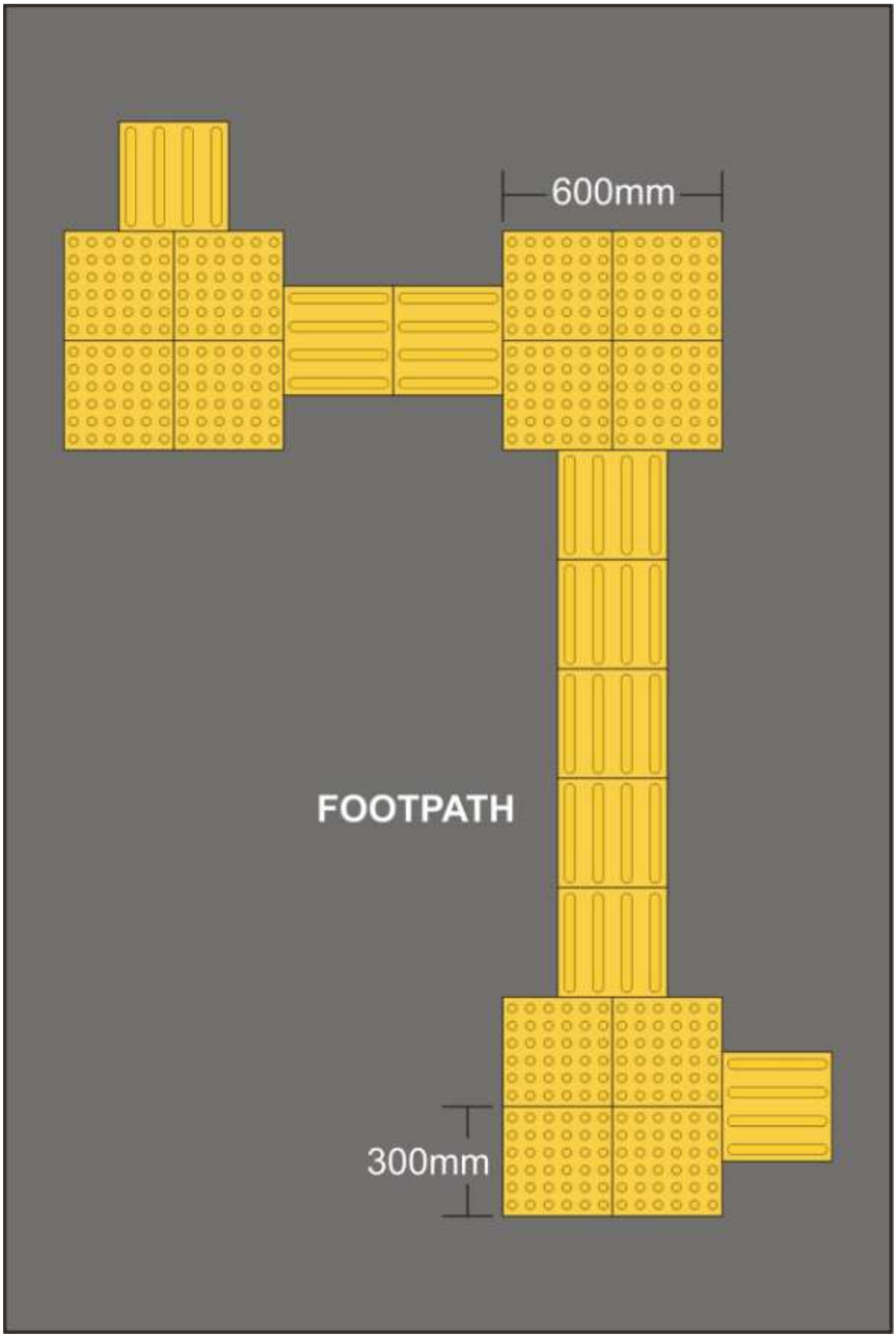
Modified from: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 6-3: Placement of warning paver for steps



Recreated: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 6-4: Configuration of guiding and warning paver



Recreated: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 6-5 Guiding path and approach footpath to the building

In some situations, appropriate signs are required to include Braille and tactile components to assist persons with visual impairment (Photo 6-1). Some areas where Braille and tactile signage may be required include:

- accessible entries
- directions and information signs regarding functional area
- directions to nearest accessible facility, posted at non accessible facilities
- designated areas for emergency assistance
- elevator and lift signage
- Approaching stairways, escalators, ramps or overhead obstructions less than two meters above the ground where no suitable barrier exists.

Photo 6-1 Tactile paver to guide and warn persons with visual disabilities

6.2.3 Elements of Signage Design

All signs should be treated consistently in terms of the basic principles used in determining their layout, specifically: lettering, color, shape, size, design and placement (Samarthyam, 2014). A detail of language and letters is given in Table 6-1.

