

**COMPARISON OF DIFFERENT GUIDELINES
FOR
ACCESSIBILITY OF BUILT ENVIRONMENT IN INDIA**

A Brief Analysis and Recommendations

By

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For

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May 2016

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1 Introduction

There are three documents detailing the norms for the accessibility of built environments (as on March 2016) in India. They are:

1. Handbook on Barrier Free and Accessibility, Central Public Works Department (CPWD), 2014 (referred to as CPWD in this document).
2. Harmonised Guidelines and Space Standards for Barrier Free Built Environment for Persons with Disability and Elderly Persons, Ministry of Urban Development, 2015 (referred to as HG in this document).
3. Annexure B, Anthropometrics and Specific Requirements for Barrier Free Buildings and Built Environment, Part 3 Development Control Rules and General Building Requirements, Draft National Building Code of India, Bureau of Indian Standard (BIS), 2015 (referred to as NBC in this document).

There is also an international Standard: ISO 21542:2011, Building construction - Accessibility and Usability of the Built Environment, International Organization for Standardization (referred to as ISO in this document).

It was felt that an exercise should be undertaken to compare the Guidelines and to highlight the differences so that they could be ironed out and so that there is only one Standard for India with regard to the accessibility of built environments. Keeping the above in view, NCPEDP, an advocacy organisation working for the rights of persons with disabilities, commissioned this work to DEOC (www.deoc.in), a social enterprise, specialising in the field of policy research and training. This comparative analysis is intended to aid government/policy makers/experts when finalising the Standards for India.

1.1 Methodology

DEOC studied the various sections of the three Indian Guidelines. There were inconsistencies with regard to the areas covered in each of the Guidelines. For example, the Harmonised Guidelines have included bus stops, railway stations, taxi and auto rickshaw stands, airports, adapted housing, etc. while the other two Guidelines, CPWD and NBC, have not covered them. It was also seen that certain areas like auditoriums, sports arenas, swimming pools, management and maintenance

issues, etc. have not been included in any of the Guidelines. So it was decided that the areas which *are covered* in at least two out of the three Indian Guidelines should be included in the study, so that comparison is possible.

The Guidelines, including the ISO Standards, were systematically compiled in a table format in order to enable easy comparison. A brief analysis was also undertaken to highlight the differences. At many places, the text had to be edited to make it more readable, but this was not possible at all places. Observations and recommendations have been listed under each section.

1.2 Terminology

As can be seen from the titles of the three documents, different terms are being used to refer to the set of accessibility requirements. The CPWD refers to it as a 'Handbook' while the Ministry of Urban Development refers to it as 'Guidelines'; for the BIS, it is a 'Building Code', and for the ISO, it is a 'Standard'. Unfortunately these terms have different meanings. For example 'Guidelines' are not considered mandatory but 'Standards' are considered mandatory. However please note that, in this document, the terms Guidelines and Standards are interchangeably used.

2 Anthropometrics

2.1 Manual Wheelchair

Dimensions	CPWD	HG	NBC
Length	645 mm- 1100 mm	1000-1200 mm	100 mm - 1200 mm
Width	510 mm - 725 mm	650 – 720 mm	650 - 720 mm
Height	850 mm - 1140 mm	910 - 950 mm	910 - 950 mm
Wheelchair footrest	-	350 mm (deep)	350 mm (deep)
Wheelchair castor width	-	12 mm	12 mm
Seat height	-	480 mm	480 mm
Armrest height	-	760 mm	760 mm
Lap height	-	675 mm	675 mm
When the wheelchair is folded	-	width : 300 mm height of armrest : 760 mm	width : 300 mm height of armrest : 760 mm
Weight	10.27 kg	-	-

Observations and Recommendations

1. HG and NBC dimensions of manual wheelchair are the same. They are more comprehensive than the CPWD Guidelines. The source from where the information has been taken has not been given. It is recommended that CPWD should take the dimensions given in HG and NBC, which seem more realistic. It would be useful if HG and NBC mention the source of information i.e. from where the anthropometrics of manual wheelchair have been taken.
2. There is a typographical error in NBC regarding the length of the wheelchair. Instead of 1000 mm it is mentioned as 100 mm as can be seen in the Table above. It should be corrected.
3. The ISO 21542:2011 does not have the dimensions of the wheelchair. It is based on ISO 7176-5 and ISO/TR 13570-21 which details the dimensions and maneuvering space of wheelchairs.

2.2 Electric Wheelchair

Dimensions	CPWD
Length	1060 - 1200 mm
Width	520 - 700 mm
Height	1010 - 1400 mm
Weight	36.100 kg

Observations and Recommendations

1. Only CPWD Guidelines have given the dimensions of electric wheelchair. The source from where the information has been taken has not been given. It is recommended that HG and NBC add the information.

2.3 Reach

Reach	CPWD	HG	NBC	ISO
Forward reach of a wheelchair user (without obstruction)				
Maximum reach from the Floor (upper)	1200 mm	1200 mm	1200 mm	1100 mm
Maximum reach from the floor (Lower)	400 mm	380 mm	400 mm	400 mm
Forward reach (with obstruction)				
Maximum reach from the floor (upper)	1100 mm	1000 mm	1000 mm	-
Depth	500 mm	500 mm	-	-
Side reach (without obstruction)				
Maximum reach from the floor (upper)	1300 mm	1300 mm	1300 mm	-
Maximum reach from the floor (Lower)	250 mm	250 mm	250 mm	250 mm
Side reach (with obstruction)	The maximum side reach over an obstruction 860 mm high by 500 mm deep is 1200 mm from the floor	The maximum 860 mm high x 500 mm deep is 1200 mm. Side reach over obstruction (upper) – 1200 mm from floor level. Max. Side reach over obstruction (lower) – 500 mm	The maximum side reach over an obstruction of size 860 mm high x 500 mm deep is 1200 mm from the floor	-

Reach	CPWD	HG	NBC	ISO
Comfortable and maximum reach zone (when seated on a wheelchair)	-	Comfortable : 900 mm - 1200 mm; Maximum 1200 mm - 1400 mm.	Comfortable : 900 mm - 1200 mm. ; Maximum 1200 mm - 1400 mm.	-

Observations and Recommendations

1. Maximum Forward Reach from the Floor (upper) without obstruction: The ISO Standard is 1100 mm while Indian Standards are saying 1200 mm. Indian Standards should adopt the ISO Standard of 1100 mm, which seems more suitable for larger population.
2. Maximum Forward Reach from the Floor (lower) without obstruction: The HG Standard is different (380 mm) from the rest (400 mm). HG should change it to 400 mm as per the ISO.
3. Maximum Reach from the Floor (upper) with obstruction: The CPWD Standard is different (1100 mm) from the rest (1000 mm). CPWD should change it to 1000 mm. NBC has not given the 'depth' of the obstruction, which should be added as given in other Standards.
4. Maximum side reach with obstruction (lower): HG says 500 mm. It is not there in other Standards. It should be added in CPWD and NBC.

2.4 Turning Space

Wheelchair	CPWD	HG	NBC	ISO
Manual wheelchair	Minimum: 1500 mm 1/4 Turn : 1500 mm X 1500 mm 1/2 Turn: 1500 mm X 1700 mm	Minimum: 1500 mm. Ideal: 2000 mm	Minimum: 1500 mm Comfortable: 1800 mm Ideal: 2000 mm	Dimensions are given for different situations, like landings, in front of the door, etc. for 45 degrees, 180 degrees etc. Value ranges from 1500 to 2000 mm.
Powered wheelchairs/ scooters	1800 mm	-	-	

Observations and Recommendations

1. The dimensions given are more or less similar in all the Guidelines. The minimum is based on the dimensions of manual wheelchairs in HG and NBC.
2. The turning space requirement varies depending on the degree of the turning required 45 degrees, 90 degrees, 180 degrees etc. This should be clearly explained in the HG and NBC Guidelines and should comply with the ISO Standards.
3. The terminology used by CPWD should change to degree rather the ¼ turn etc. It should also be made more comprehensive based on the ISO Standards.

2.5 Vision Zone

Dimensions	CPWD	HG	NBC	ISO
Placement height of information panels along pathways and maps	-	Between 900 mm and 1800 mm	Between 900 mm and 1800 mm	Between 1200 mm and 1600 mm
Size of the smallest letter		15 mm	15 mm	-

Observations and Recommendations

1. Standards given in HG and NBC are the same. CPWD has not included any specification on vision zone.
2. As per ISO, information, including directional and functional signs should be placed below 1600 mm, where it is easy to approach, to touch and read the sign. The upper limit given in HG and NBC should be lowered to 1600 mm as per the ISO Standard, as it would suit larger population.

2.6 Protruding Objects/Solitary Obstacles (with respect to white cane)

	CPWD	HG	NBC	ISO
Hazard zone	Between 680 mm and 2000 mm (projecting beyond 90 mm)	Between 300 mm and 2200 mm (projecting beyond 100 mm) Headroom not mentioned in text but the diagram says 2200 mm.	Between 300 mm and 2100 mm (projecting beyond 100 mm) Headroom minimum - 2100 mm	Between 300 mm and 2100 mm (projecting more than 100 mm) Headroom minimum - 2100 mm

	CPWD	HG	NBC	ISO
Hazard protection		<p>Hazard protection should be provided if objects project more than 100 mm into an access route and their lower edge is more than 300 mm above the ground. Hazard protection associated with such objects should take the form of a kerb or other solid barrier so that person with visual impairment can detect the hazard using a cane. The hazard protection should not extend beyond the front edge of the object, nor should it be set back more than 100 mm from its front edge.</p>	<p>Hazard protection shall be provided if objects project more than 100 mm into an access route and their lower edge is more than 300 mm above the ground. Hazard protection associated with such objects shall take the form of a kerb or other solid barrier so that a blind or partially sighted person can detect the hazard using a cane. The hazard protection shall not extend beyond the front edge of the object, nor shall it be set back more than 100 mm from its front edge. In case the hazard is at 600 mm above the ground, the same will not be in the range of detection of the mobility aid/white cane and should therefore be extended to the ground</p>	<p>When a projecting obstacle exists, a protective guard shall be provided at ground level, under the projecting object such as a kerb or fixed element at a height of 100 mm – 300 mm as cane detection. Cane detection shall not be set back more than 100 mm from the face of the projecting object. Wing walls, side partitions, alcoves or recesses are solutions for projecting elements where free space under the object is needed. Winged protection shall extend continuously between 300 mm and 1 000 mm above the floor and shall contrast visually with the background.</p>

	CPWD	HG	NBC	ISO
			level.	

Observations and Recommendations

1. The hazard zone is different in HG, NBC and CPWD, while it's the same in NBC and ISO. It is recommended that all Indian Standards follow the guidelines as recommended in NBC.
2. The minimum headroom is specified in NBC and ISO. This needs to be incorporated in CPWD and HG.
3. Hazard protection is not described in CPWD. It is recommended that all Indian Standards be aligned to NBC and NBC should include the description on winged protection in this section as in ISO.

2.7 Tactile Walking Surface Indicators (TWSIs)

Dimensions	CPWD	HG	NBC	ISO
Types of Tiles	Directional Tile/Block: Parallel raised bars for guiding the users along an intended safe path. Hazard Warning Tile/Block: Raised big dots (35mm in diameter) arranged in square grid parallel to the sides of the slab	Tactile Guiding Blocks (Line-type): This block indicates a correct path/route to follow for a person with visual impairment Tactile Warning Blocks (Dot-type):	Tactile Guiding Blocks – Tiles of size 300 mm x 300 mm that incorporate flat topped bars 5 mm (± 0.5 mm) high, 20 mm wide and spaced 50 mm from the centre of one bar to the centre of the next. They are used externally to guide people with visual impairments along the circulation path. Tactile Warning Blocks – Tiles of size 300 mm x 300 mm that	Attention indicators and guiding indicators. Tactile attention indicators may be installed at the vicinity of pedestrian crosswalks, the platforms of railway stations, and both the top and bottom of stairs and ramps, and in front of escalators, travelators and elevators, and the like to ensure safety. Tactile guiding indicators may be

Dimensions	CPWD	HG	NBC	ISO
	<p>for indication of potential hazards ahead.</p> <p>Positional Tile/Block: Raised small dots (23 mm in diameter) placed in staggered positions for indication of possible change in walking directions.</p>	<p>This block indicates an approaching potential hazard or a change in direction of the Walkway.</p> <p>Figure 5-1 has dimensions for warning blocks and figure 5-3 has dimensions for guiding blocks.</p>	<p>incorporate rows of 5 mm (± 0.5mm) high flat topped blister like domes that are easily detectable underfoot by persons with visual impairments, recognized as a sign of approaching hazards.</p> <p>Figure 30 gives the diameters etc of the warning blocks.</p>	<p>used in combination with attention indicators in order to indicate the walking route where no other tactual information is available to get from one place to another. Annexure A is very detailed and includes dimensions of domes and bars, visual contrast, spacings etc. etc.</p>

Observations and Recommendations

1. CPWD mentions three types of tiles whereas HG, NBC and ISO mention two types. CPWD should make it to two types based on ISO.
2. Some specifications like dimensions of bars and cones are only given in the figure and not in text in HG and NBC. All information should also be in text.
3. Terminology to refer the tactile blocks is different in different Guidelines. The term 'Tactile Walking Surface Indicators (TWSIs)' is used in ISO whereas the term, 'Tactile Ground Surface Indicators (TGSI)' is used in NBC and HG. CPWD uses terms tactile tile or blocks. There should be one terminology that should be used. ISO terminology can be adopted. The Annexure A, 'Tactile walking surface indicators (TWSIs)' of ISO is detailed and could be adopted by the Indian Standards.

3 Walks and Paths

Dimensions	CPWD	HG	NBC	ISO
Minimum clear width	For one way traffic: 1200 mm For two way traffic : 1650 mm -1800 mm	For two way traffic: 1800 mm. Exceptional cases (such as around trees/poles etc.): 1500 mm.	For two way traffic: 1800 mm. Exceptional cases (such as around trees/poles etc): 1500 mm.	For constant two way traffic: 1800 mm For frequent two-way traffic, 1500 mm, provided that passing places are included at intervals of maximum 25 m; Infrequent two-way traffic : 1200 mm, a passing and turning space of at least 1800 mm x 2000 mm should be provided for every 25 m; When it is unlikely that people will have to pass one another: 900 mm, a turning space of at least 1800 mm x 2000 mm should be provided for every 25 m.
Free from barriers	Free from protrusion hazards, steps, kerbs other than dropped kerbs, steep ramps, doors or	Avoid gratings and manholes in walks.	Gratings and manholes shall be avoided in walks. Obstacles, such as objects or signs mounted on walls, bollards, columns or freestanding supports along the walking path shall be avoided.	Obstacles, such as objects or signs mounted on walls, bollards, columns or free-standing supports along the walking path should be avoided.

Dimensions	CPWD	HG	NBC	ISO
	doorways which will impede the passage of a wheelchair.			
Solitary obstacles projecting into an access route		<p>Obstacles such as lighting columns, bollards, signposts, seats and trees, should be located at or beyond the boundaries of walkways. Where unavoidable, protruding objects should not reduce the clear width of an accessible route or maneuvering space.</p> <p>Bollards should be avoided but where necessary be at least 1000 mm high, provide a wheelchair passage width of at least 900 mm (Figure 5-5), and should not be linked with chains.</p>	<p>Obstacles, such as objects or signs mounted on walls, bollards, columns or freestanding supports along the walking path shall be avoided. Unavoidable free standing posts or columns within access routes on pathways shall be clearly marked with visual indicators.</p> <p>Bollards shall be avoided, but where necessary shall be at least 1 000 mm high and shall provide a wheelchair passage width of at least 900 mm, and should not be linked with chains.</p>	<p>Objects with a height lower than 1 000 mm can create a hazard for blind or partially sighted people. Permanent equipment that cannot be located outside the boundaries of a path shall be:</p> <p>a) designed to be easily seen with a minimum difference in LRVs of 30 points to the background, and</p> <p>b) shielded to protect against impact, and</p> <p>c) accompanied by a feature that warns of the presence of a potential hazard and is detectable for a person using a white cane or stick.</p>
Visual indicators for unavoidable free standing		A band of 200 mm, between heights of 1400 mm and 1600 mm from the walkway floor finish, and which	Visual indicators at least 75 mm in height with a minimum visual contrast of 30 points difference to the	Visual indicators at least 75 mm in height with a minimum visual contrast of 30 points difference to the background

Dimensions	CPWD	HG	NBC	ISO
posts/ columns		contrasts visually with the remainder of the post or column.	background shall be placed at a height between 900 mm - 1000 mm and 1500 mm - 1600 mm above floor level.	shall be placed at a height between 900 mm – 1000 mm and 1500 mm – 1600 mm above floor level.
Surface	Firm and non-slippery.	Smooth, hard and have levelled surface suitable for walking and wheeling. Irregular surfaces as cobble stones, coarsely exposed aggregate concrete, bricks etc. often cause bumpy rides and should be avoided.	Smooth, hard and have levelled surface suitable for walking and wheeling. Irregular surfaces as cobble stones, coarsely exposed aggregate concrete, bricks etc, often cause bumpy rides and shall be avoided.	Firm with an even and slip-resistant surface and should be free from drainage gratings. Care shall be taken to ensure that adjacent surface materials do not display different slip resistance characteristics, particularly at the edges of changes of level or gradients.
Gradient		The walkway should not have a gradient exceeding 1:20. It also refers to cross slope.	The walkway shall not have a gradient exceeding 1:20. It also refers to cross slope. If the slope or any part of a path on an accessible route to a building exceeds 1:20, it shall be designed and constructed as a ramp. The cross fall gradient across an access route shall not exceed 1:50 (20 mm/m), except when associated with a dropped	The cross fall gradient across an access route should not exceed 1:50 (20 mm/m), except when associated with a dropped kerb. If the slope or any part of a path on an accessible route to a building exceeds 1:20, it shall be designed and constructed as a ramp.

Dimensions	CPWD	HG	NBC	ISO
			kerb.	
Rest area		When walks exceed 60 meter in length it is desirable to provide rest area adjacent to the walk at convenient intervals of 30 meter form of bench/ resting seats. For comfort, seat height should be between 450 mm-500 mm, have a backrest and hand rests at 700 mm height.	When walks exceed 60 m in length, it is desirable to provide rest area adjacent to the walk at convenient intervals of 30 meter in the form of benches/resting seats. For comfort, seat height shall be between 450 mm -500 mm, and the seating shall have a back rest and hand rests at 700 mm height.	
Levels, grooves and gratings		Vertical level changes up to 6 mm: May not need edge treatment. Between 6 mm and 12 mm should be leveled off with a slope no greater than 1:2. Grating cover: Narrow slots not more than 10mm wide, perpendicular to the direction of movement. Grating should be flushed with finished ground level. Treat the grating with a non-slip finish.	Vertical level changes up to 6 mm: May not need edge treatment. Between 6 mm and 12 mm should be leveled off with a slope no greater than 1:2. Grating cover: Narrow slots not more than 10mm wide, perpendicular to the direction of movement. Grating should be flushed with finished ground level. Treat the grating with a non-slip finish.	
Drainage of path/access			A dished channel should not be constructed within the	A dished channel should not be constructed within the

Dimensions	CPWD	HG	NBC	ISO
routes			boundaries of a path or ramp. Dished channels shall have a maximum width of 150 mm and a maximum drop into gully of 5 mm. A drainage grating that is within the boundaries of a path or a ramp shall be set flush with the surface.	boundaries of a path or ramp. Dished channels shall have a maximum width of 150 mm and a maximum drop into gully of 5 mm. A drainage grating that is within the boundaries of a path or a ramp shall be set flush with the surface.
Lighting for walkways		Lighting should illuminate the walkway; lighting fixtures not exceeding a height of 4m from ground level should be provided. Lighting must be provided every 20 – 30m, focusing light not on the car lanes, but on the walkways. A whiter light source, for example high-pressure sodium, is preferable in city and town centers for the aesthetic effect and for better colour definition, which benefits those with poor sight. White lighting at average 35-40 lux is recommended to ensure colour contrast of tactile	Lighting for walkways shall be as given below: Lighting should illuminate the walkway; lighting fixtures not exceeding a height of 4 m from ground level should be provided. Lighting shall be provided every 20 m to 30m, focusing light not on the car lanes, but on the walkways. A whiter light source, for example high-pressure sodium, is preferable in city and town centres for the aesthetic effect and for better colour definition, which benefits those with poor sight. White lighting at average 35 to 40 lux is recommended to ensure colour contrast of	The routes to and around a building shall have sufficient artificial lighting to facilitate awareness of changes of level or gradient. The positioning of lights should not cause glare, reflection or shadows. Ramps, entrances, steps, signage, etc., should be well lit artificially, with an illuminance of at least 100 lux.

Dimensions	CPWD	HG	NBC	ISO
		<p>pavers and visible at night to persons with low vision. Under no circumstances the lighting pole should interfere with the clearance of the walkway. Light pole may preferably be located within the tree-planting zone. Lower level light poles are preferred to avoid shadow where there are high trees.</p>	<p>tactile blocks and to ensure visibility at night to persons with low vision. Under no circumstances shall the lighting pole interfere with the clearance of the walkway. Light pole may preferably be located within the tree-planting zone. Lower level light poles are preferred to avoid shadow where there are high trees.</p>	
<p>Tactile pathways</p>	<p>Page No.1, 2 and 3 have diagrams which are not very clear.</p>	<p>Figure 5-2 gives configuration and layout of tactile pavers: guiding and warning</p>	<p>Tactile pavers/TGSI shall be installed at following places: In open space to orient persons with vision impairment; In front of an area where traffic is present; In front of an entrance/exit to and from a ramp, staircase or multi-level crossing facility; Entrances/exits at public transport terminals or boarding areas; Sidewalk section of an approach road to a building; From a public facility to the nearest public transport station; In rural</p>	<p>Tactile walking surface indicators should be used to indicate directional orientation information where no other clues indicate the path of travel. Across large areas, halls and complex buildings, blind people need a tactile route or guiding pattern to follow (see Annex A).</p>

Dimensions	CPWD	HG	NBC	ISO
			<p>areas, stones of different sizes can be used to separate the road from the kerb, and to indicate the approach to public places. Fig. 31 gives Installation of TGSI.</p>	

Observations and Recommendations

1. Width of the paths: ISO is more comprehensive than other Standards as it provides minimum width for one way, two way traffic and for frequent and infrequent traffic. It also provides for turning spaces for paths lesser than 1500 mm in width. CPWD, HG and NBC should make this section comprehensive as per ISO.
2. Surface, Rest Area, Gradient, grooves, gratings: The Standards given in NBC and HG are more detailed compared to CPWD. NBC is more comprehensive as it includes points in ISO regarding Drainage of Paths in Access Route. CPWD and HG should make the changes as per NBC.
3. Visual indicators for unavoidable free standing posts/ columns: Standards given in HG are different from NBC and ISO. HG should be updated as per NBC and ISO. CPWD should include this point.
4. The CPWD, HG and NBC have given the specifications for the installation of TWSI/TGSI in the pathway as a graphic. It should be described in the text as well.
5. Overall, this section in NBC is well drafted. NBC should include turning spaces in the minimum width of pathway as given in ISO along with diagrams and should detail the laying of TWSI/TGSI in the text.

4 Parking

Dimensions	CPWD	HG	NBC	ISO
Ratio of accessible parking spaces	Total No. Car Parking Space in Lot and Required No. of Accessible Car parking Spaces: 1- 50: 1 accessible car park; 51- 150: 2 accessible car parks; 151 - 250: 3 accessible car parks; 251 - 350: 4 accessible car parks; 351 - 450: 5 accessible car parks; Above 450: 6 accessible car parks.	Two accessible parking lot should be provided for every 25 car parking spaces.	Minimum of one accessible designated parking space shall be provided in every parking area; Less than 10 parking spaces : 1 accessible car park up to 50: 2 accessible car parks; Up to 100: 4 accessible car parks; Up to 200: 6 accessible car parks; Over 200: 6 accessible car parks and one for each additional 100 parking spaces shall be provided. In specialized facilities such as health care facilities, shopping areas and recreational facilities, a greater number of designated accessible parking spaces should be considered.	Minimum of one accessible designated parking space shall be provided in every parking area; Less than 10 parking spaces : 1 accessible car park; up to 50: 2 accessible car parks; Up to 100: 4 accessible car parks; Up to 200: 6 accessible car parks; Over 200: 6 accessible car parks and one for each additional 100 parking spaces shall be provided. In specialized facilities such as health care facilities, shopping areas and recreational facilities, a greater number of designated accessible parking spaces should be considered.

Dimensions	CPWD	HG	NBC	ISO
				Additionally, some designated accessible parking spaces should be provided for motorists accompanied by a child in a perambulator or pushchair and shall be designated with a perambulator sign.
Location (Maximum distance to parking from entrance /lift lobby)	not mentioned	Within 30 meters	Within 30 meters	Within 50 meters
Minimum dimensions of car parking space	<p>Length x Width: 5000 x 3600 mm</p> <p>The common loading/unloading area shall have at least 1200 mm wide and be marked with yellow hatched markings.</p>	<p>5000 mm × 3600 mm</p> <p>Where there are two accessible parking bays adjoining each other, then the 1200mm side transfer bay may be shared by the two parking bays. The transfer zones, both on the side and the rear should have yellow or white cross-hatch road markings.</p>	<p>4800 mm × 3600 mm</p> <p>Where there are two accessible parking bays adjoining each other, then the 1200 mm side transfer bay may be shared by the two parking bays. The transfer zones, both on the side and the rear should have yellow or white cross-hatch road markings</p>	<p>Width x Length 3900 mm x 5400 mm.</p> <p>The minimum width includes the transfer area beside the car with a minimum of 1500 mm. Two accessible parking spaces with one shared transfer area are widely used and shall have a minimum width of 6300</p>

Dimensions	CPWD	HG	NBC	ISO
		The accessible route of 1200 mm width is required for wheelchair users to pass behind vehicle that may be backing out.	The designated accessible parking spaces shall be located on a gradient not greater than 1:50, throughout its length and its width. The accessible route of 1200 mm width is required for wheelchair users to pass behind vehicle that may be backing out.	mm.
Minimum dimensions for van parking space			For road side parking of an accessible van: 9000 mm x 2400 mm with a kerb to access the nearest sidewalk.	4800 mm wide and 9000 mm long. As an alternative, a parking space of 2400 mm wide 9000 mm in length along a sidewalk can be used, provided the sidewalk is at least 2400 mm wide.
Surface		Have a firm, level surface without aeration slabs; and Wherever possible, be sheltered.	Have a firm, level surface without aeration slabs; and Wherever possible, be sheltered.	Firm and level ground with no variation of surface exceeding 5 mm, between paving, surface features and mix of different surfaces or finishes. The designated accessible

Dimensions	CPWD	HG	NBC	ISO
				parking spaces shall be located on a gradient not greater, throughout its length and its width, than 1:50.
Head clearance for parking		At least 2400 mm.	At least 2600 mm.	Minimum 2400 mm. National building regulations can have other dimensions reflecting the height of local transportation vehicles.
Signage	Indication / directional signage along driveway showing the way leading to the parking spaces reserved for persons with a disability should be provided.	International symbol of accessibility should be displayed at approaches and entrances to car parks to indicate the provision of accessible parking lot. Directional signs shall be displayed at points where there is a change of direction and along the route leading to the accessible parking lot. Accessible parking lot should be identifiable by the International Symbol of	International symbol of accessibility should be displayed at approaches and entrances to car parks to indicate the provision of accessible parking lot. Directional signs shall be displayed at points where there is a change of direction and along the route leading to the accessible parking lot. Accessible parking lot should be identifiable by the International Symbol of	It is important that the locations of the designated parking spaces are clearly signposted at the entrance to the building site or car park with information providing direction to designated parking spaces and to other accessible facilities. Therefore, directional arrows combined with the international symbol of access shall be used. Designated accessible parking spaces shall be

Dimensions	CPWD	HG	NBC	ISO
		<p>Accessibility. The signs should not be obscured by a vehicle parked in the designated lot.</p> <p>Vertical signs shall be provided, to make it easily visible, the sign should be at a minimum height of 2100 mm.</p>	<p>Accessibility. The signs should not be obscured by a vehicle parked in the designated lot.</p> <p>Vertical signs shall be provided, to make it easily visible, the sign should be at a minimum height of 2100 mm.</p>	<p>marked both on the pavement with the international symbol of access and with a vertical sign with the international symbol for accessible parking space to indicate the location of the designated accessible parking.</p> <p>The vertical sign should be located so that it does not create a hazard.</p>

Observations and Recommendations

1. Ratio of accessible parking spaces: The ratio given in CPWD and HG is insufficient and should be made compliant with ISO. This section in NBC has been taken from ISO, which is comprehensive. However, there is an additional point in ISO which is, "Additionally, some designated accessible parking spaces should be provided for motorists accompanied by a child in a perambulator or pushchair and shall be designated with a perambulator sign." This could also be added in the NBC.
2. Location of parking: NBC and HG mention that accessible parking that serves a building should be located nearest to an accessible entrance and/or lift lobby within 30 m whereas ISO mentions 50 m. Standard given in HG and NBC seem better. CPWD should add the information.

3. Dimensions of car parking space: CPWD has not mentioned the rear space requirement, which should be added. ISO is talking of side transfer of 1500 mm whereas NBC, CPWD and HG only provides for 1200 mm transfer space. Indian Standards could adopt the ISO with regard to the transfer space requirement.
4. Van parking: CPWD and HG have missed out on requirements for van parking. NBC mentions it but it has missed out the transfer space or sidewalk of 2400 mm wide, though it is there in the figure. It should be added in text of NBC.
5. Head Clearance: HG and ISO mention 2400 mm for head clearance space whereas NBC states 2600 mm. HG should be revised it to 2600 mm as given in NBC. CPWD should include this point.
6. Many specifications, signage heights, van parking, maximum distance of parking from entrance, head clearance etc. are not given in the CPWD Guidelines, which should be added.

5 Ramps

Dimensions	CPWD	HG	NBC	ISO
Minimum width	1800 mm.	1200 mm. Level difference/ rise and the width of Ramp: For 150 - 300 mm: 1200 mm; 300 - 750 mm : 1500 mm; 750 - 3000mm : 1800 mm; More than or equal to 3000mm: 1800 mm.	1200 mm. Level difference/rise and the width of Ramp For 150 - 300 mm: 1200 mm; 300 - 750 mm: 1500 mm; 750 - 3000 mm: 1800 mm; More than or equal to 3000 mm: 1800 mm.	1200 mm. (The unobstructed width of a ramp shall be not less than 1000 mm between the handrails or any obstructions.) Exceptional considerations in adaptation of urban areas or at the entrance of existing buildings: The unobstructed width of a ramp shall be not less than 900 mm.
Maximum gradient	1:12 Slope with the ratio of 1:20 (5%) to 1:15 (6.7%) is preferred.	Level difference and corresponding Gradient: For 150 - 300 mm - 1:12; 300 - 750 mm - 1:12; 750 - 3000 mm - 1:15; More than or equal to 3000: 1:20.	Level difference and corresponding Gradient: For 150 - 300 mm - 1:12; 300 - 750 mm - 1:12; 750 - 3000 mm - 1:15; More than or equal to 3000: 1:20.	Level difference and corresponding Gradient For 210mm: 1:12; 235 mm : 1:13; 280mm: 1:14; 315 mm: 1:15; 350mm: 1:16; 385 mm: 1:17; 420 mm: 1:18; 460 mm: 1:19; 500 mm: 1:20; no limit: less than 1:20. A ramp with a gradient higher

Dimensions	CPWD	HG	NBC	ISO
				<p>than 1:12 is difficult to use and can create a risk of an accident; it is therefore not suitable for independent use. Exceptional considerations in adaptation of urban areas or at the entrance of existing buildings - For 35 mm: 1:8; 375 mm: 1:8; 750 mm: 1:9; 1000 mm: 1:10; 1150 mm: 1:11; 1250 mm: 1:12.</p>
<p>Landing space</p>	<p>A clear space of not less than ramp's width shall be provided at the head and foot of every ramp, i.e. door swing and alike shall not be allowed to swing onto the landing.</p>	<p>Ramps should have a level landing at the top and bottom of each run and also where the run changes direction. Landings should:-</p> <ul style="list-style-type: none"> - Be provided at regular intervals of not more than 9000 mm of every horizontal run - Have a level platform of not less than 1500 mm; - 300 - 750 mm landing every 5m of ramp run; - 750 - 3000 mm landing after every 9 m of ramp 	<p>Ramps shall have a level landing at the top and bottom of each run and also where the run changes direction</p> <p>Landings shall be provided at regular intervals of not more than 9 000 mm of every horizontal run. It shall have a level platform of not less than 1500 mm</p> <ul style="list-style-type: none"> 300 - 750 mm landing every 5 m of ramp run; 750 - 3000 mm landing after every 9 m of ramp run; More than or equal to 3000 mm, landing after every 9 m 	<p>An end landing shall be provided at the foot and the head of a sloped path, a stepped path, or a ramp. The area of an end landing may be a part of the continuing path.</p> <p>The length of an end landing and an intermediate landing shall be not less than 1500 mm.</p> <p>The length of an intermediate landing at any change in direction of more than 10° shall be at least 1500 mm measured on the centre line. Exceptional considerations for</p>

Dimensions	CPWD	HG	NBC	ISO
		run; More than or equal to 3000 mm, landing after every 9 m of ramp run.	of ramp run.	existing buildings: The clear space at the beginning and at the end of the ramp shall be at least 1200 mm at surface level. Intermediate landings shall also be at least 1200 mm.
Resting space outside the swing of door	A level resting space outside the swing of any door at the top of a ramp should be provided to avoid the possibility of 'roll-back' for wheelchair user when trying to open the door.	A clear, firm and level landing of at least 1800mm x 1800mm should be provided on either side of the entrance door.	Ramps should not ideally connect straight to doors as wheelchair users need a leveled platform at the end of the ramp to maneuver and negotiate opening the door.	The area of a landing shall be clear of any obstruction including the path of swing of a door or gate.
Alternate to ramp		Where the horizontal run	Where the horizontal run of	In addition to a ramp, a flight

Dimensions	CPWD	HG	NBC	ISO
		of the approach ramp exceeds 9000 mm length, an alternative stepped approach, in addition to the ramp approach, should be provided for people with ambulatory disabilities.	the approach ramp exceeds 9000 mm length, an alternative stepped approach, in addition to the ramp approach, shall be provided for people with ambulatory disabilities.	of steps should be provided if the change in level is more than 300 mm.
Tactile warning		Single row of tactile warning blocks should be placed at beginning and end of each ramp at also at the beginning and end of each run.	Single row of tactile warning blocks shall be placed at beginning and end of each ramp and also at the beginning and end of each run.	Where required on a continuous accessible path of travel, tactile warning indicators should be located at both the top and bottom of ramps across the whole width of the stair (ramp). See further details in the below row.
Placement/ measurement of tactile warning			Tactile warning blocks shall be placed 300-400 mm before the beginning and end of each ramp/stair run.	The tactile attention pattern should have a depth of between 600 mm and 900 mm ending 300 mm to 500 mm before the front edge of the first down going step.

Dimensions	CPWD	HG	NBC	ISO
surface		Should be slip resistant. Outdoor ramps and their surface should be designed to prevent water from accumulating on the walking surfaces.	-Non-glary, smooth, level, even and slip resistant even when wet; -Outdoor ramps and their surface shall be designed to prevent water from accumulating on the walking surfaces; and -The surface finish shall be hard and suitable for the volume of traffic that the ramp is likely to experience.	Rigid with a plain and slip-resistant surface, in both wet and dry conditions.
Edge protection/guarding along ramps			Ramps and landings not adjacent to a wall should have an edge protection in form of a 75 mm kerb. Providing protection at the side of the path protects people who use wheelchairs and ambulant people from injuring themselves as the result of a fall. If a level or sloped path is bounded on one or both sides by terrain that slopes downwards by up to 30° from the horizontal, a firm and level margin of at least 600	Providing protection at the side of the path protects people who use wheelchairs and ambulant people from injuring themselves as the result of a fall. If a level or sloped path is bounded on one or both sides by terrain that slopes downwards by up to 30° from the horizontal, a firm and level margin of at least 600 mm shall be provided at the relevant side or sides. If a sloped path or ramp is bounded on one or both sides

Dimensions	CPWD	HG	NBC	ISO
			<p>mm shall be provided at the relevant side or sides. If a sloped path or ramp is bounded on one or both sides by terrain that slopes downwards by 30° or more, an upstand of minimum height of 150 mm shall be provided at the relevant side or sides. Upstands shall have a minimum difference in LRV of 30 points in relation to the ramp.</p> <p>If a path, or a sloping path, stepped path, ramp, terrace or other unfenced platform rises more than 600 mm above the adjacent ground, it shall be provided with guarding. If the adjacent ground is firm and level with the path for 600 mm, no guard is needed.</p> <p>Guarding shall be designed to discourage a user, particularly a child, from climbing on it.</p>	<p>by terrain that slopes downwards by 30° or more, an upstand of minimum height of 150 mm shall be provided at the relevant side or sides. Upstands shall have a minimum difference in LRV of 30 points in relation to the ramp.</p> <p>If a path, or a sloping path, stepped path, ramp, terrace or other unfenced platform rises more than 600 mm above the adjacent ground, it shall be provided with guarding. If the adjacent ground is firm and level with the path for 600 mm, no guard is needed. Guarding shall be designed to discourage a user, particularly a child, from climbing on it.</p>
Lighting	-	-	-	The minimum illumination at

Dimensions	CPWD	HG	NBC	ISO
				the top and bottom of the ramp should be 200 lux and 150 lux in between the bottom and top.
Handrail	See section on Handrail			

Observations and Recommendations

1. Maximum gradient: ISO is better and comprehensive. For example, for a level difference of 500 mm, HG and NBC have given the required gradient as 1:12; whereas ISO mentions 1:20. Indian Standards should adopt the ISO Standards.
2. Alternate to ramp: HG and NBC, for level difference of approximately 600 mm (9000 mm horizontal run) mentions that alternate to ramp should be provided; whereas, in ISO it is mentioned that alternate to ramp should be provided for 300 mm level difference. CPWD has not given this point. The ISO standards should be adopted by Indian Standards. Moreover, the reference should be with respect to level difference and not the horizontal run as it currently the case in HG and NBC.
3. Lighting: The lighting requirement has not been given in the Indian Standards. It should be added as per the ISO Standard.
4. Edge protection/guarding along ramps: CPWD and HG have not given this point. NBC has taken the specifications from ISO. CPWD and HG should add this point.
5. Placement of tactile warning indicators: CPWD and HG have not mentioned specifications for placing the tiles in the ramp. CPWD and HG should add the specifications. NBC has given the distance for placing the warning indicators, however, has not given its depth. This should be added as per ISO.