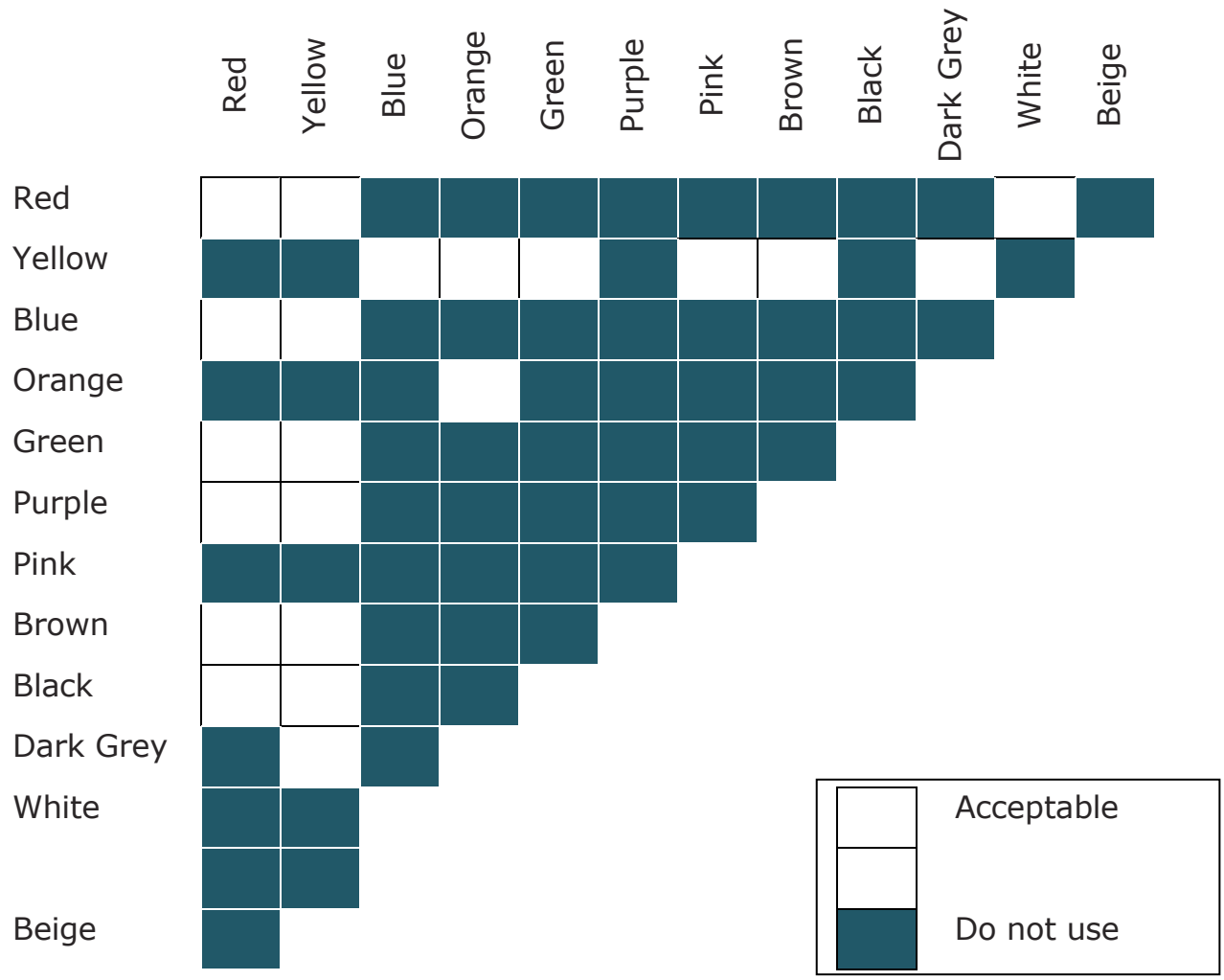
Table 6-1: Elements of signage design

Elements	Do's	Don't
Language	Should be clear, concise and unambiguous to enable ease of interpretation	Where words are required, 'Accessible' rather than 'Disabled' or "Differently Abled" is preferred as it promotes inclusion for all users. "Disabled Ramp", "Disabled Lift", etc. are not preferred rather the facility should be used by persons with disabilities and reduced mobility to ensure that these are not locked, and are regularly maintained and cleaned.

Elements	Do's	Don't
Letters	• Should be mix of Upper and lower case letters • Should be Left justified • should be raised by 1 mm min. with Braille • Minimal use of bold type • Consistent font stem widths • Avoid italics, condensed text, light stems • Should have legible directional arrows	• Usage of too many type sizes on any one sign. • Italics or script texts.
Color	• Painting objects with contrasting colors can greatly enhance safety and ease of use. • The color combinations red/green and yellow/blue, in order to avoid confusing persons who are color blind. • Avoid using shades of the same color in the sign and avoid using same colors as safety signs.	• The recommended color contrast between the letters and background is a 70 point LRV difference.

Some typical colors used for enhancing visibility. The basic principle is that the color should contrast with its surroundings. Colors, which appear to be different from each other can be very similar in terms of reflectivity, and not provide sufficient contrast (e.g. brown and green). A commonly used color scheme is white for content and navy blue for the background. Other good contrasts include black/brown/dark green on white/cream or vice versa. Using different colors for different signage types provide a distinct identification tool especially from a distance. E.g. Mandatory Traffic signs in yellow, Identification signs in blue, Historic sites in brown (Overseas Road Note 21, 2004), (Samarthyam, 2014). Schedule for color contrast with sign background is given in Table 6-2.

Table 6-2 Schedule for color contrast



Derived from: (Overseas Road Note 21, 2004)

Basic principles for color contrast:

- Content should contrast with sign background
- Sign should contrast with surrounding surfaces
- Light levels (measured in Lux)
- 70% contrast between wall and sign panel
- Avoid using shades of colors
- Avoid using the same color for safety signs
- Use a maximum 5 colors
- Surface should be non-reflective

Table 6-3: Typical schedule of color contrast for signs

Signage Background	Signage Content	Surrounding Surface	Example
White	Black, dark green or dark blue	Red Brick or Dark Stone	
Black/dark	White or Yellow	Light brick or light stone	
Black/Dark	White/Yellow	Whitewashed walls	
White	Black, dark green or dark blue	Green Vegetation	
Black	White or yellow	Back-lit sign	

Visual contrasts: Visual contrasts means adequate contrast created by difference of at least 30 LRV (Light Reflectance Value) of the two surfaces/ objects and it helps everyone especially persons with visual impairments.

- Visual contrast should be provided between:
  - Critical Surfaces (walls, ceiling and floor),
  - Signage and background sign frame/ wall,
  - Barriers and hazards should be highlighted by incorporating colors and luminance contrast (Photo 6-2 and Photo 6-3).

Photo 6-2: Signage in contrast color

Photo 6-3: Elevator, handrails and tactile pavers in good color contrast to surrounding walls

Signage dimension

Viewing distance and size of signage is given in Table 6-4.

Table 6-4: Size of signage

Viewing Distance	Size of signage
Up to 7 meters	60 mm x 60 mm
7 meters – 8 meters	100 mm x 100 mm
Exceeding 8 meters	200 mm x 200 mm to 450 mm x 450 mm

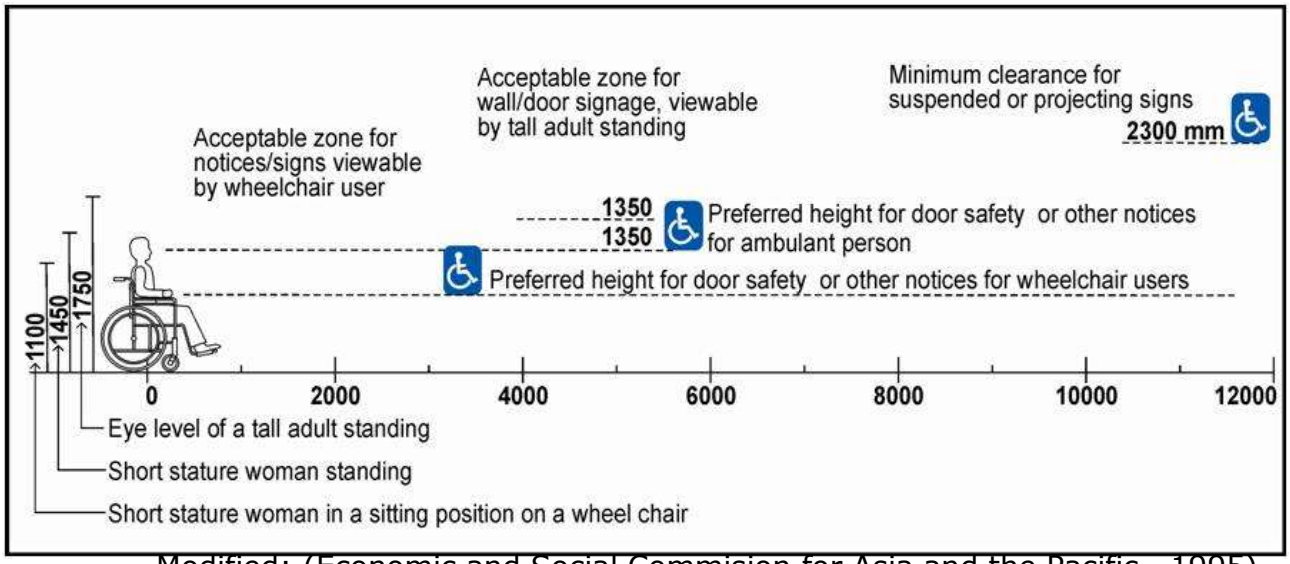
In Table 6-5 viewing distance and height of letters is given.