6 Kerb Ramps

Dimensions	CPWD	HG	NBC	ISO
Location of kerb ramps	Be provided at pedestrian crossing and at each end of the footpath of a private street or access road. Kerb separating footpath or ramp from vehicular area shall also be a dropped kerb.	Be provided where the vertical rise is less than 150 mm; Should not project into the road surface; should be located or protected to prevent obstruction by parked vehicles; and Should be free from any obstruction such as signposts, traffic lights, etc. Should not be used if they project in (The text is missing in HG)	Be provided where the vertical rise is less than 150 mm. Shall not project into the road surface Shall be so located and also protected to prevent obstruction by parked vehicles. Shall be free from any obstruction such as signposts, traffic lights, etc. Shall not be used if they project into a roadway, as it is dangerous for users and obstructive for vehicles. Shall be so located to enable users to have an unobstructed view of traffic approaching from any direction.	Be located in close proximity to the designated accessible parking area connecting the accessible path of travel to the principal entrance. The accessible path to the kerb ramp can be marked with hatching painted on the road surface to prevent people from parking in this area.
Length and width	Not less than 1200 mm in length and 1200 mm in width; With a clearance of at least 800	The width should not be less than 900 mm min.	Not be less than 1200 mm in length and 1200 mm in width; With a clearance of at least 800 mm long at the	Width should be a minimum of 1000 mm.

Dimensions	CPWD	HG	NBC	ISO
	mm. long at the back of the footway.		back of the footway.	
Maximum gradient	1:12	1:12; the flared sides should not be more than 1:10.	1:12; flared side shall not be steeper than 1:10.	Level difference and corresponding Gradient: 75 mm : 1:8 ; 110 mm: 1:9; 150mm: 1:10; 180mm: 1:11.
Tactile warning	Provided with a tactile warning strip at 300 mm from the vehicular areas; Provided with a tactile warning strip of the nominal width of 600 mm at the ramp. Tactile warning strip should have a minimum luminous contrast of 70% with the adjoining surfaces.	Diagram 7.1 has some details about tactile blocks.	They shall be provided with adequate visual and tactile warning. Tactile warning strip (TGSI) shall be provided to notify the presence of traffic. The tactile warning strip shall have a minimum luminous contrast of 70 percent with the adjoining surfaces for the elderly and persons with visual impairment.	Where required on a continuous accessible path of travel, tactile warning indicators should be located at both the top and bottom of ramps. See further detailed measures in the above section on ramps.
Surface	Raised traction strips shall be avoided. Dropped kerb should have slip-resistant surface with a minimum "static coefficient of friction" of "Very Good"	Slip-resistant surface; should be designed not to allow water accumulating on the walking surface.	Slip-resistant surface with a minimum static coefficient of friction of 'very good' grading. They shall avoid raised traction strips in order to reduce the hazard to	Slip-resistant surface.

Dimensions	CPWD	HG	NBC	ISO
	grading.		everyone. They shall be designed not to allow water accumulating on the walking surface.	
Handrail		Not required	Not required	Not required

Observations and Recommendations

1. Location of kerb ramps: Some text is missing in HG on page 56. It should be corrected.
2. Length and width: CPWD and NBC standards mention minimum width of 1200 mm whereas HG mentions 900 mm and ISO 1000 mm. HG should adopt the CPWD and NBC Guidelines for the width of kerb ramp.
3. Maximum gradient: ISO gives different gradient for different heights for kerb ramps compared to CPWD, NBC and HG. However, CPWD, HG and NBC standard of 1:12 is more suitable.
4. Tactile Warning Indicators: In HG and NBC the text should elaborate the Standards for laying them apart from just indicating them in diagram.

7 Handrails

Dimensions	CPWD	HG	NBC	ISO
Provision of handrails		Handrails must be continuous on both sides & even at landings.	For stairs and ramps, handrails shall be provided on both the sides; and be continuous, even at the landings.	Be provided on both sides of all flights of stairs, and a central handrail should be provided when the unobstructed width of the stairs exceeds 2700 mm, provided that an unobstructed width of at least 1500 mm is provided on one side. <i>Exceptional considerations for existing buildings:</i> a handrail should be provided on at least one side of the flight of stairs (principal difficulties arise in relation to heritage buildings).
Profile of handrails	Be fixed not less than 35 mm and not more than 50 mm clear of wall and with a clear height of 70 mm from the top of the bracket to	-Be slip-resistant with round ends; -have a circular section of 38-45 mm in diameter;	-Be slip-resistant with round ends; -Have a circular section of 38-45 mm in diameter;	-Have a rounded profile that can be inscribed into a 45 mm circle, and subscribed to a 35 mm diameter circle. The radius

Dimensions	CPWD	HG	NBC	ISO
	<p>the top of the handrail. Handrail shall be tubular, not less than 40 mm and not greater than 50 mm in external diameter and in other shapes that can provide the user a grip similar to that specified in the case of tubular handrails.</p> <p>Where the wall has a rough surface, the clear space should be not less than 45 mm between the handrail and the wall.</p>	<ul style="list-style-type: none"> -Have a minimum clear space of 50 mm from the walls; -Be free of any sharp or abrasive elements; 	<ul style="list-style-type: none"> -Have a minimum clear space of 50 mm from the walls; -Be free of any sharp or abrasive elements; 	<p>of the rounded edges shall be minimum 15 mm;</p> <ul style="list-style-type: none"> -Be located to provide a minimum clear space of 40 mm from an adjacent wall or other obstruction; -Have an overall projection from any side obstruction of not more than 100 mm; -Have the top 270° arc of the handrail clear along its full length; -Have a minimum of 50 mm clearance under the 270° arc along the full length of the handrail for finger indentation; -Have a surface that is smooth but provides adequate resistance to hand slippage. <p>NOTE: A wide and</p>

Dimensions	CPWD	HG	NBC	ISO
				relatively flat-topped surface on a handrail provides better support than a regularly curved one. Graspability is better on a handrail that does not require significant hand and finger joint movement. For these reasons, the use of a handrail that is elliptical is preferred.
Continuity of a handrail		Handrails must be continuous on both sides & even at landings. Handrail should have continuous gripping surfaces, without interruptions or obstructions that can break a hand hold.	Handrails should Have continuous gripping surfaces, without interruptions or obstructions that may break a hand hold.	Handrails should be continuous throughout the flight of a ramp, stair, stepped path and intermediate landing, except where they intercept with a doorway or path of travel.
Height of a handrail	The top of handrail shall be at a height of not less than 850 mm and not more than 950 mm above any nosing,	The handrails are placed at a height of between 760 mm and 900 mm above the	Be installed at a height of 700 mm to 900 mm (to be measured from the centre line of the	The height to the top of a handrail shall be between 850 mm and 1000 mm above the surface of a

Dimensions	CPWD	HG	NBC	ISO
	<p>floor or landing. One more handrail should be provided at a height of not less than 700 mm and not more than 800 mm above any nosing, floor or landing for schools and places of public entertainment.</p>	<p>floor level.</p>	<p>circular handrail across its diameter).</p>	<p>ramp, the pitch line of a stair, and the surface of a landing. A second handrail, with a lower profile than the first one, shall be provided. The height to the top of the second handrail should be between 600 mm and 750 mm above the surface of a ramp, the pitch line of a stair, and the surface of a landing.</p>
<p>Horizontal extension of a handrail</p>	<p>Handrail shall extend horizontally not less than 300 mm beyond the first and last nosing of every flight of steps or beyond the ends of a ramp and terminate into a closed end which shall turn down or return fully to end post or wall face and which shall not project into a route of travel. A recess containing a handrail should extend not</p>	<p>Handrails should - Extend horizontally for a distance of not less than 300 mm beyond the top and bottom of the ramp to provide support for persons who may need help to negotiate the ramp; and not project into another path of travel.</p>	<p>Handrail extensions shall: -Extend horizontally for a distance of not less than 300-450 mm beyond the top and bottom of the ramp to provide support for persons who may need help to negotiate the ramp; and - Not project into another path of travel. - In case the handrail is</p>	<p>A handrail on a stepped path, stair or ramp shall have a horizontal extension of not less than 300 mm beyond the first and last nosing of each flight. A handrail shall not project into a transverse circulation path unless it is continuous and intended to form part of the guidance along that path. The end of the horizontal extension should be turned</p>

Dimensions	CPWD	HG	NBC	ISO
	less than 450 mm above the top of the handrail.		enclosed in a recess, the recess shall extend at least 450 mm above the top of the rail. Handrails shall turn in towards the wall at either end.	towards the wall on the closed side of the ramp or stairs, or be turned down and terminate at the floor or ground level. NOTE: This provision supports people with mobility impairment and limits the risk of clothing being caught.
Visual and tactile information	Handrail should have a minimum luminous contrast of 30% with the surrounding wall surfaces. Handrail finished in more noticeable colors with Braille and tactile information should facilitate self-help circulation of persons with visual impairment Braille and tactile information on directional arrow and floor number shall be provided on handrail on every floor at a designated location to	Handrails may be provided with Braille/ tactile markings at the beginning and the end to give information to people with visual impairment.	Handrails may be provided with Braille/tactile markings at the beginning and at the end to give information to people with visual impairment. To aid identification, the colour of the rail shall contrast with the wall behind.	The minimum visual contrast of a handrail to the adjacent background should be as per standards on visual contrast. Raised text or tactile symbols shall be unobtrusively and permanently fitted or fixed to handrails as an important source of information for people who have a vision impairment, e.g. indication of floor number, direction of fire evacuation, location of final

Dimensions	CPWD	HG	NBC	ISO
	facilitate persons with visual impairment. Where a directional sign exists on handrails, Braille and tactile information shall also be provided.			fire exits, etc.
Mechanical resistance	Handrail shall be installed to resist a load of not less than 1.3 kN applied vertically or horizontally. Handrail shall not rotate within its fixing fittings.		The handrail shall be securely fitted to the wall to withstand heavy pressure.	Handrails shall be securely fixed and rigid. The fastenings and the materials shall be able to withstand a minimum point load, both vertical and horizontal, of 1.7 kN.

Observations and Recommendations

1. Provision of handrails: ISO mentions a central handrail for wider staircases/steps. This is missing in the Indian Standards and should be incorporated.
2. Profile of handrails: ISO recommends an elliptical profile of handrail and the details for the same are also mentioned. This is for better graspability and the Indian Standards should adopt the same.
3. Height of handrails: The ISO Standards mention a second handrail to be installed at a lower height. This is missing in HG and NBC and should be incorporated.
4. Visual and tactile Information: The colour contrast of the handrail against the wall (value) should be specified in HG and NBC.
5. Mechanical Resistance: It would be ideal to specify the force to withstand in NBC and HG as specified in CPWD and ISO.

8 Staircase

Dimensions	CPWD	HG	NBC	ISO
General	<p>Where steps or stairs are in an accessible route, complementary ramps, lifts or escalators should be provided.</p> <p>Winder, spiral staircase and splayed step should be avoided. Circular stair and sloped landing should be avoided.</p>	<p>Stairs should not be the only means of moving between floors. They should be supplemented by lifts and /or ramps.</p> <p>Also, spiral stairs should be avoided.</p>	<p>Steps and staircases are intended as an alternative to lift access in buildings and shall be of adequate design to allow all persons, with or without a disability, to travel safely and independently. Stairs shall not be the only means of moving between floors. They shall be supplemented by lifts and/or ramps.</p> <p>Spiral stairs shall be avoided.</p>	<p>Spiral and curved stairs are not recommended.</p>
Rise and going of steps	<p>Treads not less than 300 mm in width.</p> <p>Risers not more than 150 mm in height.</p> <p>Individual flight should not exceed 1800 mm in height</p>	<p>Treads should be 300 mm deep.</p> <p>Risers not higher than 150 mm.</p> <p>There should be no more than 12 risers in one flight run.</p> <p>Steps should be of a</p>	<p>Treads shall be 300 mm deep.</p> <p>Risers not higher than 150 mm.</p> <p>There shall be no more than 12 risers in one flight run.</p> <p>Steps shall be of a</p>	<p>Going of a step should be not less than 300 mm. The minimum going of the tread shall be 260 mm, and the maximum rise shall be 180 mm. The rise and tread of steps within flights shall be</p>

Dimensions	CPWD	HG	NBC	ISO
	<p>nor a total of 11 risers. Open risers should be avoided. All steps should be uniform.</p>	<p>consistent height and depth throughout the staircase. Open stairs shall not be provided to minimize the risk of stumbling.</p>	<p>consistent height and depth throughout the staircase. open stairs shall not be provided to minimize the risk of stumbling.</p>	<p>uniform. A flight of steps should not contain more than 16 risers. However, in circumstances where the plan area is restricted, a flight of a stairs shall contain no more than 20 risers. Should spiral and curved stairs be used, the inside handrail should have the inside edge vertically parallel with the going at a point where the depth of the going is a minimum of 220 mm. The sum of the going and twice the rise of a step should be not less than 600 mm and not more than 660 mm. The riser of a step shall not be open.</p>
Nosing	<p>The risers built with vertical or receding face not more than 15 mm from the vertical, without a</p>	<p>Projecting nosing and open stairs should not be provided to minimize the risk of</p>	<p>Projecting nosing and open stairs shall not be provided to minimize the risk of stumbling.</p>	<p>The projection of a step nosing over the tread below shall be avoided but, if necessary, shall not</p>

Dimensions	CPWD	HG	NBC	ISO
	projecting nosing. It shall be provided with non-slip nosing in contrasting colour.	stumbling.		be more than 25 mm. The nosing shall provide an uninterrupted transmission between riser and tread.
Minimum width of stair flights	.	The stairs should have minimum 1500 mm clear width.	The stairs should have minimum 1500 mm clear width. However, in no case the clear width of the staircase shall be reduced below 1200 mm.	<p>The minimum width of a flight of stairs shall be 1200 mm.</p> <p>The minimum width between handrails shall be 1000 mm.</p> <p><i>Exceptional considerations for existing buildings in developing countries:</i> In some member states, the minimum width of a flight of stairs may be reduced to 900 mm and the minimum width between handrails may be reduced to 800 mm.</p> <p>For Fire exit staircase: be not less than 1500 mm.</p>

Dimensions	CPWD	HG	NBC	ISO
Avoidance of projection	No appliances, fixtures or fittings shall project beyond 90 mm from the surface of any wall in a staircase below a level of 2000 mm above the treads of the staircase unless they are unavoidable, in which case they shall also be extended downwards to the level of the treads.		No appliances, fixtures or fittings shall project beyond 90 mm from the surface of any wall in a staircase below a level of 2000 mm, measured above the treads of the staircase. If such a projection is unavoidable, the same shall also be extended downwards to the level of the treads.	
Staircase landings		The stairs landing should be minimally 1200 mm deep.	The stairs landing should be minimally 1200 mm deep.	The area of a landing shall be clear of any obstruction including the path of the swing of a door or gate. Where there is a half landing or a 180° turn, it shall never be less than 1500 mm wide in order to facilitate carrying a person on a stretcher. If the stepped path is multi-channelled, the length of an intermediate

Dimensions	CPWD	HG	NBC	ISO
				landing shall not be less than the unobstructed width of the widest channel.
Head clearance			Soffit of the stairs, shall be cordoned off either by building a wall in front of it or by putting handrails to guide persons around the space.	Clear accessible height under stairs shall be a minimum of 2100 mm or greater. If the clear height is less than 2100 mm, a guard or other element shall be provided to shield against impact. Head clearance on the stair shall be minimum 2100 mm.
Colour contrast and visual warning	Treads and walls of a staircase shall be in contrasting colours.	Step edges must contrast in colour to the risers and the treads. Contrast colour bands 50 mm wide should be provided on edge of the tread. There	There shall be colour contrast between landings, and the steps. Step edges shall contrast in colour to the risers and the treads. Contrast colour bands 50 mm wide shall be provided on edge	There shall be a visual contrast between landings and the top and bottom step of a flight of stairs. Preferably, a visual warning line with a single strip of 40 mm to 50 mm without a break shall be

Dimensions	CPWD	HG	NBC	ISO
		<p>should be colour contrast between landings, and the steps.</p>	<p>of the tread.</p>	<p>provided on the front edge of the going of each step with a minimum difference in LRV of 60 points and may return down the riser for a maximum of 10 mm. The visual indicator on the going may be set back a maximum of 15 mm from the front of the nosing. As an alternative solution, a visual warning line with a width between 50 mm and 100 mm shall be provided on the going of the first and the last step of the flight.</p>
<p>Tactile warnings and information</p>	<p>Tactile warning strips shall be provided at landings and at both the bottom and top ends of a staircase, regardless of the number of steps it comprises. For landings leading to a floor or those enclosed by wall, railing or</p>	<p>Warning blocks should be installed 300 mm before the beginning and 300 mm after the end of each flight of steps to aid people with visual impairments.</p>	<p>Tactile ground surface indicators (warning type) shall be installed 300 mm before the beginning and 300 mm after the end of each flight of steps of external affairs to aid people with visual</p>	<p>Where a stair is in an open area, a tactile attention pattern may be beneficial. National regulations can require the systematic use of tactile warning on any stair. However, where different materials are used for the flights and</p>

Dimensions	CPWD	HG	NBC	ISO
	<p>balustrade, tactile warning strips of 300 mm in width shall be provided; for those leading to an open space or the entrance / exit of a building, the tactile warning strips shall be 600 mm in width. In this case, Braille and tactile information signs shall be provided on the adjacent wall to indicate the presence of an opening. For a staircase with intermediate steps between two flights, the provision of tactile warning strips shall follow the arrangement in.</p>		<p>impairments.</p> <p>Tactile warning strips shall be provided at landings and at both the bottom and top ends of a staircase, regardless of the number of steps it comprises. For landings leading to a floor or those enclosed by wall, railing or balustrade, tactile warning strips of 300 mm in width shall be provided; for those leading to an open space or the entrance/exit of a building, the tactile warning strips shall be 600 mm in width. In this case, Braille and tactile information signs shall be provided on the adjacent wall to indicate the presence of an opening. For a staircase with intermediate steps between two flights, the provision of tactile</p>	<p>landings of a stair, care should be taken to ensure that their frictional characteristics are similar in order to minimize the risk of stumbling.</p> <p>Where tactile attention patterns are used, they should be provided on the landings at the top and bottom of every flight of stairs across the whole width of the stair. The tactile attention pattern should have a depth of between 600 mm and 900 mm ending 300 mm to 500 mm before the front edge of the first down going step.</p> <p>Where tactile attention patterns are used at the top and bottom of stairs, the attention pattern shall not reduce visual detection of the first and</p>

Dimensions	CPWD	HG	NBC	ISO
			warning strips shall follow the same arrangement.	the last step of the flight.
Guards along stairs				If a stair rises more than 600 mm above the adjacent ground, it shall be provided with guards from that point on.
Lighting			Illumination level of 100-150 lux shall be maintained on the stairs.	The minimum illumination at the top and bottom of the flight should be 200 lux and 150 lux in between.
Materials and finishing			The materials selected for the surface finish of the stairs shall be firm and slip resistant, especially if surfaces are likely to become wet due to location or use, or if spillage occurs. Slippery surfaces like granite, glazed tiles are best avoided.	

Dimensions	CPWD	HG	NBC	ISO
			Shiny, polished surface materials that cause glare shall not be used for stairs or ramps.	

Observations and Recommendations

1. General: CPWD Guidelines mention that “Where steps or stairs are in an accessible route, complementary ramps, lifts or escalators should be provided”. The term ‘escalator’ should be removed from here. There should not be a choice between escalators and lifts.
2. Number of steps in a flight of stairs: The total number of steps in one flight of stairs is different in different Guidelines. The CPWD says 11, in HG and NBC, it is 12 and ISO says 16. Indian Standards should be established and should be the same in all Guidelines.
3. Minimum width: CPWD Guidelines should mention the minimum width of staircase. Clear width of staircase between the handrails should be specified in CPWD, HG and NBC as given in the ISO. NBC though mentions 1500 mm as the minimum width, it also says that in no case it should be less than 1200 mm. It may be useful to add in the NBC that for fire exit staircases the width should be 1500 mm.
4. Landings: Staircase landing Standards should be taken from ISO in all Indian standards as the same takes into account turning space for stretchers etc.
5. Head clearance: Head clearance for staircase should be specified in Indian Standards as given in the ISO.
6. Visual and tactile warning: Specifications for visual contrast are more elaborate in ISO and should be adopted in Indian Standards as well.
7. Lighting: Requirements for minimum illumination level is missing in CPWD and HG. It’s there in NBC but lower than the ISO. ISO Standards should be adopted.
8. Guard along stairs: ISO mentions guards along staircase. This should be adopted in Indian Standards.

9 Doors and Windows

Dimensions	CPWD	HG	NBC	ISO
Minimum width of doors	Not less than 900 mm between the open door and opposite jamb or the other leaf.	The minimum clear opening of doorways should be 900mm, measured between the face of the door and the face of the door stop with the door open at 90°..	The minimum clear opening of doorways shall be 900 mm, measured between the face of the door and the face of the door stop with the door open at 90°.	The minimum unobstructed width of an entrance doorway shall be not less than 800 mm; 850 mm or more is recommended Note: Many national building regulations require a minimum width of 900 mm for an entrance door.
Clear height of a doorway				The minimum clear height of a doorway shall be not less than 2000 mm.
Wheelchair maneuvering space		Corridor should have a width of at least 1200 mm to allow a 90° turn to be made through a door. In narrow spaces sliding doors may be preferable.	A corridor shall have a width of at least 1200 mm to allow a 90° turn to be made through a door. In narrow spaces, sliding doors may be preferable. Front approaches to pull side of swinging doors shall have maneuvering space that extends 600 mm minimum beyond the latch	Level maneuvering area on either side of the door, if any door is opening towards a descending stair, the minimum safe distance for maneuvering should be 2000 mm, including doorswing, to minimize the risk for wheelchair users. In front of the door opening into

Dimensions	CPWD	HG	NBC	ISO
			<p>side of the door, if 1200 mm minimum is provided perpendicular to the doorway; or maneuvering space that extends 450 mm minimum beyond the latch side of the door shall be provided, if 1500 mm minimum is provided perpendicular to the doorway.</p> <p>Front approaches to push side of swinging doors shall have maneuvering space that extends 300 mm minimum, beyond the latch side of the door and 1200 mm minimum, perpendicular to the doorway.</p>	<p>the building, there should be a minimum horizontal maneuvering space of 1500 mm by 1500 mm. Where turning 180° in a wheelchair may be required, there shall be a minimum of 1600 mm by 2150 mm.</p>
<p>Unobstructed area to reach /operate the handle</p>	<p>The unobstructed area adjacent to the door handle on the leading face of a single door shall not be less than 330 mm in width. Door, if less than 330 mm from the corner of a room,</p>	<p>Wheelchair maneuvering spaces should be free of any obstructions and space should be provided on the side of the door handle in the following manner:</p>	<p>Wheelchair maneuvering spaces shall be free of any obstructions and be provided on the side of the door handle in the following manner:</p> <ul style="list-style-type: none"> - On the pull side, a minimum space of 650 mm; 	<p>A clear space of 600 mm (700 mm recommended) at the latch side of the door is required to allow someone to operate the door handle.</p> <p>The maximum distance from the handle of the</p>

Dimensions	CPWD	HG	NBC	ISO
	shall swing from the side nearer to that corner.	<ul style="list-style-type: none"> - On the pull side, a minimum space of 650 mm; - On the push side, a minimum space of 300 mm; - For two-way swing door, a minimum space of 300mm. 	<ul style="list-style-type: none"> - On the push side, a minimum space of 300 mm; and - For two-way swing door, a minimum space of 300 mm. 	<p>door leaf to the wall surface shall not exceed 250 mm. Design, installation and maintenance of sliding doors should be specially considered.</p> <p>A maneuvering space of not less than 600 mm shall be provided between the leading edge of a door and a wall that is perpendicular to the doorway; 700 mm or more is recommended.</p>
Two doors in series		The minimum space between two hinged or pivoted doors in series should be 1200 mm plus the width of the door swinging into that space.	The minimum space between two hinged or pivoted doors in series, shall be 1500 mm plus the width of the door swinging into that space.	
Double-action self-closing doors	Double-action self-closing door shall have a check mechanism to prevent the door swinging beyond the			

Dimensions	CPWD	HG	NBC	ISO
	closed position and a transparent vision-panel with a bottom edge not more than 1000 mm above the floor and the top edge not less than 1500 mm above the finished floor level.			
Height of handles	Door handle shall not be less than 950 mm and not more than 1050 mm above the finished floor level, measured from the top surface of the grip.	Be mounted at a height of 850 mm to 1100mm from the floor. -Push –pull mechanisms that require no grasping; - Lever handles to be preferred on latched doors; - It is safer to use D shaped handles as they reduce the risk of catching on clothing, or injuring from the exposed lever end. - Doorknob is not recommended.	Be mounted at a height of 850 mm to 1100 mm from the floor. -Push-pull mechanisms that require no grasping; - Lever handles to be preferred on latched doors; - It is safer to use D-shaped handles as they reduce the risk of catching on clothing, or injuring from the exposed lever end; and - Doorknob is not recommended.	Door furniture shall be located between 800 mm and 1000 mm in height, preferably 900 mm. Door locks, door handles, bells and other devices for gaining entry to a place shall be easy to locate, identify, reach and use, and shall be operable with only one hand. D-lever handles are preferred.
Door thresholds	Door threshold shall not	There should be no	There shall be no thresholds	Entrances into the building

Dimensions	CPWD	HG	NBC	ISO
	exceed 20 mm in height and shall be beveled to facilitate passage of wheelchairs.	thresholds. If thresholds are unavoidable, they should not exceed 12 mm and those exceeding 5 mm should be beveled.	(doorsills). If thresholds are unavoidable, they shall not exceed 12 mm and those exceeding 5 mm shall be beveled.	should be level. Any raised threshold shall not exceed 20 mm. Where a raised threshold is necessary, it shall have maximum height of 20 mm, be bevelled down, and have a minimum difference in LRV of 30 points compared to the floor.
Kick-plates	All doors which allow the passage of wheelchairs should have kick-plates of not less than 200 mm high fitted on the face which swings away.	Kick- plates of 300-400 mm height (Figure 5-25) are recommended for doors in high use in order to protect the push side of doors from damage.	Kick-plates of not less than 300-400 mm height are recommended for doors in high-use in order to protect the push side of doors from damage.	
Door identification	The presence of door, whether opened or closed, should be apparent to persons with visual impairment through the careful choice of colour and materials for the door and its surroundings.	To help people with impaired sight to see doors, the door and frame should be in a colour which contrasts with the adjoining wall. The door should not be of a highly polished/reflective material such	To help people with impaired sight to see doors, the door and frame should be in a colour which contrasts with the adjoining wall. The door shall not be of a highly polished/reflective material such as stainless steel.	Doors forming part of an accessible path of travel shall have a difference in light reflectance value to doorframe and the surrounding wall of not less than 30 points, The minimum width of the area of visual contrast

Dimensions	CPWD	HG	NBC	ISO
	Provision of marking on glass doors would help persons with visual impairment to distinguish obstacles and passage as well as for public to avoid collision. Door handle of manually operated doors and control switch or button of door with powered open devices should have a minimum luminous contrast of 30% with the background finishes.	as stainless steel.		shall be 50 mm. If this is not possible to achieve, a marking of at least 50 mm width (e.g. around the frame of the door), with a different visual contrast from the wall (with a minimum difference in LRV of not less than 30 points) shall surround all the perimeter of the door. There should be a visual contrast between the door leaf and the handle of at least 15 points.
Vision/viewing panels	Should be installed with bottom edge not more than 1000 mm and top edge not less than 1500 mm above the finished floor level.	Panel giving visibility from a height of 800 mm to 1500 mm.	Panel giving visibility from a height of 800 mm to 1500 mm.	The lower edge of the glazed panel shall be not more than 600 mm above the finished floor, the upper edge of the glazed panel shall be not less than 1600 mm above the finished floor, in width, the glazed panel shall start not more than 200 mm from the latch edge of the door, and the glazing

Dimensions	CPWD	HG	NBC	ISO
				shall be not less than 150 mm wide, the glazed panel may be subdivided by narrow construction cross-sections of a maximum width of 200 mm.
Visual indicator on glass doors	The leading edge of glass door should be marked to indicate glass. "If frameless glass door is used, it shall be prominently marked so as to make it visible. The marking shall be placed across on the glass door such that at least a portion of the marking is placed between 900 mm and 1500 mm above the finished floor. The colour marking shall also be provided to glass panel adjacent to the glass door."	The presence of a glass door should be made apparent, with permanent manifestation at two levels, within 800 mm to 1000 mm from the floor and within 1400 mm to 1600 mm from the floor , contrasting visually with the background seen through the glass in all light conditions. The edges of a glass door should also be apparent when the door is open. Note: If a glass door is adjacent to, or is incorporated within, a fully glazed wall, the	The presence of a glass door shall be made apparent, with permanent manifestation at two levels, within 850 mm to 1000 mm from the floor and within 1400 mm to 1 600 mm from the floor, contrasting visually with the background, seen through the glass in all light conditions. The edges of a glass door shall also be apparent when the door is open. Note: - If a glass door is adjacent to, or is incorporated within, a fully glazed wall, the door and wall shall be clearly differentiated from one another, with the door more	Glazed (glass) walls and fully glazed doors shall be clearly marked with visual indicators. Large glazed areas close to circulation spaces could be mistaken for openings. Glazed walls, doors and other areas of full height glazing are very disorientating for blind or partially sighted people. The reflections from these surfaces can be particularly confusing. Uninterrupted visual indicators of at least 75 mm height with a difference in light reflectance values of minimum 30 points to the background shall be

Dimensions	CPWD	HG	NBC	ISO
		<p>door and wall should be clearly differentiated from one another, with the door more prominent. To achieve this, the door may be framed on both sides and the top by an opaque high-contrast strip at least 25 mm wide.</p>	<p>prominent. To achieve this, the door may be framed on both sides and also on the top by an opaque high-contrast strip at least 25 mm wide.</p>	<p>placed at a height of 900 mm to 1 000 mm and 1300 mm to 1400 mm above floor level. An additional visual indicator placed at a height of 100 mm to 300 mm is recommended. Visual indicators consisting of two separate colours with a minimum difference in LRV of 60 points are recommended to enable lighting conditions and backgrounds to be taken into account.</p>
<p>Door opening force</p>	<p>Horizontal force of not more than 30 N and 22 N respectively. Door required to have fire resistance period installed along accessible routes shall be opened with horizontal force of not more than 30 N.</p>	<p>The maximum force for pushing or pulling or sliding a door should be 20 N.</p>	<p>The maximum force for pushing or pulling or sliding a door shall be 20 N.</p>	<p>When the operating force needed to open the door is greater than 25 N, an automatic opening door is recommended. People with impaired mobility often experience difficulties when using self-closing doors. The force required to open doors should be 25 N. Self-closing doors should</p>

Dimensions	CPWD	HG	NBC	ISO
				have an opener. Buildings for public use should preferably have automatic doors or controlled door closing devices with a hold- open device. An alternative option is the use of dual powered controlled door closing devices with electromagnetic retention for higher power spring.
Door closure speed	A closing period of at least 3 seconds measured from an open position of 70° to a point 75 mm from the closed position measured from the leading edge of the door.	The sweep period of the door should be adjusted, so that from an open position of 90 degrees the door does not take less than 3 seconds to move to a semi-closed position.	The sweep period of the door should be adjusted, so that from an open position of 90°, the door does not take less than 3 sec to move to a semi-closed position.	
Windows		Unobstructed viewing zone between 600mm and 1400mm. -Curtain or Venetian blind controls/ropes should be at 800-1000 mm height	Unobstructed viewing zone between 600 mm and 1400 mm. - Curtain or venetian blind controls/ropes shall be at 800-1000 mm height from the finished floor	The lower edge of the glazing should be no higher than 1100 mm from the floor. Hardware, shutters and switches for remote control should be placed

Dimensions	CPWD	HG	NBC	ISO
		<p>from the finished floor level.</p> <p>- Handle should be located at a height of between 600 mm to 1100 mm from the floor.</p> <p>For the requirements for handles, also see the Door section.</p>	<p>level.</p> <p>For the requirements for handles, also see the Door section.</p>	<p>between 800 mm and 1100 mm above the floor. Opening windows shall not project into pedestrian areas below a height of 2100 mm.</p> <p>For the requirements for handles, also see the Door section.</p>

Observations and Recommendations

1. Height of doorway: Only ISO has given the minimum clear height of a doorway which shall be not less than 2000 mm. CPWD, HG and NBC should add this point.
2. Maneuvering space: CPWD has not mentioned about the maneuvering space required on either sides of the door. NBC says that space is required beyond the latch side of the door for the pull and push. HG should add the point. ISO gives requirement for turning space in case 180 degree turn is required or if staircase is there. These should be incorporated in the Indian Standards.
3. Unobstructed space to reach the handle: HG and NBC are comprehensive with regard to minimum space required on push side and pull side. CPWD should update the Standards and make it in line with HG and NBC.
4. Two doors in a series: HG mentions that "the minimum space between two hinged or pivoted doors in series should be 1200 mm plus the width of the door swinging into that space". However, NBC mentions 1500 mm. CPWD has not covered this. CPWD should add this point and HG should revise it as per NBC.
5. Double-action self-closing door: Only CPWD gives requirement for Double-action self-closing door. HG, NBC should add this point too.

6. Height of handles: Standards given in HG and NBC are the same, i.e. 850 to 1100 mm; in CPWD it is 950 to 1050 mm and in ISO it is between 800 and 1000 mm. ISO Standards seem more suitable and should be adopted by Indian Standards.
7. Door threshold: CPWD should adopt the specification given in HG and NBC with regard to the maximum height of thresholds. In addition, ISO provides LRV requirement and should be adopted in all Indian Standards.
8. Kick plates: CPWD mentions that "all doors which allow the passage of wheelchairs should have kick-plates of not less than 200 mm high fitted on the face which swings away." HG and NBC say the height should be 300-400 mm. The standard given HG and NBC is better and CPWD should adopt the same.
9. Door identification: CPWD and ISO give the LRV requirement of door with the surrounding. ISO is comparatively more comprehensive. HG and NBC should add the information from ISO.
10. Vision panel: HG and NBC have given the lower edge requirement as 800 mm while CPWD has given 1000 mm and ISO 600 mm. ISO seems more suitable and all Indian Standards should adopt the ISO Standard. ISO also gives width of glazed panel. This should also be added in Indian Standards.
11. Visual indicators on glass doors/panels: HG and NBC requirements are more or less similar and it mentions manifestation at two levels. CPWD has given different requirement and provides for marking at only one level. ISO has provided for visual indicators at three levels. ISO has also given requirements for width of visual indicators and LRV requirements. ISO is more comprehensive. This should be adopted in Indian Standards.
12. Door opening force: HG and NBC mention that the maximum force for pushing or pulling or sliding a door should be 20 N. CPWD says 22 N and ISO say 25 N. HG and NBC standards are fine. CPWD should revise the Standard to make it 20 N.
13. Door closing speed: HG and NBC have same requirements. CPWD should revise the Standards as per HG and NBC.
14. Different types of doors: ISO has also given specification for revolving door, sliding or folding door, powered swing door and automatic opening doors. These should be adopted by Indian Standards (pages 52 and 53 of ISO).
15. CPWD should add a section on windows. ISO has given that windows should not open in pedestrian area below height of 2100 mm. This should be included in HG and NBC.

10 Elevators and Lifts

Dimensions	CPWD	HG	NBC	ISO
Minimum inner dimensions of lift car	2000 mm x 1100 mm	1500 mm wide x 1500 mm deep; wherever possible, 13 passenger lift to be provided, which allows easy maneuverability of wheelchair user.	1500 mm wide x 1500 mm deep, that allows Easy maneuverability of wheelchair users.	1100 mm x 1400 mm. If a trolley with a stretcher is considered, the minimum inner dimensions of cars shall be 1200 mm x 2300 mm. If an entrance is provided on two adjacent sides, the minimum inner dimensions of cars shall be 1600 mm x 1400 mm.
Lift signage		Lifts should be marked with the symbol of accessibility and directional signs be provided to the lifts. Signs indicating the location of an accessible lift should be provided in a location that is clearly visible from the	Lifts shall be marked with the international symbol of accessibility. Directional signs indicating the location of an accessible lift shall be provided at a location that is clearly visible from the building entrance. The	The lifts shall be marked with signage as set in the standards showing that they fulfill minimum accessibility requirements.