Table 6-5: Size of Letters in signage

Viewing Distance	Height of letters
2 - 3 meters	15 mm
6 meters	20 mm
8 meters	25 mm
12 meters	40 mm
15 meters	50 mm
25 meters	80 mm
35 meters	100 mm
40 meters	130 mm
50 meters	150 mm

Viewing distances for signage

- Long distance signage include fascia signs, external location, external direction, building numbers;
- Medium range includes location + direction, identification signage; and
- Close range would include room signs, directories, wall mounted information, etc.



Modified: (Economic and Social Commision for Asia and the Pacific , 1995)

Figure 6-6: Viewing distances for signage

Location of signs

- Signs should be provided at all sites, terminuses, developments and buildings in appropriate locations including approach to building / facility / service, entrance/ exit, public facilities such as fire exits and parking etc.;
- Directional signs should readily identify and provide a logical sequence from a starting point to a point of destination and a clear indication of return routes to named exits. The names of destinations should be consistent throughout the signing system;
- A clear indication of the existence of steps or ramps on a route should be provided at both ends of the route;
- Information and direction signs should be provided at junctions of circulation routes and key destinations such as doorways, at reception points, at facilities such as telephones, drinking water facility, toilets, and in areas where hearing enhancement systems are fitted;
- Signs to facilities for persons with disabilities should incorporate the International Symbol for Accessibility;
- Universally recognized symbols/pictograms should be used to replace text, wherever possible. Other symbols should supplement text, but should not be used in isolation. Symbols are an essential aid for persons with learning difficulties; and
- A wall mounted or ceiling hung information board should be provided at lift landings, floor level landings of staircases, and at other major decision points (junctions/intersections) in main circulation routes.

Signage locations outside public terminals/ stops

- Outdoor signs can be fixed to the ground- freestanding, fixed to walls, poles, and posts or suspended from above. Raised lettering on a building represents a good long term value in terms of cost effectiveness and longevity. It gives a building an identity due to its size and scale that cannot be achieved by post signs. They should be located away from reach of passing pedestrians.

Sign location inside the public terminuses

- Signs should be located where they are clearly visible (Figure 6-7);

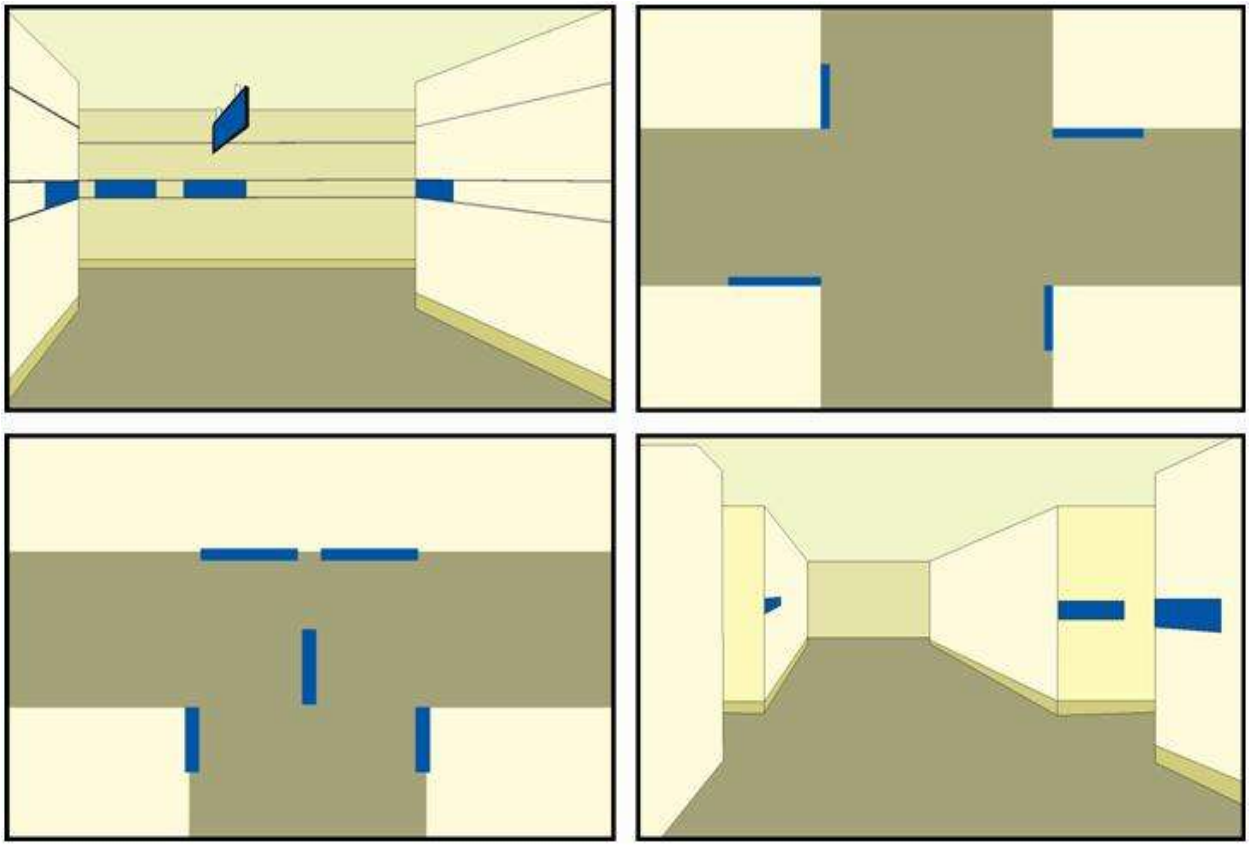


Figure 6-7: Sign location inside the public terminuses

- A person with low vision may be able to read a sign if they can approach the sign for close up viewing. Wall-mounted signs that contain detailed information; timetables, maps or diagrams, should be centered around 1400 mm from the ground, with the bottom edge not less than 900 mm from the finished floor level and the top edge up to 1800 mm from the finished floor level (Figure 6-8);
- Signs should be positioned in way that the reader does not obstruct circulation paths. Position projecting or ceiling suspended signs above head height at 2300 mm from floor level. Although it is important that the sign does not create a head height obstacle, it is equally important that the size of the lettering increase in proportion to the distance from the reader;
- Top of building directory signage, building direction signage and bulletin board signs should be 1800 mm from the finished floor level;

- Room number and identification signage to be at 1400 mm from the finished floor level to bottom of the sign, and 50 mm from the door frame. In case of tile wall, the closest horizontal joint should be used; and
- Detailed signs and instructions, especially safety notices, should be located at both high and low levels, i.e. at 1600-1700 mm and at 1000-1100 mm to allow convenient close viewing by wheelchair users.