Dimensions	CPWD	HG	NBC	ISO
		<p>building entrance. The sign should incorporate a representation of the International Symbol for Access.</p> <p>A sign indicating the number of the floor should be provided on each lift landing on the wall opposite the lift. It is also recommended to install a floor directory of the main facilities and services available on the lift landing, along with an accessible emergency egress route that clearly indicates the location of nearest refuge areas for Persons with Disabilities.</p>	<p>directional signs shall incorporate a representation of the International Symbol of Accessibility.</p> <p>A sign indicating the number of the floor arrived shall be provided on each lift landing on the wall opposite the lift in big fonts with good colour contrast.</p> <p>It is recommended to install a floor directory of the main facilities and services available on the lift landing, along with an accessible emergency egress route that clearly indicates the location of the nearest refuge area for persons with disabilities.</p>	
Lift car entrance – Door opening	Clear entrance width: 900 mm.	Clear opening of not less than 900 mm and	Clear opening of not less than 900 mm and	The unobstructed entrance width shall be

Dimensions	CPWD	HG	NBC	ISO
	<p>Lift car doors and landing doors shall be of the horizontally sliding type, power- operated and automatically controlled. An audible signal shall be provided to signify the closing of the doors to alert persons. A detection device shall be provided to re- open the lift doors in the event of hitting any obstacle.</p> <p>The detection device shall be positioned at a height of between 500 mm to 600 mm above the floor of the lift car.</p> <p>Lift door systems should be designed to allow adequate time for passage of persons with a disability and the elderly. Where planning allows, lift cars may be provided with opposing doors to allow a wheelchair user to leave without having to</p>	<p>contrasting in colour from the adjoining wall. There should be no difference in level between the lift door and the floor surface at each level. The gap between the lift door and building floor should not be more than 12 mm.</p> <p>Time of closing of an automatic door should be more than 5 seconds and the closing speed should not exceed 0.25 meters per second.</p>	<p>contrasting in colour from the adjoining wall. There shall be no difference in level between the lift door and the floor surface at each level. The gap between the lift door and building floor shall not be more than 12 mm.</p> <p>Time of closing of an automatic door shall be more than 5 sec and the closing speed shall not exceed 0.25 m/s.</p>	<p>at least 800 mm; 900 mm is preferred. If a trolley with a stretcher is considered, the minimum unobstructed entrance width: 1100 mm.</p> <p>The car and landing doors shall be constructed as automatic power operated horizontally sliding doors. The colour and tone of the lift entrances should contrast with the surrounding wall finishes. The door opening time shall be adjustable to suit the conditions where the lift is installed (normally between 2 s and 20 s). A mechanism to increase this time shall be installed to be customized by a user</p>

Dimensions	CPWD	HG	NBC	ISO
	reverse.			<p>with mobility impairments (e.g. by means of a button outside the car to call the lift to the floor for it to arrive with extended door opening time, and a button marked with a wheelchair symbol inside the car with the same purpose). A presence sensor device shall cover the opening over the distance between at least 25 mm and 1800 mm above the car door sill (e.g. light curtain). The device shall be a sensor which minimizes the likelihood of physical contact between the user and the leading edges of the closing panel(s).</p>
Maneuvering space outside				The maneuvering space should not be in any

Dimensions	CPWD	HG	NBC	ISO
the lift entrance				<p>circulation route nor directly opposite to any stair circulation. If a stair is situated opposite the entrance, the distance to the stair shall be at least 2000 mm to allow safe maneuvering. The maneuvering area shall be adequately lit with a minimum illumination of 100 lux.</p> <p>A maneuvering space of 1200 mm X 1200 mm can be accepted according to national regulations and national standards, but could lead wheelchair users to dangerous situations.</p> <p>In order to aid in location of the lift entrance, a distinguishable floor surface of approximately 1500</p>

Dimensions	CPWD	HG	NBC	ISO
				mm X 1500 mm should be installed outside the doors. This could be obtained by means of a change of colour or floor finish. Changes in floor finish should be flush.
Handrail/grab bars	The top of the gripping surface of the handrails shall be at a height of 850 mm – 950 mm, with a space of 30 mm - 50 mm between the handrails and wall.	Grab bars should: Be placed at a height of 900 mm from the floor level; and be fixed on both sides and at the rear of the lift.	Grab bars shall be placed at a height of 900 mm from the floor level. These shall be fixed on both sides and at the rear of the lift.	At least one handrail shall be provided in the car and shall be fixed horizontally on the same side as the car operating panel; it is recommended to provide one handrail on each car wall. Handrails may be interrupted at the car operating panel(s) if it is required to gain access to lift controls. The gripping part of the handrail shall: - be in a perimeter of between 100 mm and 160 mm,

Dimensions	CPWD	HG	NBC	ISO
				<p>- have a minimum dimension of 25 mm (35 mm is recommended),</p> <p>- have a maximum dimension of 55 mm (45 mm is recommended), and</p> <p>- have no sharp edges.</p> <p>The height to the top of the handrail shall be between 800 mm and 950 mm above the floor; a height of 850 mm (+/-) 25 mm is recommended.</p> <p>The free space between the wall and the gripping part shall be between 35 mm and 45 mm; 50 mm is recommended.</p> <p>The projecting ends of the handrails shall be closed and turned towards the wall to minimize the risk of injury.</p>

Dimensions	CPWD	HG	NBC	ISO
Audio and visual indicators		<p>The lift should have a voice announcement system along with a visual display to indicate the floor level and also the information that the door of the cage is open or closed for entrance or exit.</p> <p>The announcement system should be clearly audible i.e. the announcement should be 50 decibel.</p>	<p>The lift shall have a voice announcement system along with a visual display to indicate the floor level and also the information that the door of the cage is open or closed for entrance or exit. The announcement system shall be clearly audible, that is, the announcement shall be 50 dB.</p>	
Floor and wall surfaces of the car	<p>The use of visually and acoustically reflective wall surfaces can cause discomfort for persons with visual and hearing impairment.</p>	<p>The use of visually and acoustically reflective wall surfaces should be minimized within the lift car as visual reflections can cause discomfort and affect the visual acuity of people with visual impairments.</p> <p>The floor of the lift car should be slip resistant and have similar</p>	<p>The use of visually and acoustically reflective wall surfaces should be minimized within the lift car as visual reflections may cause discomfort and affect the visual acuity of people with visual impairments.</p> <p>The floor of the lift car should be slip resistant and have similar</p>	<p>Internal walls shall have a non-reflective, matte finish in a colour and tone contrasting with the floor. The car floor shall be rigid, slip-resistant and have a non-reflective, matte finish.</p> <p>A lift floor with a high LVR reassures blind and partially sighted</p>

Dimensions	CPWD	HG	NBC	ISO
		frictional qualities to the floor of the lift landing to decrease the risk of stumbling.	frictional qualities to the floor of the lift landing to decrease the risk of stumbling.	people that they are not stepping into an open lift shaft. The floor of the car should have a similar surface characteristic to the landing floor. The control buttons shall comply with ISO 4190-5 with tactile and contrasting design to the surrounding wall in order to locate them easily. Surface materials that a user can be allergic to include nickel, chromium, cobalt and natural or synthetic rubber; these materials should be avoided in buttons, controls, handles or handrails.
Emergency call button in lifts/emergency warnings	An emergency alarm push button together with a buzzer, an indication light for acknowledgement and	The emergency communication system should be coupled with an induction loop	The emergency communication system should be coupled with an induction loop	The car shall have an alarm device (two-way communication system) permanently

Dimensions	CPWD	HG	NBC	ISO
	<p>an intercom shall be provided in each lift car and be connected to the building management office or the caretaker's office. The building Management office or the caretaker's office shall be equipped with a buzzer, indication light(s) (one for each lift) and an intercom connected to the lift car(s). The indication light for acknowledgement shall be in the form of a blinking light adjacent to the intercom speaker and a notice when light blinks, it indicates your emergency call has already been received. Please be patient and wait for the rescue. In English and Hindi shall be provided next to the blinking light. This system shall be</p>	<p>system installed all around the lift. Telephone units, where provided, should have an inbuilt inductive coupler to assist persons using hearing aids.</p>	<p>system installed all around the lift. Telephone units, where provided, should have an inbuilt inductive coupler to assist persons using hearing aids.</p>	<p>connected to a manned security point according to the following:</p> <ul style="list-style-type: none"> - The device shall ensure voice communication in both directions with an organization in charge of passenger rescue or with the person in charge of the safety of the building. - A minimum operating force of 2,5 N shall be required to operate the alarm. - The device shall provide visual and audible information feedback for passengers confirming that: the alarm has been sent, using a yellow enlightened bell-shaped symbol, and the alarm has been received, voice

Dimensions	CPWD	HG	NBC	ISO
	<p>powered by an emergency electricity supply system in the event of power failure. The graphics for tactile markings for open- door and close-door push buttons, emergency alarm button, and main entrance level are shown in for reference. Call button panels should be provided at both sides of door openings.</p>			<p>communication established, using the green enlightened symbol consisting of two heads.</p>
<p>Mirror or mirrored wall within the car</p>	<p>For lifts of the size that does not allow a wheelchair user to turn around within the lift car, mirror should be installed with the bottom edge to be set at 900 mm above the floor level in the lift car to facilitate a wheelchair user in reversing and to see which level the lift has reached.</p>	<p>The provision of a mirror on the wall of the lift car opposite the lift door is a positive aid to navigation for wheelchair users. It allows the wheelchair user to see if anyone is behind them and also to see the floor indicator panel. The mirror should not extend below 900 mm from the</p>	<p>The provision of a mirror on the wall of the lift car opposite the lift door is a positive aid to navigation for wheelchair users. It allows the wheelchair user to see if anyone is behind them and also to see the floor indicator panel. The mirror should not extend below 900 mm from the</p>	<p>In case of a car size of 1100 mm by 1400 mm where a wheelchair user cannot turn around, a device (e.g. a small mirror) shall be installed to enable the user to observe obstacles behind when moving backwards out of the car. If a glass mirror is used it shall be made of safety</p>

Dimensions	CPWD	HG	NBC	ISO
		lift floor to avoid confusing people with impaired sight.	lift floor to avoid confusing people with impaired sight.	glass. If any wall of the car is substantially mirrored or covered with a reflective surface, measures shall be taken to avoid creating optical confusion (e.g. by means of decorated glass, or a minimum vertical distance of 300 mm between the floor and the bottom edge of the mirror, etc.).
Seat				Where a fold-up seat is provided, it shall have: a top height from the floor of (500 20) mm; A depth of 300-400 mm; A width of 400-500 mm; An ability to support a minimum load of 100 kg; 200 kg is recommended, considering the

Dimensions	CPWD	HG	NBC	ISO
				increasing number of obese people in the worldwide population.
Lighting				Internal car lighting should provide a minimum level of illumination of 100 lux at floor level, uniformly distributed, and avoiding the use of spotlights.
Control devices and signals	Essential lift control buttons including floor numbering buttons, emergency alarm push button and door opening push button in the lift car shall not be less than 900 mm and not more than 1200 mm above the floor of the car. - Provision of secondary control panel for over-spilled floor numbering buttons is always acceptable.	The call button located outside the lift should:- Have a clear floor space of at least 900 mm x 1200 mm with no obstruction placed to prevent a wheelchair user from reaching the call button; and - Be installed at a height between 800 mm and 1000 mm. The control panel should: Have a clear floor space	The call button located outside the lift shall have a clear floor space of at least 900 mm x 1200 mm with no obstruction placed to prevent a wheelchair user from reaching the call button and shall be installed at a height between 800 mm and 1000 mm. The control panel inside the lift shall meet the following requirements:	Where it is intended to provide accessibility for all, controls should be placed within a defined area. Landing controls should be placed at a minimum distance of 500 mm (600 mm recommended) from any adjacent corner or wall. Car controls should be placed at a minimum distance of 400 mm (500 mm recommended) from

Dimensions	CPWD	HG	NBC	ISO
	<ul style="list-style-type: none"> - All lift control buttons shall have a minimum dimension of 20 mm. - Braille and tactile markings shall be placed either on or to the left of the control buttons. - Such Braille and tactile markings shall be in Arabic numerals and/or symbols. Tactile markings shall have a minimum dimension of 15 mm high and be raised 1 mm minimum. - The tactile marking of the push buttons for the main entrance floor shall be identified with a symbol in a star shape. - The emergency alarm push button shall be in a tactile bell shape. 	<p>of at least 900 mm x 1200 mm with no obstruction placed to prevent a wheelchair user from reaching it; Be placed at a height of between 800 mm and 1000 mm from the floor level and Have buttons with Braille/ raised letters and in sharp contrast from the background to aid people with visual impairments.</p>	<ul style="list-style-type: none"> - It shall have a clear floor space of at least 900 mm x 1200 mm with no obstruction placed to prevent a wheelchair user from reaching it; - It shall be placed at a height of between 800 mm and 1 000 mm from the floor level; and - It shall have buttons with Braille/raised letters and in sharp contrast from the background to aid people with visual impairments. 	<p>any adjacent corner or wall. Both landing controls and car controls should be placed between 900 mm and 1200 mm above floor level, preferably 1100 mm. The controls can be placed either vertically or horizontally within this area.</p> <p>Note: In buildings with a small number of floors and a high number of wheelchair users, placing the controls horizontally can be helpful. People with mental impairments may have difficulties using a keypad system. In buildings with a small number of floors, it is recommended to use 25 mm x 25 mm square buttons or 30</p>

Dimensions	CPWD	HG	NBC	ISO
				<p>mm circular buttons with raised tactile letters, whether they are placed vertically or horizontally. Braille can be used as a complementary and independent feature to tactile figures and is useful where large texts are necessary.</p>
<p>Use of lifts (elevators) for fire evacuation</p>				<p>All lifts/elevators in new buildings should, be capable of being used for evacuation in a fire situation. If lifts/elevators in existing buildings undergo a major overhaul, or if they are replaced, they should be made capable of use for this purpose. For details, please refer to pg. 45-46.</p>

Observations and Recommendations

1. The Lift dimension/inner dimension of car: It is different in CPWD. This should be synchronised with HG and NBC, which seem more appropriate. ISO mentions a lift dimension for stretchers as well. This should be incorporated in Indian Standards.
2. Signage: It should be included in CPWD as in HG and NBC.
3. Maneuvering space: The ISO specifies maneuvering space outside the lift entrance. This should be incorporated in Indian Standards.
4. Lift door: ISO specifies a mechanism to increase the lift door opening time that shall be installed to be customized by a user with disability. This should be incorporated in Indian Standards. The lift door opening size, time of opening should be mentioned in CPWD as in NBC and HG. Lift door sensor is well detailed in ISO. This should be incorporated in Indian Standards.
7. Handrails/grab bars: It is well detailed in ISO. This should be incorporated in all Indian Standards.
8. Audio and visual indicators: They should be described in CPWD as in HG and NBC.
9. Allergic materials: ISO mentions about allergic materials, i.e. Surface materials that a user can be allergic to; these materials should be avoided in buttons, controls, handles or handrails. This should be incorporated in Indian Standards.
10. The Emergency Call Button: It is detailed in CPWD and the same should be followed in NBC and HG. However, it misses information on minimum operating force required to operate the alarm. This should be incorporated in all Indian Standards.
11. ISO specifies on the seat and lighting within the lift car as well as use of lifts during fire evacuation. These points should be included in all the Indian Standards.
12. Control panel and mirrors within the lift car are well detailed in ISO and it is recommended that all the Indian Standards follow the same. For example - size of the controls, horizontal distance of controls from the adjacent wall, optical confusion for mirrors.

11 Vertical and Inclined Lifting Platforms

Dimensions	CPWD	HG	NBC	ISO
Minimum dimensions of the platform		The minimum width 1050 mm and the minimum length should be 1250 mm.	The minimum width shall be 1100 mm and the minimum length shall be 1400 mm.	The minimum dimension 1100 mm by 1400 mm. <i>Exceptional considerations for existing buildings:</i> In existing buildings of minor public importance and with few visitors, where sufficient space is not available, other dimensions may be considered, e.g. 900 mm by 1400 mm or 800 mm by 1250 mm. Local building regulations should be observed.
Vertical lifting platforms		For maximum level changes of 2500 mm, vertical movement platform lifts may be installed. For level changes of more than 1200 mm, the lift should be placed in a closed structure with doors at different accessible levels.	For maximum level changes of 2500 mm, vertical movement platform lifts may be installed. For level changes of more than 1200 mm, the lift shall be placed in a closed structure with doors at different accessible levels. Vertical platform lifts may have a variety of openings for entry and exit and their minimum size shall be 1200 mm X 1000 mm.	

Dimensions	CPWD	HG	NBC	ISO
		Vertical platform lifts can have a variety of openings for entry and exit. Minimum size should be 1200 X 1000 mm.		
Guarding				If driving, guiding or lifting mechanisms present hazards at the sides of a platform, the mechanisms shall be guarded to protect the users. The guarding shall be smooth, hard and continuous.
Inclined movement platform lift		Inclined movement platform lifts consist of three elements a railing, an electric generator and a moving platform or seat. Inclined movement platform lift can be installed along the stair wall as long as they do not obstruct the required width of the exit. The seat or platform can be folded	Inclined movement platform lift may be installed along the stair wall as long as they do not obstruct the required width of the exit. The seat or platform may be folded when not in use. The minimum width of the stairs shall be 900 mm to allow the installation of the lift. Platform lifts may be installed on all types of stairs including switch back stairs, that is, those with a rotation of 180° and spiral staircases. Inclined movement	

Dimensions	CPWD	HG	NBC	ISO
		<p>when not in use.</p> <p>The Minimum width of the stairs should be 900 mm to allow the installation of the lift. Platform lifts can be installed on all types of stairs including switch back stairs i.e. those with a rotation of 180 and spiral staircases.</p>	<p>platform lifts are usually used to connect one or more floors or to overcome split levels in existing buildings.</p>	

Observations and Recommendations

1. CPWD should have this section incorporated as in HG and NBC.
2. Minimum dimensions of the platform should be revised in HG as per NBC.
3. ISO mentions about a condition where if driving, guiding or lifting mechanisms present hazards at the sides of a platform, the mechanisms shall be guarded to protect the users. This should be incorporated in all the Indian Standards.

12 Unisex Accessible Toilets

Dimensions	CPWD	HG	NBC	ISO
Minimum Size of the unisex accessible toilet (Corner toilet)	2200 mm (depth as per diagram in Page 22) x 1750 mm (diagram does not match with the dimension).	2200 mm (as per diagram 8.2, it is width) x 2000 mm (as per diagram 8.2, it is depth).	2000 mm (as per figure 85, it is width) x 2200 mm (as per figure 85, it is depth).	1700mm width and 2200 mm depth.
Minimum clear maneuvering space	1500 mm x 1500 mm measured at 350 mm above finished floor level.	1800 mm x 1800 mm in front of the water closet and wash basin.	1800 mm x 1800 mm in front of the water closet and wash basin.	1500 mm X 1500 mm, except for Type C where 300 mm under the washbasin is accepted as part of the total maneuvering space.
Height of WC from the floor	380 mm - 450 mm.	450 mm - 480 mm.	450 mm - 480 mm.	400 mm - 480 mm For children between 205 mm - 380 mm. (National regulations may give the most convenient and appropriate height for an accessible toilet seat at a national level.)
Minimum distance from the edge of the toilet seat to the rear				650 mm - 800 mm.

Dimensions	CPWD	HG	NBC	ISO
wall				
Distance from the adjacent wall to the centre line of the WC	As per diagram on page 22, it is 500 mm. (It is not mentioned in the text).	460 mm to 480 mm.	460 mm to 480 mm (Fig. 85 is showing 500 mm).	450 mm. For children 305 mm to 380 mm.
Backrest	Water closets shall be equipped with a back support such as a seat lid and seats shall not be spring- actuated.	Have a suitable back support to reduce the chance of imbalance or injury caused by leaning against exposed valves or pipes.	Have a suitable back support to reduce the chance of imbalance or injury caused by leaning against exposed valves or pipes.	If a backrest is provided, the distance from the seat to the backrest should range between 500 mm and 550 mm.
Minimum floor space on the transfer side adjacent to WC and in front	Not mentioned. It is given in the diagram in Page 22 and there seems to be some error there.	1350 mm depth and 900 mm width, both in front and on the transfer side, adjacent to the water closet.	1350 mm depth and 900 mm width, both in front and on the transfer side, adjacent to the water closet.	Minimum free clearance beside the toilet seat shall be 900 mm; 1200 mm is preferred for lateral transfer and assistance.
Grab bar				
Distance from WC		A hinged type horizontal grab bar should be installed adjacent to the water closet; at a distance of 320 mm from the centre-line of the WC.	A hinged type horizontal grab bar should be installed adjacent to the water closet; at a distance of 320 mm from the centre-line of the WC.	On both sides of a toilet, a grab rail (whether drop-down or fixed to the wall) shall be provided at a distance between 300 mm to 350 mm from the centre of the toilet.