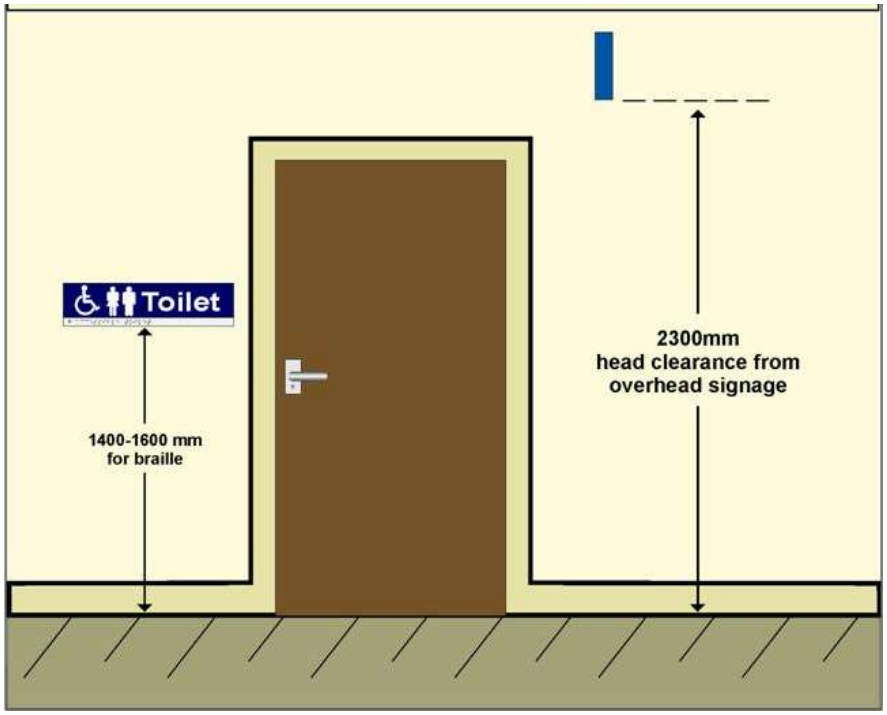


Figure 6-8: Signage placement for a room

6.2.4 Layout and Design

In the design of a signage system, the following components must be kept in mind:

i. Pictograms
ii. Accessibility Symbols
iii. Alternative formats etc. embossed letters with Braille
iv. Maps and Models
v. Audio/ Visual Information
vi. Lighting and Illumination (measured in lux)

i) Pictograms

Signs should incorporate a combination of lettering and symbols to maximize effectiveness. Not only does this assist persons with Autism, intellectual disabilities and multiple disabilities as well as those who are unfamiliar with the local language, cultures and customs. Symbols used should comply with both national and international standards (Figure 6-9), which benefits local users and visitors alike and transcends language barriers.

Figure 6-9: Drinking water (left), water bell for fire alarm (middle), no smoking (right)

ii) Accessibility symbol

The International Symbol of Accessibility (Figure 6-10) must be displayed at all accessible entrances. If an entrance is not accessible, directions to an accessible route, including the symbol, must be provided. Similar guidelines refer to elevators, evacuation and refuge areas, restrooms and bathing facilities. Symbols of accessibility are also required to identify volume control telephones, text telephones, and assistive listening systems. Colour to be navy blue with white lettering, symbols and border and size to be 200 mm x 200 mm square with 1.25 mm border.

The specific pictograms shown in Figure 6-11 to Figure 6-14, are required in certain signage situations. (TRIPP, 2012)

Figure 6-10: International symbol of accessibility

Figure 6-11: Ramp

Modified: (IUT, 2013)

Figure 6-12: Accessible public telephone

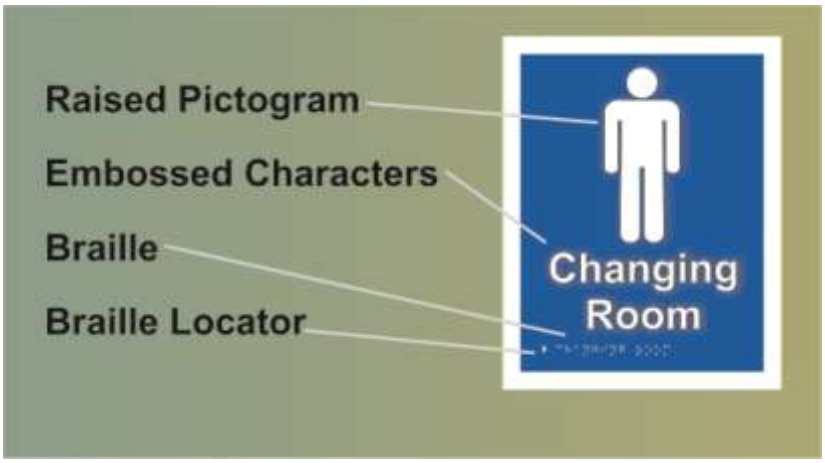
Figure 6-13: Unisex accessible toilet

Adapted from: (IUT, 2013)

Figure 6-14: Accessible parking signage

iii) Alternative formats etc. embossed letters with Braille and tactile

Braille, embossed letters, raised pictograms and raised arrows are tactile features that can be incorporated into signs, which can be particularly helpful to persons with visual impairment. This can occur in many ways but where signs are concerned a person who reads a sign tactually would want to experience all the information which is to be read as raised above the surface of the sign (Figure 6-15).



Source: (CPWD, 2014)

Figure 6-15: Raised pictogram and Braille signage

This information would include pictograms, text and Braille or if the sign includes mapping elements then every element on the map would be raised above the element on which it is positioned. Such signs or directory layouts/maps need to be installed at appropriate heights and locations so that people in both standing and seated positions can access these.

Braille signage should not replace tactile/raised text signage as many people who are blind or visually impaired do not use Braille as their primary form of communication.

iv) Maps & models

Tactile maps –which consist of raised lines or characters to assist interpretation by touch. These are particularly useful where way finding issues exist.

- A map or model can be particularly helpful for persons unable to read signs, are unfamiliar with the language or who may not be able to understand written directions;
- Outside the building a color blocked simplified plan with key destinations and routes marked, or a 3D perspective view is easy for most people to follow;
- The effectiveness of a simplified floor plan, identifying key facilities and services is the most effective tool within a building;
- A 3D model provides perspective views of a building or site, which is easier for a layperson to visualize (Photo 6-4). Plan views can be hard to visualize if they are too complicated;

- A tactile map or model is a useful way of providing information to persons with visual impairments who wish to navigate around a building. This includes relief or embossed line-work with Braille. It may lights to identify spaces and audio feedback buttons; and
- These should be located at key areas of a site to direct vehicular movement where confusion may arise. In the interior of a building, it should be located in the entrance lobby in an area of clear visibility, within reach without being an obstruction.

Photo 6-4: Tactile map (Hong Kong) and tactile map with audio (Tokyo), Subway system

v) Audio/ Visual information

Audio signs, which can play a recorded message when touched or activated by a person's movement or presence. Information can be provided in various formats, languages or methods of transmission.

- Audible announcements are helpful to most people but particularly to persons with visual impairments;
- It is essential that there is a significant difference between the level of background noise and the level of the signal or announcement;
- Persons with hearing impairment require at least a +5dB S/N ratio;
- In environments that are noisy, any spoken information should be repeated at least once;
- Audible alarm systems should operate at least 15dBover the prevailing sound level, with a maximum of 120dB; and
- Locate 3D maps and tactile models, close to elevators and in areas of potential hazards.

vi) Lighting and illumination

Illumination for signage should be designed to minimize light and glare on surrounding roads and properties. External light sources should be shielded so that they do not produce glare off the site, on any object other than the sign. No direct or indirect light should create a hazard for pedestrians or motorists. Also, coloured or flashing lights should not be used that can be confused or taken as traffic control devices. For energy conservation, light sources should preferably be compact fluorescent or LED lamps, or other lighting technology that is of equal or greater energy efficiency. Incandescent lamps should be avoided, as these are not conducive to persons with Autism.

Signs should have a matt finish, not a shiny or glossy one, and should be well and evenly lit with uniform lighting over the surface of the sign of between 100 - 300 lux. Minimum acceptable level of lighting for directional signage, maps and text panel is 200 lux. Examples of what different lux levels would correspond to in every day terms:

Illumination	**Example**
1 lux	Moonlight
400 lux	A brightly lit office
400 lux	Sunrise or sunset on a clear day
1,000 lux	Typical TV studio lighting
32,000 lux	Sunlight on an average day (min)

6.2.5 Categories of Signage

Different categories of signage describe the various functions, content, and location of signs. Signs provide information, identify a department or service, or warn of hazards (Samarthyam, 2014). There are six categories of signage:

i. **Identification signs:** To signify arrival. Also called Destination Sign. Usually identify entrances, street addresses, buildings, rooms, facilities, places and spaces.
ii. **Directional signs**: For Way-finding- with arrows along travel routes are usually wall mounted or overhead signs and include directional arrows to direct users to specific areas or elements within an area. This can incorporate provision of signage at navigational decision points.
iii. **Information signs:** Provide detailed info- includes maps & directories with 'You are Here' labels, inform users about the features and facilities of a place or space. Information signs include directions, maps, building identification signs, notices and interpretative signs.
iv. **Safety, regulatory, prohibition and advisory signs:** Provide lifesaving directives and/ or mandatory rules to be followed.
v. **Temporary signs**: Used for a limited time, such as while there are workers, labors on site, wet floor, etc.

6.3 Implementation

- Create awareness, sensitization and capacity building of all stakeholders, architects, designers, builders, contractors, policy makers, government functionaries, NGOs, etc. to develop a comprehensive understanding on the need for planning and inserting way finding signage system in public spaces for creating accessibility for all types of users.
- Sign locations should be part of the process of planning a building and environment with its placement clearly defined.
- Cost for installation of building signage should be included in the general budget for building construction.

6.4 Maintenance and Monitoring

Materials: Signage Material should be non-reflective, non- glossy, preferably matt finish. Natural and artificial lighting should not produce glare on the signage surface. They should be capable of withstanding weathering over the life of the sign with little maintenance and anchored properly to account for climatic conditions including wind storms, rain and hail. Some suggested materials for signage are wood, acrylic, Aluminum Composite Panel (ACP), plexi glass, neon and matt-finished metal.

Maintenance: While planning, design and location of signs are all important considerations, maintenance of signs is equally important to consider. A system of signs needs to be permanent yet made such that it can be revised/ changed or replicated at a future time to reflect changes in a building/ site utilization a system of signs that are relatively permanent. These should be revised or recycled occasionally to reflect changes in building utilization. Permanence and longevity must be balanced with flexibility and adaptability to change.

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Annexure I

Literature Review

1. Identification of 'ALL' users and covering diverse access needs

It was found that universal design principles supersedes all other standards for use by people from trans-generation groups, diverse disabilities and persons with reduced mobility. A holistic approach is provided in international documents giving information on a range of technical, policy and practical issues. It involves engineers, planners, central and local government officials, policy makers, transport operators, and persons with disabilities, to enable them to work together towards improving the inclusive mobility of all pedestrians, NMV and public transport users.

2. Establishing clear indicators for Inclusiveness and Access

A paradigm shift from barrier free to universal accessibility supplemented with user needs is required in planning, design and implementation. Cities gearing up to be world class and inclusive, should have improved safety and independent mobility linked with reliability and affordability. Notwithstanding the diversity of possible approaches, literature review has paved the way for design principles to include SARA that highlights gender safety, age friendly, disability specific and cost effective measures for the community.

In addition to above, the review gives direction for design and implementation based on the following evidence-based approaches:

- Human-rights based approach
- Multi-sectoral approach
- Person-centered approach

3. Establishing standards for universal accessibility

The demand driven 'design for all' with rights based approach and international and national consensus on the ultimate goal – to provide equal access to all people, outlines the need for standards on universal accessibility. While some countries have amended their guidelines with access standards to gear up for refurbishment/ new construction, many others have implemented universal accessibility features highlighting 'not special but equal' provisions as mandated by their law.

Cities like Singapore, Manila, Putrajaya, etc. have demonstrated projects retrofitted for pedestrian only zones, which facilitates people to walk, cycle or use adapted mobility aids; unobstructed transferring from pedestrian areas to public transport infrastructure and better environment conditions. Because of the structural barriers, many people need assistance either from an escort or from drivers and other passengers. Yet other people's unwillingness or inability to give help in appropriate ways, whether because of attitude or of ignorance of the needs of persons with reduced mobility and persons with disabilities, is often felt to be a social barrier to mobility. Universal accessibility standards will help promote equity and reliability for people who assist persons with disabilities and facilitate their occasional or regular travelling/commuting.