Dimensions	CPWD	HG	NBC	ISO
Height of the grab bar	The mounting height is not given in the text. There are some dimensions mentioned in the diagram which is not clear.	Be mounted at a height between 200 mm and 250 mm from the water closet seat.	Be mounted at a height between 200 mm and 250 mm from the water closet seat.	Grab rails shall be provided at a height of 200 mm to 300 mm above the toilet seat.
Vertical and horizontal /L shaped grab bars	The two grab rails constructed in one continuous piece is acceptable.	One L-shape grab bar: 600 mm long horizontal and 700 mm long vertical should be mounted on the side wall closest to the water closet.	One L-shape grab bar, 600 mm long horizontal and 700 mm long vertical shall be mounted on the side wall closest to the water closet.	Vertical grab rail shall exceed from the horizontal grab rail to a height of 1700 mm above floor level. The grab rail shall extend a distance of minimum 150 mm to the front edge of the toilet seat. The horizontal grab rail shall be uninterrupted for its full length.
Foldable/hinged grab bars	There shall be one folding grab rail on the wide side of the cubicle adjacent to the water closet at a height between 725 mm to 750 mm above the finished floor level when lowered from the	A hinged type horizontal grab bar should be installed adjacent to the water closet between heights of 200 mm - 250 mm from the top of the water closet seat and extending 100 to	A hinged type horizontal grab bar shall be installed adjacent to the water closet, between heights of 200 mm - 250 mm from the top of the water closet seat, and extending	On the sides where a lateral transfer is possible, a foldable grab rail (drop-down support rail) shall be provided at a height of 200 mm to 300 mm above the toilet seat. The

Dimensions	CPWD	HG	NBC	ISO
	wall.	150 mm beyond the front of the water closet.	100 to 150 mm beyond the front of the water closet.	length of the foldable grab rail should overlap the front edge of the toilet seat in between 100 mm and 250 mm. The positioning of a foldable grab rail should allow access from a wheelchair when folded up. For children: The grab rail height for toilets for children should be between 510 mm to 635 mm.
Dimension of grab bar	35 mm - 500 mm in external diameter.	38 mm - 45 mm in diameter.	38 mm - 45 mm in diameter.	35 mm - 50 mm diameter.
Minimum grip space from the wall	30 mm.	50 mm.	50 mm.	40 mm.
Capacity to take static load	150 kg.	250 kg.	250 kg.	Minimum 1 kN force from any direction, with 1.7 kN as a recommendation.
Toilet door	Door shall be installed with push-type or lever-type handles and capable of being easily opened/closed by one	The toilet door should be either an outward opening door or two-way opening door or a sliding type and should	The toilet door shall either be an outward opening door or two way opening door or a sliding type and shall	The door shall have an unobstructed width of at least 800 mm, with minimum 850 mm as a

Dimensions	CPWD	HG	NBC	ISO
	<p>hand. Any door fastening shall be capable of being released from the outside in the event of an emergency. No coin box shall be affixed to the door of the cubicle. The length of grab rail shall not be less than 600 mm. There shall be one grab rail fixed on each of both the inner and outer surfaces of the cubicle door; which shall not be less than 32 mm and not more than 40 mm in external diameter.</p>	<p>provide a clear opening width of at least 900 mm. Be provided with 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. Be capable of being locked from the inside by a device that is operable by one hand, activated by a force not more than 22 N and which does not require fine finger control, tight grasping, pinching or twisting of the wrist.</p>	<p>provide a clear opening width of at least 900 mm. It shall be provided with 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. It shall be capable of being locked from the inside by a device that is operable by one hand, activated by a force not more than 20 N and which does not require fine finger control, tight grasping, pinching or twisting of the wrist.</p>	<p>recommended value, and it shall be easy to open and close. The door should open outwards. If the door opens inwards, there shall be a way to open the door, or remove it, from the outside. There should be no openings under or above the door. A horizontal pull handle on outward opening doors shall be provided at a height of 700 mm above the floor.</p>
Toilet Paper	<p>It can be seen in the photo on Page 22 (below the grab rail) but not in text or in the figure/diagram.</p>	<p>280 mm above the WC (as per diagram on page 67).</p>	<p>280 mm above the WC (as per diagram on page 162).</p>	<p>Dispensers for toilet paper shall be reachable from the toilet seat, either under the grab rail or on the side-wall of a</p>

Dimensions	CPWD	HG	NBC	ISO
				corner toilet at a height between 600 mm to 700 mm from the floor.
Towel, soap dispensers and hand dryer	-	Towel and soap dispensers, hand dryer and waste bin positioned such that the operable parts and controls are between 800 mm and 1000 mm from the floor. - Accessories should be placed in close proximity to the basin, to avoid a person with wet hands wheeling a chair.	Towel and soap dispensers, hand dryer and waste bin positioned such that the operable parts and controls are between 800 mm and 1000 mm from the floor. Accessories shall be placed in close proximity to the basin, to avoid a person with wet hands wheeling a chair.	Soap dispenser 800 mm to 1100 mm above floor; towels or dryer 800 mm to 1100 mm above floor. Non-touch soap dispensers are preferred.
Cloth hook		Mounted on a side wall not more than 1200 mm from the floor and projecting not more than 40 mm from the wall.	Mounted on a side wall not more than 1200 mm from the floor and projecting not more than 40 mm from the wall.	Should be set at heights of 1050 mm and 1400 mm.
Other fittings				Needle boxes to safely dispose of needles (for example, from diabetes patients) should be

Dimensions	CPWD	HG	NBC	ISO
				provided. If a sanitary bin is supplied, it should be reachable from the toilet seat. Sanitary bins with non-touch opening devices are preferred.
Emergency call bell	An emergency call bell shall be equipped with a weatherproof push button for activating the alarm. The push button shall be installed below the vertical grab rail inside the W.C. cubicle adjacent to the water closet at a height between 600mm to 650mm above the finished floor level. A notice "Emergency Call" in English, Hindi and Braille shall be fitted next to the emergency Pushbutton. The alarm shall be installed	An emergency alarm cum call switch should be provided within easy reach on the wall near water closet at two levels: at 300 mm and 900 mm from the floor level to allow user to call for help in case of an emergency.	An emergency alarm cum call switch shall be provided within easy reach on the wall near water closet at two levels: at 300 mm and 900 mm from the floor level to allow user to call for help in case of an emergency.	An assistance alarm, which can be reached from changing or shower seats, from the WC and by a person lying on the floor, shall be provided in all accessible toilets and accessible sanitary rooms. This alarm should be connected to an emergency help point, or where a member of staff can assist. Visual and audible feedback should be provided to indicate that, when the alarm has been operated,

Dimensions	CPWD	HG	NBC	ISO
	<p>outside the toilet or a buzzer shall be fitted in the caretaker's office.</p>			<p>the emergency assistance call has been acknowledged and action has been taken. It should take the form of a pull cord, coloured red, with two red bangles of 50 mm diameter, one set at a height between 800 mm and 1100 mm and the other set at 100 mm above floor level. A reset control shall be provided for use if the alarm is activated by mistake. It shall be reachable from a wheelchair and, where relevant, from the WC, the tip-up seat in a shower or changing facility, or the bed in an accessible bedroom. The reset control shall be easy to</p>

Dimensions	CPWD	HG	NBC	ISO
				<p>operate and located with its bottom edge between 800 mm and 1100 mm above floor level.</p> <p>For a corner toilet room, the reset button should be above the fixed horizontal grab rail beside the toilet paper holder.</p> <p>The marking of the reset control shall be both visible and tactile.</p>
Emergency warning alarm	-	There should be a visual emergency alarm in the toilet.	There shall be a visual emergency alarm in the toilet.	A visual emergency alarm shall be provided to alert people who are deaf or hard of hearing in the event of an emergency.
Flushing control	Mounted on the wide side of the cubicle at a height between 600 mm to 1050 mm above the finished floor level and shall be hand-	Should either be lever type or automatic, and located on the transfer side of the water closet. The flush control should not be	Shall either be lever type or automatic, and located on the transfer side of the water closet. The flush control shall not be	

Dimensions	CPWD	HG	NBC	ISO
	operated or automatic. Hand operated controls shall be capable of being operated with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required shall not be greater than 22 N.	located more than 1000 mm from the floor.	located more than 1000 mm from the floor.	
Colour contrast		There should be adequate colour and tonal contrast between the fixtures, walls and the flooring. This is to enable easy recognition by persons with visual impairments.	Use of the same colour everywhere, for example, white basins and white tiles, etc shall be avoided and colour and tonal contrast should be used to differentiate elements in the environment.	Fixtures and fittings in sanitary facilities should visually contrast with the items and surface on which they are positioned.
Lighting/ illumination				The minimum illumination measured at 800 mm above floor level shall be 200 lux in the area of the washbasin. Light switches should

Dimensions	CPWD	HG	NBC	ISO
				be fixed inside all accessible toilet cubicles or the light should automatically switch on when someone enters the room. Timed light switches should not be installed or used.
Water supply/ hand-held shower (health faucet)				An independent water supply (hand-held shower) shall be provided next to the toilet. An alternative such as a combination bidet and rear side pan/built-in bidet can be installed.

Observations and Recommendations

1. Types of Toilets: ISO has given three types of toilets - A, B and C. Type A allows both right and left lateral transfers. Types B and C only allow one side transfer. Indian Guidelines (CPWD, HG and NBC) have given requirements only for toilets that allow one side transfer ('Corner toilet').
2. Dimensions of corner toilet: There are different dimensions for corner toilets in different Guidelines. CPWD provides 2200 mm x 1750 mm; HG gives 2200 mm x 2000 mm, NBC says 2000 mm x 2200 mm. ISO mentions 1700 mm

- width X 2200 mm depth. There seems to be an error in the diagram of HG (Figure 8.2), the measurements for depth and width seems to have got interchanged. This should be corrected in the diagram. Moreover, the Indian Standards should specify in the text as to which is width and which is depth. CPWD should revise the dimensions based on NBC.
3. Maneuvering Space: CPWD should revise its specifications as per HG and NBC.
 4. Height of WC from floor: NBC and HG are the same. ISO also has given dimensions for accessibility of toilet for children. CPWD should revise the dimensions as per NBC and HG. Indian Standards should add the specifications for children.
 5. Distance between adjacent wall and centre line of WC: CPWD gives the distance as 500 mm. This should be in synchronised with NBC and HG which is 460-480 mm.
 6. Backrest: CPWD, HG and NBC should mention the distance from the seat to the backrest as given in the ISO.
 7. Minimum floor space adjacent to WC: CPWD should specify the space requirement in text and the diagram should match the information given in text. The dimension should be the same as HG and NBC.
 8. Vertical grab bar: As per ISO, the grab bar should end at 1700 mm from finished floor level. According to HG and NBC the vertical grab bar should end at 700 mm from the horizontal grab bar (which would work out to 1350 mm from floor level). This should be increased to match the ISO Standard to enable better grip while standing.
 9. The foldable grab bars: In CPWD, only mounting height is mentioned but not the extended part beyond the WC. This should be incorporated as per NBC and HG. All Indian Standards should have specification for children.
 10. Dimension of grab bars: In CPWD, external diameter has been given as 35 - 500 mm. (There is an error in the upper limit.) This should be corrected as HG and NBC (38 -45 mm).
 11. Minimum grip space from the wall: CPWD should revise the Standard from 30 mm to 50 mm to make it same as HG and NBC Standards.
 12. Capacity to take static load: CPWD should revise the Standard from 150 kg to 250 kg to make it in line with HG and NBC Standards.
 13. Toilet door: The mounting height of horizontal pull bar on the toilet door is given as 1000 mm in HG and NBC whereas the height given in ISO is 700 mm. The HG and NBC Guidelines seem high. Either it should be revised as per ISO or should be based on anthropometrics of Indian population with disability. The minimum force required for opening the door in HG should be revised from 22 N to 20 N to make it in line with NBC. CPWD should add these points as given in HG and NBC.
 14. Toilet paper: The specifications for placement of toilet paper dispenser are not given in text in Indian Guidelines though given in the diagrams. The specifications should also be given in the text as given in ISO.

15. Accessories: CPWD should add specifications for the placement of towel, cloth hook, hand dryer, soap dispenser, etc. In ISO, it says non touch soap dispensers are preferred. This should be incorporated in Indian Standards as well. The point related needle box and sanitary bin given in ISO should be included in Indian Standards.
16. Emergency call bell: ISO has covered this aspect in detail. Indian Standards should adopt the specifications from the ISO.
17. Emergency warning alarm: CPWD should add this point.
18. Flushing Control: It should be standardised in Indian Guidelines. CPWD should revise the Standard for the placement of flushing control as per HG and NBC. HG and NBC should add the point related to force required to operate the flush as per CPWD.
19. Colour contrast: CPWD should mention regarding colour contrast between fixtures, wall and flooring.
20. Lighting: Indian Standards should add minimum illumination levels as per given in ISO.
21. Health faucet: The Indian Standards should mention the provision for hand held shower (health faucet) next to WC.

13 Washbasin

Dimensions	CPWD	HG	NBC	ISO
Height of the washbasin (rim/ top edge)	Not higher than 750 mm above the finished floor level.	750 mm – 850 mm.	800 mm and 840 mm from the floor. Be mounted such that the minimum distance between the centreline of the fixture and the side wall is 460 mm.	750 mm to 850 mm from the floor. The differences in stature of the population worldwide may require lower or higher heights of washbasins. National regulations may give the most convenient and appropriate height for washbasins at a national level.
Knee and toe Space	A clearance of 550 mm shall be maintained from the finished floor level to the bottom of the apron.	Knee clearance: 200 mm. Foot clearance: 230 mm.	Knee space of at least 750 mm wide by 200 mm deep by 680 mm high. Toe space of at least 750 mm wide by 230 mm deep by 230 mm high.	knee clearance: between 650 mm and 700 mm high and 200 mm deep. Toe clearance of at least 300 mm.
Maneuvering space in front of washbasin		1800 mm x 1800 mm in front.	900 mm wide by 1200 mm deep, of which a maximum of 480 mm in depth may be under the wash basin.	In front of the washbasin, space should allow for a frontal or oblique approach by a wheelchair.
Reach to the				The front edge of the washbasin

Dimensions	CPWD	HG	NBC	ISO
tap				shall be located within a distance of 350 mm to 600 mm from the wall. The reaching distance to the tap control shall be a maximum of 300 mm.
Dimensions of shelf		400 mm x 200 mm fixed at a height of between 900 mm and 1000 mm from the floor.	400 mm x 200 mm fixed at a height of between 900 mm and 1000 mm from the floor.	200 mm x 400 mm at a height of 850 mm.
Mirror		The bottom edge at a height of not more than 1000 mm from the floor and mirror should be tilted at an angle of 30 degree for better visibility of wheelchair user	The bottom edge at a height of not more than 1000 mm from the floor as shown in the figure; and mirror shall be tilted at an angle of 30° for better visibility of wheelchair user. Care shall be taken in placing mirrors and lights to avoid confusion and dazzling for visually impaired users.	Top height min. 1900 mm, bottom height max. 900 mm above floor.

Observations and Recommendations

1. Height, knee and toe space of washbasin: HG and CPWD should be revised as per NBC.
2. Reach to the tap: This point should be added in all Indian Standards as per ISO.
3. Shelf and mirror: CPWD should include this point as other Standards.
4. Mirror: The mounting height of mirror should be as per ISO (i.e. bottom height 900 mm).

14 Taps

Dimensions	CPWD	HG	NBC	ISO
Type of taps / controls	Automatic or lever control type without spring loading. Tap shall not require tight grasping, pinching or twisting of the wrist.	Hand-operated or electronically controlled. Hand-operated controls should: <ul style="list-style-type: none"> - be operable by one hand; - require no tight grasping, pinching or twisting of the wrist; have handles of lever type (not self-closing) operable with a closed fist.	Hand-operated or electronically controlled Hand-operated controls shall: <ul style="list-style-type: none"> - Be operable by one hand; -Require no tight grasping, pinching or twisting of the wrist Have handles of lever type (not self-closing) operable with a closed fist.	Taps should be mixer, lever or sensor operated to aid operation.
Force required	Not greater than 22 N.	Less than 22 N to activate.	Less than 20 N to activate.	
Colour/tactile		Colour-contrasted with the surrounding face plate panel and the face plate should similarly contrast with the background wall on which it is mounted.	Colour-contrasted with the surrounding face plate panel and the face plate shall similarly contrast with the background wall on which it is mounted. Hot and cold water taps should be identifiable by both colour and tactile markings.	

Information		Preferably be in relief (embossed letters/ symbols accompanied with Braille information) for tactile reading.	preferably be in relief (embossed letters/symbols accompanied with Braille information) for tactile reading.	
Temperature				A thermostat be installed to limit the temperature of the hot water to a maximum of 40° C in order to prevent scalding.

Observations and Recommendations

1. Force required to operate: There should be standardisation. 20 N as given in NBC and should be incorporated in all the Indian Standards.
2. Colour and tactile indicators: CPWD and HG should include the points given in NBC.
3. Temperature: The point related to installing thermostat as given in ISO should be incorporated in all Indian Standards.

15 Urinals

Dimensions	CPWD	HG	NBC	ISO
Approach and maneuvering space	Not less than 800 mm wide x 1500 mm deep in front.	A clear floor space 760 mm by 1220 mm should be provided in front of urinals to allow forward approach. Urinal shields (that do not extend beyond the front edge of the urinal rim) may be provided with 735 mm clearance between them.	A clear floor space 760 mm by 1220 mm shall be provided in front of urinals to allow forward approach. Urinal shields (that do not extend beyond the front edge of the urinal rim) may be provided with 735 mm clearance between them.	Clear floor area in front of the urinal of at least 750 mm wide and 1200 mm deep.
Height of urinal (height to the bottom rim)	Be wall hung urinal with a front rim not higher than 400 mm.	Urinals shall be stall-type or wall-hung, with an elongated rim at a maximum of 430 mm above the finish floor.	Urinals shall be stall-type or wall-hung, with an elongated rim at a maximum of 430 mm above the finish floor.	When wall hung urinals are fitted in the washroom, at least one at following heights should be provided: <ol style="list-style-type: none"> 1. 600 mm-750 mm. 2. 380 mm and 3. 500 mm
Grab bars	Have vertical grab rails of 600 mm length on both sides at a height of 1200 mm above the finished floor level	Installed on each side and in the front of the urinal to support ambulant persons with disabilities. The front bar is to provide chest support; the sidebars are for the user to	installed on each side and in the front of the urinal to support ambulant persons with disabilities (for example, crutch users). The front bar is to provide chest support; the	Both Urinals (for wheelchair users and standing persons) should be equipped with a vertical grab rail.

Dimensions	CPWD	HG	NBC	ISO
	for use by persons with ambulant disabilities.	hold on to while standing.	sidebars are for the user to hold on to while standing.	
Flush control		Located not more than 1200 mm from the floor.	Located not more than 1200 mm from the floor.	
Colour contrast		There should be adequate colour and tonal contrast between the fixtures, walls and the flooring. This is to enable easy recognition by persons with visual impairments.	Use of the same colour everywhere, for example, white basins and white tiles, etc shall be avoided and colour and tonal contrast should be used to differentiate elements in the environment.	Urinals should contrast visually with the wall to which they are attached.

Observations and Recommendations

1. Approach and maneuvering space: CPWD should revise the Standards based on HG and NBC.
2. Height of urinal (height to the bottom rim): ISO mentions installing urinals at 3 different heights. This should be incorporated in Indian Standards.
3. Grab bars: CPWD should add the point related to providing chest support from HG and NBC.
4. Flush control and colour contrast: These should be added in CPWD.

16 WC Compartments for Ambulant Disabled People

CPWD	HG	NBC	ISO
-	<p>The dimensions are only given in the diagram and not in text. Based on information in diagram some of the dimensions are given below: WC height is 500 mm; horizontal grab rail 280 mm above WC; Vertical grab rail is 835 to 1295 mm above floor; pull rail on door is 1070 mm above floor; 900 mm is width of the toilet.</p>	<p>The dimensions are only given in the diagram and not in text. Based on information in diagram some of the dimensions are given below: WC height is 500 mm; horizontal grab rail 280 mm above WC; Vertical grab rail is 835 to 1295 mm above floor; pull rail on door is 1070 mm above floor; 900 mm is width of the toilet.</p>	<p>Toilet seat height, depth and distance to wall should comply with 26.6 (i.e same as that for the unisex toilet, i.e between 400 mm and 480 mm). Clear manoeuvring space in front of the toilet should be minimum 900 mm 900 mm, the door should open outwards, with a minimum. Unobstructed width of 800 mm. Grab rails on both sides of toilet, independent water supply beside toilet seat, and floor drain where necessary.</p>

Observations and Recommendations

1. HG and NBC should give the specifications in the text also apart from diagram. CPWD should add this section.

17 Bathrooms and Showers

Dimensions	CPWD	HG	NBC	ISO
Size of shower compartments/cubicle - minimum internal dimensions	Shower compartment : 1500 mm x 900 mm.	Shower cubicle: 2000 mm x 2200 mm. - A toilet cum shower room: 2400 mm x 2500 mm	Shower cubicles: 2000 mm x 2200 mm. A toilet cum shower room: 2400 mm x 2500 mm.	Wet showering area: 900 mm x 1300 mm, with a transfer area of also 900 mm x 1300 mm.
Gradient				The floor in the shower recess shall have a gradient between 1:50 and 1:60 sloping to a floor drain. The area outside the shower recess shall have a gradient between 1:70 and 1:80 draining towards the shower recess. The transition into the shower recess shall be level without a step down or a kerb.
Waste outlet				The waste outlet should be centrally located and be a round type outlet, not a channel type, to ensure the stability of

Dimensions	CPWD	HG	NBC	ISO
				the shower chair.
Minimum clear floor space	The minimum clear floor space in front of the shower entrance shall be 1500 mm x 900 mm with the 1500 mm dimension parallel to the shower entrance.	The minimum clear floor space in front of the shower entrance should be 1350 mm x 900 mm with the 1350 mm dimension parallel to the shower entrance. The floor of the shower should be slip resistant.	The minimum clear floor space in front of the shower entrance shall be 1350 mm x 900 mm with the 1350 mm dimension parallel to the shower entrance. The floor of the shower shall be slip-resistant even when wet.	A free space at least 1300 mm x 900 mm shall be provided on the clear side of the foldable seat, to allow access from a wheelchair, in addition to the maneuvering space of 1500 mm. The screening of a shower recess shall be either a curtain or a door system that maintains the required circulation and maneuvering space and does not interfere with the level entry.
Grab rails for shower compartments	Be L-shaped or two bars arranged in L-shaped configuration and -Not be less than 750 mm by 900 mm in length; -Be installed at a height between 700 mm and 800 mm from the	-Have one L-shaped bar or two grab bars in L-shaped configuration between 700 mm and 800 mm from the shower floor. Have one grab bar at least 750 mm long installed vertically with another at least 900 mm long mounted horizontally.	Have one L-shaped bar or two grab bars in L-shaped configuration between 700 mm and 800 mm from the shower floor as shown in the figure. Have one grab bar at least 750 mm long installed vertically with another at least 900 mm	Grab rails shall be set according to 26.7 (as for the unisex toilet) and Figure 45 where a shower room diagram is shown. As per the diagram it is not L shaped. There are separate bars). The vertical grab rail holds the flexible shower

Dimensions	CPWD	HG	NBC	ISO
	shower floor; and -Be capable of carrying a static load of 150 kg.		long mounted horizontally.	head.
Position of shower seat	Be installed at a height between 430 mm and 480 mm from the top of the seat to the finished floor level.	The shower seat should be positioned such that the distance between the centerline of the water closet and the adjacent wall is 450 mm to 480 mm, and the distance between front edge of the water closet and the rear wall is 650 mm. The top of the shower seat should be at a height of 450 - 480 mm from the floor.	The shower seat shall be positioned such that the distance between the centerline of the water closet and the adjacent wall is 450 mm to 480 mm, and the distance between front edge of the water closet and the rear wall is 650 mm. The top of the shower seat shall be at a height of 450 - 480 mm from the floor.	When folded down, have its top surface set between 400 mm and 480 mm above floor level and spaced a maximum of 40 mm from the rear wall.
Size of shower seat	Size shall not be less than 550 mm in width and 400 mm in depth.	Have a minimum dimension of 400 mm wide extending the full depth of the cubicle, less a space required for the shower curtain.	Have a minimum dimension of 400 mm wide extending the full depth of the cubicle, less a space required for the shower curtain.	Minimum size of shower seat shall be 450 mm x 450 mm.
Other features of shower seat	Have a rounded edge and be self-draining. Be installed on the	- A wall mounted shower seat, preferably fold up kind. - Be self-draining, non-	-A wall mounted shower seat, preferably fold up kind. -Be self-draining, non-	The foldable seat shall have the following features: Self-draining; slip-

Dimensions	CPWD	HG	NBC	ISO
	wall next to the taps and controls.	slip and with rounded edge; - Be on the wall nearest to the controls; - Enclosures for the shower cubicle shall not obstruct transfer from wheelchair onto shower seat.	slip and with rounded edge; - Be on the wall nearest to the controls; -Enclosures for the shower cubicle shall not obstruct transfer from wheelchair onto shower seat.	resistant and stable; foldable in an upwards direction; when folded, it shall not present a hazard and the grab rail shall be accessible from the foldable seat. The foldable seat should have the following features: rounded front corners (radius 10 mm to 15 mm), rounded top edges (minimum radius of 2 mm to 3 mm). The foldable seat should preferably be height adjustable.
Shower heads and controls	Be of the hand-held type. Be provided with a hose not less than 1500 mm in length. Be provided with a wall mounting bracket to allow	The adjustable and detachable shower head (telephone shower/ hand-held shower), with a minimally 1500 mm long hose, should be installed between 800 mm and 1200 mm from the floor. All shower controls	The adjustable and detachable shower head (telephone shower/hand-held shower), with a minimally 1500 mm long hose, shall be installed between 800 mm and 1200 mm from the floor. All shower controls shall be at a distance of 500	A hand held detachable shower head shall be provided with a flexible hose of minimum length 1200 mm, and it shall be able to reach within 100 mm of the shower floor.

Dimensions	CPWD	HG	NBC	ISO
	use in a fixed position. Where shower heads are mounted on a vertical bar, the bar shall have a minimum length of 500 mm with the lower end not less than 450 mm above the finished floor level.	should be at a distance of 500 mm from the rear wall. -Shower controls should be installed between 750 mm to 1000 mm from the floor.	mm from the rear wall. Shower controls shall be installed between 750 mm to 1000 mm from the floor.	
Shelf		A shelf should be provided for toiletries between 400-800 mm.	A shelf shall be provided for toiletries between 400-800 mm.	

Observations and Recommendations

1. Size of shower compartments: CPWD should revise the Standards based on HG and NBC.
2. Surface and gradient: ISO mentions that the transition into the shower recess shall be level without a step down or a kerb and it also specifies the gradient. These should be added in the Indian Standards.
3. Waste outlet: The point related waste outlet should be included in Indian Standards.
4. Grab rails for shower compartments: CPWD should incorporate points related to dimensions of grab bars from HG and NBC. HG and NBC should add the point related to the strength of grab bars.

5. Position of shower seat: CPWD should make the specifications same as HG and NBC. ISO has given that it should be placed 40 mm from the rear wall, which should be incorporated in the Indian Standards. Also, the term water closet should be replaced with shower seat.
6. Size of shower seat: HG and NBC mention that it should, be 400 mm wide extending the full depth of the cubicle. However, the diagram is showing L- shaped shower seat (Fig 95 of NBC). This should be specified with exact dimensions in the text and diagram. The detailing of shower seat like the "rounded front corners (radius 10 mm to 15 mm), rounded top edges (minimum radius of 2 mm to 3 mm). The foldable seat should preferably be height adjustable." These should be added in Indian Standards.
7. Shower controls: CPWD should incorporate points from HG and NBC.

18 Emergency Evacuation Needs

Dimensions	CPWD	HG	NBC	ISO
General (warning systems)				Available technologies enable warnings to be communicated simultaneously by sounder, light strobe, voice message and individual tactile sensation by vibration.
Non auditory alarms		Non – auditory alarms (visual or sensory) to alert persons with hearing impairments should be installed at visible locations in all areas that the building users may visit (including toilet areas, storerooms etc.). Non-auditory alarms include flashing beacons.	Non-auditory alarms (visual or sensory) that include flashing beacons, to alert persons with hearing impairments shall be installed at visible locations in all areas that the building users may visit (including toilet areas, storerooms, etc).	Visual strobe alarms should be provided, particularly in isolated areas (bathrooms, meeting rooms) and noisy areas. Room layouts, lighting levels and furniture arrangements shall be considered to ensure that these alarms are visible. A strobe frequency of 0.5 Hz – 4 Hz minimizes the risk of triggering a reaction from a person with epilepsy. Care should be taken to ensure that overlapping strobes do not combine to result in a higher frequency of flashing. Vibrating devices such as pagers or mobile phones can be integrated with alarm systems to provide an individual alarm. A larger number of strobes/beacons with low output should be specified –

Dimensions	CPWD	HG	NBC	ISO
				<p>never a small number of strobes/beacons with high output as these produce glare causing confusion and disorientation among building users. Adapt light output of strobes/beacons to suit the use of particular areas.</p> <p>For light strobes/beacons, a slow rate of flash should be ensured (e.g. once every two seconds) in order to avoid epileptic seizures. Most importantly, the flash of one strobe/beacon should be synchronized with the flashes of all other light strobes/beacons in view.</p>
<p>Auditory warning systems</p>		<p>Audible alarms with 'Voice Instructions' should be installed that can help guide them to the nearest emergency exit. As an alternative to the pre-recorded messages, these alarms may be connected to central control room for on-the-spot broadcasts.</p>	<p>Audible alarms with 'voice instructions' shall be installed that may help guide them to the nearest emergency exit. As an alternative to the pre-recorded messages, these alarms shall be connected to the central control room for on-the-spot broadcasts.</p>	<p>Acoustic warning systems: A larger number of sounders between 85 dB to 95 dB with low output should be specified – never a small number of sounders with high output which only leads to confusion and disorientation among building users. Vocal messages should be short and should contain appropriate warning information which is easily assimilated. The speaker should be distinct and easy to understand. In today's multi-cultural built</p>

Dimensions	CPWD	HG	NBC	ISO
				environment, messages should be given in at least two different languages.
Alarm panels		Fire alarm boxes, emergency call buttons and lighted panels should be installed between heights of 800 mm and 1000 mm from the finished floor surface. These should be adequately contrasted in colour and tone from the background wall and should be labelled with raised letters and also in Braille.	Fire alarm boxes, emergency call buttons and lighted panels should be installed between heights of 800 mm and 1000 mm from the finished floor surface. These shall be adequately contrasted in colour and tone from the background wall and shall be labelled with raised letters and also in Braille.	
Lifts				All lifts (elevators) in new buildings should be capable of being used for people evacuation in a fire situation; lifts in existing buildings, when being replaced or undergoing a major overhaul, should be made capable of being used for people evacuation in a fire situation.
Alarm panels		Fire alarm boxes, emergency call buttons and lighted panels should be installed between heights of 800 mm and 1000 mm from the finished floor	Fire alarm boxes, emergency call buttons and lighted panels should be installed between heights of 800 mm and 1000 mm from	

Dimensions	CPWD	HG	NBC	ISO
		<p>surface. These should be adequately contrasted in colour and tone from the background wall and should be labelled with raised letters and also in Braille.</p>	<p>the finished floor surface. These shall be adequately contrasted in colour and tone from the background wall and shall be labelled with raised letters and also in Braille.</p>	
<p>Emergency evacuation routes</p>		<p>In buildings or facilities, or portions of buildings or facilities, required to be accessible, accessible means of egress shall be provided in the same number as required for exits by local building/fire safety regulations (National Disability Authority, 1998). Designating evacuation routes shall be at least 1500 mm wide, to ensure a wheelchair user and an able bodied 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 bins and flower pots etc. An exit stairway to be considered part</p>	<p>In buildings or facilities, or portions of buildings or facilities to which these requirements apply, accessible means of egress shall be provided in the same number as required for exits by local building/ fire safety regulations. These shall meet the following requirements: - Designated evacuation routes shall be minimum 1500 mm wide, to ensure that a wheelchair user and a non-disabled user are able to pass each other along the route. The route shall be free of any steps or sudden level changes and shall be kept free from obstacles such as bins and flower pots etc, all the time.</p>	<p>It is essential that movement to and from each area of rescue assistance does not encroach on the evacuation travel space of the staircase. Door leaves should also not open into or over this evacuation space. Note: There may be competition between staircase evacuees and people using the area of rescue assistance (and reduced ability to achieve objectives) if the evacuation travel space of the staircase overlaps the space used for movement to and from an area of rescue assistance. Fire evacuation routes, including all areas of rescue assistance, shall be kept clear at all times. An area of rescue assistance should be of sufficient size to cope with expected needs in a fire emergency. For example, if there are only two</p>

Dimensions	CPWD	HG	NBC	ISO
		<p>of an accessible means of egress shall have a minimum clear width of 1500 mm between handrails and shall either incorporate an area of refuge within an enlarged floor-level landing or a horizontal exit. Orientation and direction signs should be installed frequently along the evacuation route and these should preferably be internally illuminated.</p> <p>Whilst the emergency lighting provided by traditional overhead emergency lighting luminaries, conforming to the Indian Standard IS: 9583-1981:</p> <p>Exit signs shall be in accordance with IS: 4878-1968. Exit signage should also be available in tactile format in the evacuation route.</p> <p>Note: Fireproof doors along circulation paths that are not exclusively egress routes generally require a force greater than 25 N to operate,</p>	<p>- An exit stairway considered a part of an accessible means of egress shall have a minimum clear width of 1500 mm between handrails and shall either incorporate an area of refuge with an enlarged floor-level landing or a horizontal exit.</p> <p>- Orientation and direction signs shall be installed frequently along the evacuation route and these shall preferably be internally illuminated.</p> <p>- The emergency lighting provided by traditional overhead emergency lighting luminaries, conforming to the Indian Standard IS: 9583-1981: - Exit signs shall also comply with the good practice. Exit signage shall also be available in tactile format in the evacuation route.</p> <p>NOTE – Fireproof doors along circulation paths that are not exclusively egress routes generally require a force greater than 20 N to operate,</p>	<p>evacuation staircases on a floor in a building (on opposite sides), each area of rescue assistance should be designed to cater for the expected needs of the full floor.</p>

Dimensions	CPWD	HG	NBC	ISO
		<p>rendering several disabled people dependent on others to negotiate these doors. Consider holding the doors open with magnetic catches or 'floor springs' that are connected with the fire alarm system.</p>	<p>rendering several disabled people dependent on others to negotiate these doors. Doors which may be held open with magnetic catches or 'floor springs' that are connected with the fire alarm system, may be considered.</p>	
<p>Provision of refuge areas</p>		<p>Accessible refuge areas shall meet the following requirements: -Where a required exit from an occupiable level above or below a level of accessible exit discharge is not accessible, refuge areas shall be provided on each such level (in a number equal to that of inaccessible required exits). -Every required area of refuge is to be accessible from the space it serves by an accessible egress route. -Every area of refuge shall have direct access to an exit stairway. -Each area of refuge must be</p>	<p>Accessible refuge areas shall meet the following requirements: - Where a required exit from an occupiable level above or below a level of accessible exit discharge is not accessible, refuge areas shall be provided on each such level (in a number equal to that of inaccessible required exits). - Every required area of refuge shall be accessible from the space it serves by an accessible egress route. - Every area of refuge shall have direct access to an exit stairway. - Each area of refuge shall be</p>	<p>An area of rescue assistance in a building should: be provided on every floor of a building, adjoin every evacuation staircase, include space for persons in wheelchairs, have good lighting and be clearly indicated with good signage, be fitted with an accessible and reliable independent communication system fitted at a height of 800 mm to 1100 mm above floor level, facilitating direct contact with a person in the designated control room for the building, be of sufficient size for the storage of an evacuation chair and a manual fire alarm call point, a fire evacuation supply kit containing, for example, smoke hoods, suitable gloves to protect a person's hands</p>

Dimensions	CPWD	HG	NBC	ISO
		<p>separated from the remainder of the story by a smoke barrier having minimally one hour fire resistance rating. Each area of refuge is to be designed to minimize the intrusion of smoke.</p> <ul style="list-style-type: none"> -The size of the refuge to provide at least two accessible areas each being not less 750 mm by 1200 mm. The area of rescue assistance shall not encroach on any required exit width. The total number of such areas per story shall be not less than one for every 200 persons of calculated occupant load served by the area of rescue assistance. -All stairs next to the refuge should have a clear width of 1500 mm between the handrails. -A method of two-way communication, with both visible and audible signals, shall be provided between each area of rescue assistance and the primary 	<p>separated from the remainder of the storey by a smoke barrier having minimally one hour fire resistance rating. Each area of refuge shall be designed to minimize the intrusion of smoke.</p> <ul style="list-style-type: none"> - The size of the refuge shall provide at least two accessible areas each being not less than 750 mm by 1200 mm. The area of rescue assistance shall not encroach on any required exit width. The total number of such areas per storey shall be not less than one for every 200 persons of calculated occupant load served by the area of rescue assistance. - All stairs next to the refuge shall have a clear width of 1500 mm between the handrails. - A method of two-way communication, with both visible and audible signals, shall be provided between each 	<p>from debris when pushing his/her manual wheelchair, etc. Note: Many commercially available smoke hoods are advertised to provide protection from more fire effects than they actually do provide.</p>

Dimensions	CPWD	HG	NBC	ISO
		entry.	area of rescue assistance and the primary entry.	
Signage		<p>Each area of rescue assistance shall be identified by a sign, which states "REFUGE AREA" and displays the international symbol of accessibility. The sign should be illuminated when exit sign illumination is required.</p> <p>Signage should also be installed at all inaccessible exits and where otherwise necessary to clearly indicate the direction to areas of rescue assistance.</p> <p>In each area of rescue assistance, instructions on the use of the area under emergency conditions shall be posted adjoining the two-way communication.</p>	<p>Each area of rescue assistance shall be identified by a sign which reads "REFUGE AREA" and displays the international symbol of accessibility. The signs shall be illuminated when exit sign illumination is required. Signage shall also be installed at all inaccessible exits and where otherwise necessary to clearly indicate the direction to areas of rescue assistance. In each area of rescue assistance, instructions on the use of the area under emergency conditions shall be posted adjoining the two-way communication.</p>	<p>Be marked with good signage. Communication systems at areas of rescue assistance should provide visual feedback to people with hearing impairments that their location has been noted. The control point for the communication systems should be of a robust design to avoid risk of confusion about the location of building users. Where a signal board is used, this should be engraved or otherwise permanently marked to identify the particular building location, and should not rely on sticky labels or translation tables.</p>
Assisted fire evacuation strategy			A fire defence plan elaborates the particular fire engineering strategy which has been developed for a specific building. It is usually in hard	A fire engineering strategy is needed that will indicate what is required so that every occupant can be protected from fire, from their location when fire begins through

Dimensions	CPWD	HG	NBC	ISO
			<p>copy and/or electronic format and comprises fire engineering drawings, descriptive text, fire safety related product/system information, with supporting calculations and fire test data. The fire defence plan shall demonstrate a proper consideration for the fire safety, protection and evacuation of the users of the building (occupants, visitors and other users) and who may or may not have a health condition or impairment. This may be a requirement of national legislation.</p>	<p>their evacuation and at their location after evacuation, in accordance with accepted principles of fire evacuation for all. Included in these principles are that the features of the building should support successful evacuation and every occupant, whatever his or her abilities, should be able to evacuate independently to the maximum degree possible. However, independent evacuation may not be possible for all occupants, particularly in the case of existing buildings. For those occupants who need assisted evacuation, there should be a strategy for the provision of assisted evacuation, and there may need to be areas of rescue assistance.</p>
Evacuation chairs				<p>Evacuation chairs should be capable of: being safely and easily operated; carrying people of high weight (up to 150 kg); going up and down staircases; travelling long distances horizontally and externally.</p>

Observations and Recommendations

1. Indian Standards should mention all the available technologies, as in ISO (example, individual tactile sensation by vibration).
2. Non auditory and auditory alarms: It is well detailed in ISO and Indian Standards should incorporate them.
3. Alarm panel: It should be included in CPWD.
4. Lifts: ISO mentions that all new lifts should be used for evacuation of people with disabilities. It should be incorporated in all Indian Standards.
5. Emergency Evacuation Routes: This has been detailed in NBC and HG. HG uses the term, 'able bodied'. It should be changed to 'non disabled people'. CPWD should add this point.
6. Force required to open fire door: HG mentions 25 N and NBC 20 N as the force required to open the fire door. HG should change it to 20 N and CPWD should include this point.
7. Refuge area: ISO has a few additional points like providing sufficient size for the storage of an evacuation chair, manual fire alarm call point, a fire evacuation supply kit containing, for example, smoke hoods, etc. These should be added in Indian Standards.
8. Assisted fire evacuation strategy: ISO mentions that a strategy should be prepared for occupants who need assisted evacuation. This is mentioned in NBC as a fire defence plan. It should be incorporated in HG and CPWD as well.
9. Signage: ISO mentions, "Where a signal board is used, this should be engraved or otherwise permanently marked to identify the particular building location, and should not rely on sticky labels or translation tables." This should be incorporated in HG and NBC. CPWD needs to include the description on signage as in HG and NBC.
10. Evacuation chairs: This point needs to be included in all Indian Standards.