As mandated in the Indian law and need of the huge population of persons with reduced mobility and persons with disabilities, it is imperative that universal accessibility standards be established and enforced.

4. Establishing conditions for improved environment

Environment is the most crucial and critical aspect that needs to be addressed in every facility, especially transportation, as it is the major cause for depletion of resources (air, water and soil). Therefore, by introducing shaded, more eco-friendly and pedestrian friendly pathways will eventually encourage all pedestrians walk and thereby reducing the use of private transportation. In addition, if the buffered zones run along NMV lanes and footpaths, this will positively add to carbon-oxygen balance and reducing the adverse effects of carbon emissions and other hazardous

gases. The inclusive street infrastructure like toilets, resting places, lighting at night, dustbins for clean environment and proper signage and signals will also encourage the diverse users to use footpaths and NMV lanes. However, continuity and consistency in terms of raised or leveled crossings, shaded pedestrian islands (to reduce heat effect) and inclusive grade separators will provide a welcoming environment for every pedestrian.

5. Establishing benchmarks for universal accessibility

The literature review also highlights the gap of set benchmarks for audits and surveys related to accessibility, walkability and safety audits of pedestrian and street design. While some NGOs/ CSOs have conducted walkability audits, they have recommended the need for 'disabled friendly' infrastructure only. However, the concentration is more on having kerb ramps and safe crossings, while a street design audit require much more linkages with safety and walkability standards of universal accessibility. The accessibility audits conducted in six cities of India highlight that walkability score is maximum near residential facilities and is minimum in public transport terminals.

Recently, in India, several Ministries, urban local bodies and development authorities have recognized the need for audits and third party intervention with users' perspective to improve the existing corridors and plan appraisal (vetting) of new plans. Like the access auditors in UK, US and Japan (who support and guide local and regional stakeholders with the implementation of improving seamless energy efficient mobility chains for all rely upon their benchmarks for scoring and recommendations), in India we have the same necessity.

Annexure II

Ideal and transitional specification for standard bus entrances (Rickert, Bus Rapid Transit Accessibility Guidelines, 2007)

Item	Ideal specification	Transitional specification
Maximum first step height	**250 mm**	**325 mm**

Maximum height for subsequent steps	**200 mm**	**225 mm**
Maximum number of steps (total)	**3**	**3**
Maximum ground to floor height	**650 mm**	**775 mm**
Minimum depth of steps	300 mm (280 mm on vehicles less than 2.5 m wide)	
Step risers	**Vertical, smooth, flat, color contrast on nose**	
Minimum ceiling height at door	**1.8 m above first step**	
Entrance width between handrails	700 mm, max 850 mm (single stream) min. 530 mm, max.850 mm (for wider doorways with central handrail). Handrails to start within 100 mm from outside edge of first step.	

Ideal and transitional specification for accessible bus (wheelchair access)

	Parameters	**Details**	**Recommended Specifications**	
			Standard Bus (Type I Bus as per AIS 052)	**Mini/ Midi Buses**
1	Doors	Minimum Width of Service Doors	1. At least one door will be 1200 mm (to facilitate easy access for persons with reduced mobility and persons with disabilities) and the other door could be 650 mm 2. Doors mandatory 3. Type of Door opening: Preferably in swinging	Mini 650 mm (hydraulic lift provision) Midi 800 mm (length 8m) (hydraulic lift provision) Layout to maximize the standee passenger • Doors mandatory • Type of Door opening: Preferably in swinging
2	Windows	Minimum Width of Windows (clear vision zone)	550 mm	450 mm
		Minimum Height of Windows	550 mm	450 mm
		Type of Window	The window panes shall be sliding type for all buses except AC buses. In AC buses there shall be provision for adequate ventilation in case of AC failure	The window panes shall be sliding type for all buses except AC buses. In AC buses there shall be provision for adequate ventilation in case of AC failure
3	Guard Rails		-All School buses shall be provided with minimum of two guard rails -The first guard rail shall be provided at a height of 75 mm from the lower window sill -The distance between two guard rails shall be 75 to	-All School buses shall be provided with minimum of two guard rails -The first guard rail shall be provided at a height of 75 mm from the lower window sill -The distance between two guard rails shall be 75 to

			100 mm. - Guard rail for other types of buses may not be provided if the lower edge of the window sill is at least 200 mm above the uncompressed top of the seat cushion	100 mm. - Guard rail for other types of buses may not be provided if the lower edge of the window sill is at least 200 mm above the uncompressed top of the seat cushion
4	Emergency Exits	No. of emergency exits & dimension (min.)	At least 1 emergency doors/ exits or apertures dimension –1250 mm x 550 mm (for emergency window – min 4000 cm^2)	At least 1 emergency doors/ exits or apertures dimension –1250 mm x 550 mm (for emergency window – min 4000 cm^2)
5	Steps	Maximum height of first step from ground	400 mm	400 mm
		Maximum height of other steps	250 (300 if door behind rear axle) mm max for Type – I	250 (300 if door behind rear axle) mm
6	Max. Floor Height	The floor height shall be measured at any one of the service doors of the vehicle in unladen condition (reference point to be specified by the manufacturers)	650 mm (35 % of total floor area min.) or 400 mm (35 % of total floor area)	650 mm in the entrance area (35 % of standee area of floor area)
7	Gangway	Minimum Width	1900 mm	1750 mm (for standee) 1500 mm (for non-standee)
		Minimum Width	450 mm	450 mm 300 mm (for non-standee)
8	Seats	Seat Layout	1x 1 or 2x0 in low floor area	2 x 1
			2x2 in the higher floor area	2x2 (for non-standee bus)
		Seating Area/Space Per Passenger (Total Width X Depth)	400x350 mm (AIS 052)	400x350 mm (AIS 052)
		Seat spacing	650 mm - Type I	

Annexure III

Check List - Bus Rapid Transit Accessibility (Rickert, 2006)

1.	**Public participation elements in place**	Yes	No
	Focus groups of disabled persons have been utilized		
	Advisory committee of disabled persons and seniors in place		
2.	**Accessible standards met for public space elements**	Yes	No
	Sidewalks along length of trunk line corridors are at least 2000 mm wide (with at least 900 mm clearance at obstructions), with 2.2m overhead clearance		
	Sidewalks on key side roads providing neighborhood access to BRT corridors are at		

	least 2000 mm wide (with at least 900 mm clearance at obstructions), with 2.2m overhead clearance		
	Surface condition of sidewalks (level, paved, side slope not greater than1-2%, drainage, non-skid, lighting ok)		
	Tactile paver-design and use are as p he standards		
	Tactile warnings pavers- where required (e.g., at curb ramps, unguarded platform edges) provided		
	Full-width kerb ramps at all pedestrian crossings with gradient from horizontal not more than 1:12 (8%) and with smooth transition to street and/or continuous sidewalks (raised crossings) planned		
	Other ramps with gradients 1:12 max (1:15 preferred)		
	Traffic signals pedestrian-friendly with audio announcement		
	Pedestrian foot over bridges if provided include access features to assist persons with disabilities		
	Long-term planning process in place for phasing in accessible footpaths to feeder route bus stops (note: this is an especially critical issue.)		
3.	**Fare collection**	Yes	No
	Fare cards user-friendly		
	Fare card vending sites accessible to persons with disabilities		
4.	**Access at trunk line stations**	Yes	No
	All stations served by trained station assistants and/or security personnel		
	Stations signage &wayfinding design easy to understand by new users and supplemented by pictograms		
	Ramps to stations not greater than 1:12 (8%) gradient		
	Long stations have exits at both ends where possible		
	One fare gate at least 900 mm wide		
	Folding seats if off-peak waiting times exceed 5 minutes		
	Stations have guard rails / sliding doors, which automatically open with bus doors		
	Adequate lighting		
	Adequate color contrast		
	Audible warning at sliding doors		
	Transit information in audible and visual formats, tactile format for persons with visual impairments		
	Transfer terminals have clear information		
	Accessible routes planned to connect stations and terminals with other transport modes (pedestrian paths, cycle paths, inter-city buses, etc.)		

5.	**Platform to bus floor gap: 75 mm gap (100 mm maximum gap); gap eliminated if possible**	Yes	No
	Station door designated for persons with disabilities at rear entrance of bus		
	Station assistants trained to assist wheelchair users, others with disabilities		
	Drivers trained to approach platforms with bus parallel to platform edge		
	Bus design and platform design coordinated to eliminate vertical gaps and minimize horizontal gaps		
	Gap eliminated by transit ramp ,bridges lowered from buses		
	Gap mitigated by use of beveled curbs, precision docking, and/or gap fillers		
6.	**Access at feeder line stops**	Yes	No
	High use bus stops prioritized for accessibility features		
	Enforcement planned to keep bus stops free of other vehicles		
	Shelters and waiting areas meet accessibility criteria		
7.	**Specifying access for trunk line and feeder line buses**	Yes	No
	Seamless integration of accessible station and bus design and operational features		
	Full spectrum of access features included in specifications for trunk line and new feeder line buses		
8.	**Signage and announcements**	Yes	No
	Exterior signage meets or exceeds size and color specifications		
	Interior signage and announcements meet needs of passengers with visual impairment and hearing impairment		
9.	**Bus entrances and interior design**	Yes	No
	Accessible travel paths checked on any buses with doors on both sides		
	If low floor buses used, meet access standards		
	First step of new feeder buses not more than 250 mm above ground level		
	Handrails on both sides of entrances and exits and meet specifications		
	All turnstiles removed from feeder buses		
	Consideration given to including a retractable 1st step or kneeler feature on those feeder line buses with a design where this can be done inexpensively		
	Flooring is nonskid		
	Adequate (plentiful) use of vertical stanchions and hand holds painted in yellow or other contrasting color		
	Seating meets standards to keep passengers from sliding		
	Prioritized seats for seniors, persons with disabilities		
	Visual and audible stop request signals		
	If wheelchair access, securements meet safety norms		
	Have special circumstances (e.g., steep hills) been taken into consideration in specifying wheelchair securement methods and equipment?		
10.	**Feeder line bus deployment and wheelchair access**	Yes	No
	Deployment of accessible buses on prioritized lines with integrated phase-in of pedestrian access to prioritized bus stops		
	Wheelchair user access provided or to be phased in by some combination of raised bus stops, low-floor buses, wheelchair lifts, ramps, and/or wayside platforms		
	If personal assistance required to board/debark wheelchair users, service is reliably available using trained personnel		
11.	**Public information**	Yes	No
	Public information will be available in alternative formats		
	Phone and text phone number for complaints and commendations		

	Accessible service center		
	Accessible web site		
	Public education campaign		
12.	**Training**	Yes	No
	Driver training to include courteous and appropriate treatment of seniors and disabled passengers as well as smooth operation (avoiding abrupt starts and stops, driving slowly at curbs)		
	Consideration given to provision of orientation to new disabled users		
	Training for emergencies includes policies regarding disabled passengers		

Source: Bus Rapid Transit Accessibility Guidelines, Tom Rickert, available at www.worldbank.org, typing the document title in the search box.

Note: Checklist has been modified to suit the Indian BRT Guidelines

Annexure IV

1 Signage Typeface and Style

Sign typefaces must be standard, legible and clearly discernible. Sans serif fonts should be used (Samarthyam, 2014). Some examples of Sans serif fonts are:

Arial
Helvetica
Lucida Sans
Trebuchet
Verdana

Script fonts should not be used. Some examples of Serif fonts are:

Comic Sans MS
Lucida Handwriting
Zapf Chancery
Shelly -Allegro Script

2 Character Height

A style should be chosen based on a character width-to-height ratio within 3:5 and 1:1 (Figure 1) and the stroke width-to-height ratio between 1:5 and 1:10. It should be consistent for each sign. (Samarthyam, 2014)

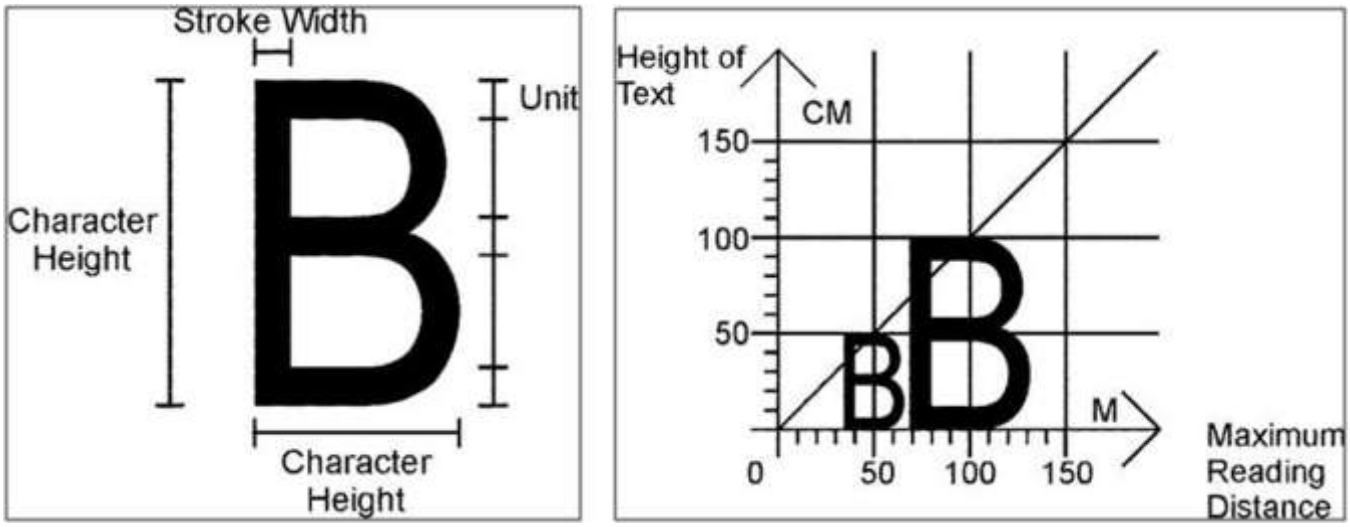

Figure 1: Character Height and character proportion

3 Line spacing

The spacing between lines should be 50% of the line height. Figure 3 indicates what is meant by "line height" and from where the measurement of 50% should be taken. (Samarthyam, 2014)