19 Signage

Dimensions	CPWD	HG	NBC	ISO
Location	Sign should be erected to indicate clearly the locations of accessible routes through the building.	A good signage scheme should cover all public buildings, spaces, and facilities including transportation infrastructure and should include locations such as: a. Approach to building / facility / service b. Entrance / exit c. Main lobby or reception d. Public facilities such as library, toilets etc. e. Departments and offices f. Fire exits g. Parking and garages	A good signage scheme should cover all public buildings, spaces, and facilities including transportation infrastructure and should include locations such as: a. Approach to building/facility/service; b. Entrance/exit; c. Main lobby or reception; d. Public facilities such as library, toilets etc; e. Departments and offices; f. Fire exits; and g. Parking and garages.	
Types of signages		According to the purposes it serves, Signage can be of following types: a) Directional b) Information	According to the purposes it serves, signage may be of following types: a) Directional; b) Information;	The main types of signs are: -Orientation signs: sketches, plans, models, etc. -Directional signs:

Dimensions	CPWD	HG	NBC	ISO
		c) Identification d) Instructive e) Health and Safety	c) Identification; d) Instructive; and e) Health and Safety.	directional information from point A to B. -Functional signs: explanatory information. -Informative signs: purely informative, for example a name. -Signs for emergency exits
Placement / height of the signs	Braille and tactile sign shall be installed on adjacent wall or door of public toilet to indicate whether the toilet is for male, female or unisex. The sign shall be placed at 900 mm to 1500 mm above the finished floor level. If there is no door, the sign shall be provided on the wall in front of the toilets. A Braille and tactile fire exit map shall be provided directly above the call button of the	Wall-mounted signs/ 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. Duplicating detailed signs and instructions, especially safety notices, should be located at high and low levels, i.e. at 1600 to 1700mm and at 1000 to 1100mm.	Wall-mounted signs; 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. Position projecting or ceiling suspended signs above head height at 2300 mm from floor level. Top of building directory signage, building direction	Directional and functional signs should be located below 1600 mm. Signs should be placed between 1200 mm and 1600 mm from the floor or ground surface. Where it is likely that the sign may be obstructed, as in a crowded situation, the signs shall be placed at a height of at least 2100 mm above the floor. The same requirement applies to signs fixed to the ceiling or projecting

Dimensions	CPWD	HG	NBC	ISO
	accessible lift in the lobby of the accessible lift in a building if a fire exit map for the use of the public is provided. The map shall be placed at 800 mm to 1200 mm above the finished floor level.	Position projecting or ceiling suspended signs above head height at 2300 mm from floor level. 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.	signage and bulletin board signs shall 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 signs, and 50 mm from the door frame. In case of the tile wall the closest horizontal joint should be used. Detailed signs and instructions, especially safety notices should be located at both high and low levels, that is, at 1600 - 1700 mm and at 1000 -1100 mm.	from walls. In that case, there should be two signs; one that can be seen from a distance above other people's heads, one as a complement at the height recommended above. Where there is sufficient space, door signs shall be located on the latch side of the door within 50 mm to 100 mm of the architrave.
Size of signage	The height of signs shall be not less than the following : - 60 mm for doors -110 mm for corridors - 200 mm for external	Size of signage for various viewing distances shall be as below: Upto 7m : 60 x 60 mm; 7 - 8 m: 100 x 100 mm; exceeding 8 m: 200 x 200 mm to	Size of signage for various viewing distances shall be as below: Upto 7 m: 60 x 60 mm; 7 - 8 m: 100 x 100 mm; exceeding 8 m: 200 x 200 mm to	The letter height depends on the reading distance. A letter height between 20 mm and 30 mm for each meter of viewing distance is preferred.

Dimensions	CPWD	HG	NBC	ISO
	use.	450 x 450 mm Size of letters in signage for various viewing distances shall be as below: 2-3 m : 15 mm; 6 m: 20 mm; 8 m: 25 mm; 12 m: 40 mm; 15m: 50 mm; 25 mm: 80 mm; 35m: 100 mm; 40 m: 130 mm; More than 40 m: 150 mm.	450 x 450 mm Size of letters in signage for various viewing distances shall be as below: 2-3 m : 15 mm; 6 m: 20 mm; 8 m: 25 mm; 12 m: 40 mm; 15 m: 50 mm; 25 mm: 80 mm; 35m: 100 mm; 40 m: 130 mm; More than 40 m: 150 mm.	The letter height should not be less than 15 mm.
Character, content and layout, signage typeface and style	Lettering should be plain and legible, e.g. Arial (medium) using lower case letters except for initial capitals. Corners of sign should be rounded. Sign should be in raised characters. The system of sign used should be clear and consistent.	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. - Should be mix of upper and lower case -Should be Left justified -Should be Tactile	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. -Should be mix of upper and lower case -Should be Left justified -Should be Tactile embossed with Braille -Minimal use of bold -Consistent font stem	It is recommended that messages of single words or groups of words begin with an upper case letter and continue with lower case letters (sentence case). The words should not be placed too close together. Adequate height spacing should separate the lines. Lines of text should be ranged from a vertical line (unjustified). Signs with a single

Dimensions	CPWD	HG	NBC	ISO
		embossed with Braille -Minimal use of bold -Consistent font stem widths -Avoid italics, script text, condensed text, light stems.	widths -Avoid italics, script text, condensed text, light stems.	word may be centre justified. The fonts should be easy to read. The font style should be a sans serif font similar to Helvetica or Arial medium. Signs should be readily understandable.
Colour and luminous contrast	Luminous contrast of not less than 70% should be provided to differentiate the international symbol of accessibility from the background, either light-on-dark or dark-onlight. The commonly employed colours are white for the wheelchair figure and blue for the background.	The colour combinations red/green and yellow/blue should not be used in order to avoid confusing persons who are colour blind. Safety signs use primarily red, yellow and green as information colours. For other signs it is preferable to use Blue and White Colours. - Text should contrast with sign background -Sign should contrast	The colour combinations red/green and yellow/blue should not be used in order to avoid confusing persons who are colour blind. Safety signs use primarily red, yellow and green as information colours. For other signs it is preferable to use Blue and White Colours. - Text should contrast with sign background - Sign should contrast with environment - Light levels	Minimum difference in LRV for small targets, such as signs and inscriptions, to signboards, should be 60 points. Signboards should have a minimum difference in LRV from the background of 30 points. Red-green combination should be avoided. Difficulties in perception can also appear when using the colours green, olive green, yellow, orange,

Dimensions	CPWD	HG	NBC	ISO
		<p>with environment</p> <ul style="list-style-type: none"> - Light levels (measured in Lux) -70% contrast between wall and sign panel -Avoid shades of colours -Avoid using same colours as safety signs -Maximum 5 colours Non-reflective surface. Table 6-1 gives Typical Schedule of Colour Contrast for Signs. 	<p>(measured in Lux)</p> <ul style="list-style-type: none"> -70% contrast between wall and sign panel -Avoid shades of colours -Avoid using same colours as safety signs -Maximum 5 colours on-reflective surface. Table B-11.5.1.3 gives Typical Schedule of Colour Contrast for Signs. 	<p>pink and red. Refer to the contrast section in B.7.</p>
Line spacing and character proportion and height	-	<p>The spacing between lines should be 50% of the line height. A style should be chosen because based on a character width-to-height ratio within 3:5 and 1:1 and the stroke width-to-height ratio between 1:5 and 1:10. It should be consistent for each sign.</p>	<p>The spacing between lines shall be 50 percent of the line height. A style shall be chosen based on a character width-to-height ratio within 3:5 and 1:1 and the stroke width-to-height ratio between 1:5 and 1:10. It shall be consistent for each sign.</p>	<p>Adequate height spacing should separate the lines. Lines of text should be ranged from a vertical line (unjustified).</p>
Pictograms	Signs should be clear and easy to read and understand in order to	Ideally any signage should incorporate a combination of	Ideally any signage should incorporate a combination of lettering	Universally accepted pictograms should be used. See ISO 7000,

Dimensions	CPWD	HG	NBC	ISO
	assist persons with intellectual, cognitive and sensory disabilities.	lettering and symbols.	and symbols.	ISO 7001, ISO 7010, ISO 16069 and ISO 28564-1.
Braille	Specification of Braille cells is shown in Figure 31. As per the table given, Dot Spacing: 2.5 mm; character spacing 6.5 mm; Dot height 0.5 mm; line spacing 10.0 mm; Dot base diameter 1.5 mm.	Figure 6-21 gives Braille specifications. Not mentioned in text.	Fig. 114 gives Braille Specification for Signage. Not mentioned in text.	Where an arrow is used in the tactile sign, a small arrow shall be provided for Braille readers. On signs with multiple lines of text and characters, a semi-circular Braille locator on the left margin shall be horizontally aligned with the first line of Braille text. Braille should be raised, domed and comfortable to touch. It should be located 8 mm below the bottom line of the text and be left justified.
Tactile lettering	Sign should be in raised characters	Embossed letters, raised pictograms and raised arrows are tactile features that can be incorporated	Embossed letters, raised pictograms and raised arrows are tactile features that may be incorporated	Raised tactile letters and graphical symbols, height 15 mm to 55 mm, minimum relief 0,8 mm (1 mm to 1,5

Dimensions	CPWD	HG	NBC	ISO
		into signs, which can be particularly helpful to persons with visual impairment.	into signs, which may be particularly helpful to persons with visual impairments.	mm relief is preferred).
Maps and models	If a floor plan for the use of the public is provided, Braille and tactile floor plan showing the main entrance, public toilet and major common facilities shall be provided in a place in that building which is prominent to persons with visual impairment.	A tactile map or model is a useful way of providing information to visually impaired people and people with hearing impairments who wish to navigate around a building.	A tactile map or model is a useful way of providing information to visually impaired people and people with hearing impairments who wish to navigate around a building.	Only essential information should be included on a tactile map or floor plan. Tactile maps shall be angled between 20° to 30° from the horizontal for ease of reading, and the bottom edge shall be at a minimum height of 900 mm. The map should have a level of illumination between 350 lux and 450 lux, without glare. The key should be located at the bottom of the map and left justified. The use of a recessed Braille locator on the left hand side should assist in locating the legend. The map shall be

Dimensions	CPWD	HG	NBC	ISO
				orientated with the building.
Lighting/ signage illumination	-	Signs should be well and evenly lit with uniform lighting over the surface of the sign of between 100 and 300 lux. Minimum acceptable level of lighting for directional signage, maps and text panel is 200 lux.	Signs shall have a matt finish, not a shiny or glossy one, and shall be well and evenly lit with uniform lighting over the surface of the sign of between 100 and 300 lux. Minimum acceptable level of lighting for directional signage, maps and text panel is 200 lux.	Signs should be glare free when mounted. This depends on how the sign is placed, the material and the illumination. The background, graphical symbols, logos and other features shall be of a matte or low sheen finish. Signs can be luminescent or artificially lit. The map should have a level of illumination between 350 lux and 450 lux, without glare.
Graphical symbols	-	The International Symbol of Accessibility must be displayed at all accessible entrances. Similar guidelines refer to elevators, evacuation and refuge areas, restrooms and bathing facilities.	The international Symbol of Accessibility shall be displayed at all accessible entrances and accessible facilities. If an entrance is not accessible, directions to an accessible route, including the symbol, shall be	ISO/TC 145 Graphical symbols has developed the following standards for graphical symbols: ISO 7000, ISO 7001 and ISO 7010. These include graphical symbols relevant to accessibility and a

Dimensions	CPWD	HG	NBC	ISO
		<p>Symbols of accessibility are also required to identify volume control telephones, text telephones, and assistive listening systems.</p>	<p>provided. Similar guidelines refer to elevator, 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. Preferred colour is navy blue with white lettering. Symbols and border size shall be 200 mm x 200 mm square with 1.25 mm border.</p>	<p>selection is shown below (see Figures 66, 67 and 71). Pages 105 and 106 give a list of accessible facilities for which they can be graphically denoted. Graphical symbols on directional and door signs should be tactile, and should be accompanied by raised lettering and Braille. The size of graphical symbols is dependent on the viewing distance (D). The minimum size of the inner outline of the frame of graphical symbols (s) can be derived from formula $s = 0,09 D$, applicable for a viewing distance of 1 000 mm to 10 000 mm. Graphical symbols shall: be highly contrasted with a minimum</p>

Dimensions	CPWD	HG	NBC	ISO
				difference in LRV of 60 points and properly illuminated.
Audio signs/audio information	Braille and tactile building name and address (i.e., street name with number) or a device which when activated will provide the same information in audible form should be provided on both sides of the building entrance at a height of between 900 mm and 1500 mm above the finished floor level.	The higher the signal to noise ratio (the difference in decibels dB. between signal and ambient) the better for communication. People 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 15 dB over the prevailing sound level, with a maximum of 120 dB. Audio signs – which can play a recorded message when touched or activated by a person’s movement or presence. Information can be provided in	It is essential that there is a significant difference between the level of background noise and the level of the signal or announcement. The higher the signal to noise ratio (the difference in decibels dB. between signal and ambient) the better for communication. People with hearing impairment require at least a +5dB S/N ratio. In environments that are noisy, any spoken information shall be repeated at least once. Audible alarm systems shall operate at least 15 dB over the prevailing sound level, with a maximum of 120 dB.	

Dimensions	CPWD	HG	NBC	ISO
		various formats, languages or methods of transmission.		
Signage material		-Some suggested materials for signage are wood, acrylic, Aluminum Composite Panel (ACP).	Some suggested materials for signage are wood, acrylic and Aluminum Composite Panel (ACP).	

Observations and Recommendations

1. Placement/height of signages: CPWD says that signs should be placed at 900 mm to 1500 mm while HG and NBC mention 900 mm to 1800 mm and ISO says 1200 to 1600 mm. The upper limit should be reduced to 1600 mm in Indian Standards as given in ISO. CPWD should include the height of ceiling suspending signs.
2. Size of signage: CPWD should incorporate the specifications from HG and NBC.
3. Braille: Braille specific requirements are given only in diagrams and not in text in HG and NBC. It should be given in text too.
4. Pictograms: ISO mentions that universally accepted pictograms should be used. These should be specified in Indian Standards.
5. Tactile Lettering: CPWD, HG and NBC have not given specification for tactile lettering. It should be added based on ISO specifications.
6. Lighting/Illumination: ISO mentions that maps should have 350 to 450 lux of illumination whereas HG and NBC mention 200 lux. HG and NBC should revise their Standards as per ISO. CPWD should include this point.
7. Graphical symbols: NBC and HG have given figures for various accessibility symbols. There is no reference given of ISO Standards. There are ISO Standards for various Symbols. HG and NBC should not only have symbols added as part of the Standard but also give the ISO reference. CPWD should also incorporate the same.

20 Conclusion

Based on the study, it was felt that the CPWD Guidelines are too simplified and have not covered many areas. It needs to include a lot more technical detail in order to make it appropriate as a reference.

The HG and NBC Guidelines are very similar. Most of the content of the NBC appears to have been taken from the HG. NBC appears to have included some relevant points from the ISO and therefore making it better than the HG. It was also noted that, regarding some aspects, HG and NBC have given more stringent Standards than the ISO. However, there were some sections where the ISO was significantly more comprehensive and detailed than either the HG or the NBC. (Please refer to the 'observations and recommendations' given at the end of each section for more information regarding the gaps).

It was also observed that, in several places, only the diagrams had the specifications but there were no details given in the text. Moreover, the diagrams/figures were not clear and were not synchronised with the text in some places. The diagrams should be improved in all three Indian documents. The NBC should also improve on the presentation to make it easy to follow and be accessible.

It is very important to have ONE set of Standards in India. We recommend that the NBC, which is in the draft stage, must incorporate the recommendations in order to make it comprehensive. The Urban Development Ministry and the CPWD ought to adopt the NBC Standards rather than having their own Guidelines. The NBC should be the only reference document for all building bye-laws, guidelines for smart cities, green buildings, etc.

It must also be noted that the NBC provides standards for buildings in general. Now there are specific requirements for many different types of buildings which are not included in the NBC. Therefore, Standards have to be developed for residential buildings, schools, cinema halls, hotels/restaurants, hospitals, offices, auditorium, bus stops, sports arenas, museums, historical buildings, religious places and so on.

It is important to mention here that that the requirements for accessibility have been given as an annexure in Part 3 of the NBC, 'Annexure B, Anthropometrics and specific requirements for barrier free buildings and built environment'. These specifications should also be included in the relevant chapters of the NBC. For example, issues concerning emergency evacuation should be in the fire and safety chapter; points related to lifts should be put in the chapter where general

specifications for lifts are given; standards concerning accessible toilets should be in the plumbing section; kerb ramps should be mentioned where requirements for footpaths are given and so on. NCPEDP, in collaboration with AccessAbility and DEOC, had undertaken a study (March 2016) of the various draft chapters of NBC and the recommendations have been submitted to BIS.

Last, but not the least, it is important to state that all the Indian Guidelines appears to have been adopted from international Standards and the source from where the specific information has been taken has not been mentioned. Unfortunately, there has been no authentic study undertaken in India, with respect to the accessibility needs of persons with different disabilities, keeping in mind the range of assistive devices/technologies being used, cultural aspects, terrains in rural/urban/hilly regions, etc. ISO has mentioned at several places that national regulations have to be considered. Hence, research should be undertaken in order to develop an Indian Standard for accessibility of built environment which is suitable in the Indian context.