Figure 2: Line Spacing

4 Shape and Size

Shape

Signs should be limited to two basic shapes: vertical or horizontal rectangles and squares, in varying proportions. Consistency in shape helps distinguish between different kinds of signs at a glance. A limited number of sign shapes facilitates production and is economical.

Variations in sign shape may occur infrequently because the shape of the sign must also fit the space available. The sign shapes and their respective categories of signage are:

Rectangles

- Vertical Rectangles Secondary orientation signs
- All directional signs (except for directional with a single message)
- Narrow Horizontal Rectangles All identification signs Directional signs (single message only)
- Horizontal Rectangles All regulatory and lifesaving signs

Squares

- All informational signs
- Primary orientation signs
- Lettering

Categories of Signage (Samarthyam, 2014)

Categories	Area	Required to	Placement	Features
1. Identification Signs	**Entrance Gateways**	• Identify Building/ Campus name with logo • At entrance gateway, access points • From approach roads at Key Junctions for high visibility	• Angled towards direction of Incoming Traffic • Arrival Points • View from one Side	• Large size with large fonts for distant visibility • Landscape and Site Elements create a backdrop • Creates Campus/ Site Image • Vehicular Scale • May be illuminated
	For Buildings in a Complex	• Identify building address and/ or single/multiple tenants • Along long stretches of road with clear visibility	• Next to Entry/ Driveway • Parallel/ Perpendicular to Main Road • View from two sides	• Large fonts- minimal text • Typically Vertical
	For a Building	• Identify building tenant and/ or name of the Building & Address • Along short stretches of road with sight line from one direction	• Next to Building Entrance/ Arrival Area • Parallel to Approach Road • Within Sight lines from the Road • View from one side	• Large fonts- minimal text • Vehicular scale • Horizontal or Vertical
	On a Building	• Identify Tenants/ Building Name	• Located High on Building or Above Entry Door, Canopy, Window or Pole • Facing Main Sight lines	• Clear large fonts and logo if any • Horizontal • May be illuminated
2. Directional Signs	**Within a city/ campus/ site**	• Building names and facilities identified only, no details • Used to direct towards key destinations eg. Building Complex, Parking, Entry	• At key intersections/ decision points • Perpendicular to Approach Road • On the left side of the road • At least 45m from traffic movement to be directed	• Clear fonts with directional arrows • Same function as road signs, but smaller • Vehicular and Pedestrian scale • One line of information only (more than 3 are hard to see due to car speeds)
			• View from one/ two sides	• Coordination with overall system to avoid too much confusing information • Horizontal or Vertical • May be illuminated • Pedestrian Signs of smaller scale in high foot traffic areas • Should follow an overall design theme. E.g., Area specific colors/ graphics

	From outside the transit terminus/ site area	• Used to direct towards key destinations from outside the project area • Conform to State, local and Road Standards	• At key intersections/ decision points • Perpendicular to Approach Road • On the left side of the road • At least 45m from traffic movement to be directed • View from one/ two sides	• Clear fonts with directional arrows • Same function as road signs, but smaller • Vehicular scale • Use a distinct logo or graphic form easy identification • Horizontal or Vertical
3. Information Signs		• Provide more specific information about a building and the functions within • Building directories and Way-finding Maps which guide people to various programs and locations • Illustrated 3D graphic or Site Plan with 'You are Here' information	• To be viewed by stopped vehicles, pedestrians primarily • High foot traffic/ visitor areas • Not on primary roads, due to distraction • View from one side	• Clear fonts with directional arrows • More Detailed information than identification and directional signs • Vehicular and/or Pedestrian scale • Horizontal or Vertical • May be illuminated • Can be replicated for flyers/ brochures/ web-maps for orientation
4. Regulatory Signs	**Safety, Prohibition and Advisory Signs/ Regulatory Signs**	• Inform of certain restrictions or alert people to lifesaving devices or areas. • Traffic regulations, Parking restrictions, Transportation routes and stops, Emergency Warnings	• Along Traffic Routes at key intersections • Along sidewalks, outside of Pedestrian movement pathway •	• Conformance to standards adopted for international symbols • Clear large symbols, text if any • Consistent with regulatory signs utilized by the State and Local Civic Bodies & Road and Highway Regulations.

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5) Design for Access and Mobility Enhanced and Additional Requirements - Buildings and Facilities: AS 1428.2:1992
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17) Public Transport Accessibility Toolkit, 2013, MoUD and IUT
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19) Street Design Guidelines, UTTIPEC
20) Wayfinding Design Guidelines, CRC, 2007
21) United Nations Convention on Rights of Persons with Disabilities (UNCRPD)

Universal Design India Principles ©

1 Equitable/ Saman

The design is fair and non-discriminating to diverse users in Indian context

2 Usable/ Sahaj

The design is operableby all users in Indian context

3 Cultural/ Sanskritik

The design respects the cultural past and the changing present assist all users in Indian context

4 Economy/ Sasta

The design respects affordability and cost considerations for diverse users in Indian context

5 Aesthetics/ Sundar

The design employs aesthetic to promote social integration among users in Indian context

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Universal Design enables all passengers to move about independently and use all facilities and services within the public transportation system.

Incorporating Universal Design principles in planning, building and running various aspects of the public transport infrastructure have many merits. Such transit systems ensure equitable comfort to everyone including people with disabilities and reduced mobility such as elderly, families with young children, people with temporary ailments, people carrying heavy luggage, etc. There are commercial benefits as it curtails the need for customised design solutions, more passenger inflow and environmental benefits of using public transportation system.

Universal Accessibility Guideline aims to facilitate independent mobility of individuals, so that they can get into and participate in all activities of commuting with dignity and safety. Thus, the overall objective of this Guideline is to provide inclusive design and through that achieve social inclusion.

Contact Information
Samarthyam
B-181, Mansarovar Garden, New Delhi-110015
Telefax: +91-11-41019389, (M) +91-9810558321
Email: samarthyaindia@yahoo.com
Website: www.samarthyam.com