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UNIVERSAL DESIGNGUIDE



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Copyright © 2007 Building and Construction Authority

Published by Building and Construction Authority 5 Maxwell Road #16–00 Tower Block MND Complex Singapore 069110 Tel: (65) 6325 7720 Website: www.bca.gov.sg

First published in 2007

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Design by BOOKSMITH (booksmit@singnet.com.sg)

ISBN 978-981-05-9256-1

Universal Design, which simply means "design for all people", aims to create an environment that will address the needs of all age groups and people with different needs. In Singapore, the move towards Universal Design has gathered pace to cater to the growing proportion of greying population. It will help to make our society a more inclusive one.

In line with its mission to build a Safe, High Quality, Sustainable and Friendly built environment, the Building and Construction Authority (BCA) has embarked on several initiatives to spearhead Singapore's progress towards the adoption of Universal Design.

BCA and the National University of Singapore jointly published a *Universal Design Guide for Commercial Buildings* in 2006. The purpose was to instill awareness in Universal Design amongst designers, building owners and developers and encourage them to adopt this approach in designing their buildings.

BCA also introduced the Universal Design Awards in early 2007 to give recognition to good practices and special efforts taken in implementing Universal Design features. Seven buildings of diverse types, including residential, institutional and commercial buildings, clinched this prestigious award. We look forward to more building owners and developers recognising the need for Universal Design and adding this new and important dimension to the design of their buildings.

This new Universal Design Guide will provide the industry with a more complete set of guidelines for adoption in all building designs. It has Universal Design recommendations that are applicable not only to commercial buildings but also a wider range of building types, including residential buildings as well as public and community facilities.

Let us make Universal Design an integral part of the built environment in Singapore.

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Mah Bow Tan Minister for National Development

Foreword

It is one of the strategic thrusts of the Building and Construction Authority (BCA) to build a friendly environment that is accessible to all. We recognise that Universal Design holds the key to create an environment that allows people with different abilities to integrate fully into the mainstream of daily life.

This book serves as a comprehensive Universal Design guide for the industry. It sets out the guidelines on adopting Universal Design features in buildings and contains useful and practical recommendations for designers.

Universal Design is a definitive step towards a more caring and inclusive society. Let us make a difference together by going beyond the mandatory requirement of the Code on Accessibility in the Built Environment and apply the Universal Design principles to our built environment.

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Quek See Tiat Chairman Building and Construction Authority

Dr John Keung Chief Executive Officer Building and Construction Authority

Towards a Friendly Built Environment

In preparing this edition, reference has been made to the following:

- Building and Construction Authority, 2007, Code on Accessibility in the Built Environment, Singapore.
- Driskell David, ed. Design, 1993, *Guide: Universal Access to Outdoor Recreation*, PLAE, Inc., Berkeley, California, USA.

- Harris, Charles W., and Dines, Nicolas T., 1998, *Time-saver Standards for Landscape Architecture* 2nd Edition, McGraw-Hill Publishing Company, USA.
- Hong Kong Housing Society, 2005, Universal Design Guidebook for Residential Development in Hong Kong, Hong Kong.
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- National Standard of Canada, 1995, Barrier-free Design, Ontario, Canada.

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- Old Aged Residence Foundation, 2005, Guideline for the Design of Home for the Aged, Japan.
- Singapore Civil Defence Force, 2007, Code of Practice for Fire Precautions in Building, Singapore.
- Singapore Standard CP15:2004, Code of Practice for Installation, Operation, and Maintenance of Escalators and Passenger Conveyors, Singapore.
- Singapore Standard 531:2006, Code of Practice for Lighting of Work Places Part 1 Indoor Lighting, Singapore.

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SECTION 1 Introduction

Definition of Universal Design Principles of Universal Design Objectives Scope Use of the Guide



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Definition of Universal Design

According to Ronald Mace, "Universal Design is the design of products and environment to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."¹

Principles of Universal Design

The Seven Principles of Universal Design, developed by the Centre for Universal Design, North Carolina State University, with a consortium of universal design researchers and practitioners from across the United States², are as follows.

Principle 1 – Equitable Design

The design is useful and marketable to people with diverse abilities.

Principle 2 – Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

1. Preiser, Wolfgang F E [2001], Universal Design Handbook, McGraw-Hill, New York"

2. © Copyright 2006 The Centre for Universal Design, NC State University Raleigh, North Carolina, USA

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Principle 3 – Simple and Intuitive

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Principle 4 – Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Principle 5 – Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Principle 6 – Low Physical Effort

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The design can be used efficiently and comfortably and with a minimum of fatigue.

Principle 7 – Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

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Introduction

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Objectives

With the commitment that all persons with different abilities should continue to be integrated with society, BCA aims to derive a set of guidelines that provide information essential to achieve universal design with the goal of catering for the usability, safety, comfort and convenience for all people.

The specific objectives are the following.

 To assist urban designers and architects to better address the needs of people of different abilities

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- To promote a greater sensitivity and innovation in universal design beyond minimum requirements
- * To achieve a higher standard of universal design for the built environment

Scope

Universal design can be accomplished through a good appreciation of the broad range of abilities or disabilities of all user groups in the community. To this end, this guide gives the full range of requirements and sets out guidelines for designers to work towards an accessible environment for the independent living of people of varying abilities.

The guide begins with the needs of the following group of persons of different abilities.

Infants and Children

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Infants and children are at a young stage of their lives. They are usually treated as special persons requiring care from their caregivers in both physical and cognitive functions. Familyfriendly features such as wider corridors for prams, nursing room and appropriate anthropometric scale of furniture and sanitary fixtures are highly recommended for the convenience of the users.

Expectant Mothers

Expectant mothers experience different physiological and emotional changes during pregnancies. Some of the common symptoms are fatigue, lower backache and difficulties in walking and balancing. Thus, it is recommended that handrails for additional support and seating should be generously provided on travel routes and wherever waiting is likely.

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Introduction

The Elderly

The elderly are usually characterized by high probability of disease and low cognitive and physical function capacity. Day-to-day tasks that cause problems for them are those that require physical strength and sustained effort, particularly tasks related to indoor and outdoor mobility. To enable active engagement with life, provisions such as extra handrails for support, slip-resistant flooring and adaptation of more elderly-friendly features should be provided for the elderly to move around independently.

Wheelchair Users

Wheelchair users often face difficulties with negotiating change in levels and manoeuvring their wheelchairs in confined and congested spaces. It is thus important to design the built-environment with accessibility features such as ramps with gentle gradients, accessible lifts and toilets that address their needs, and the provision of signage to guide them to such facilities.

Ambulant Disabled People

Persons with temporary or permanent ambulant disabilities are likely to have unstable or slow movement. Special consideration should be given to ensure ease of access and movement for them between and within public areas by the careful provision, location and design of parking areas, paths, kerbs, pedestrian crossings, street furniture, open space and sanitary facilities.







The visually impaired rely on what little vision they have as well as other aids to find their way around. Physical and sensory cues such as touch, sound, smell and tactile or audible information are therefore important aids for them to move around independently.

Persons with Hearing Impairment

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It is important to understand the unique needs of the deaf or hearing impaired. Since they are unable to receive audio information, all information should be transmitted through other means, such as substituting audio alerts with visual alerts and allowing them to configure the frequency and volume of audible cues.

Persons with Visual Impairment



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Chart Outlining the Profile of People of Different Abilities

User Group Special characteristics requiring attention	Infants and children (up to 8 years old)	Expectant mothers	Elderly (more than 50 years old)	Hearing impaired persons	Sightless or partially sighted persons	Physically injured persons (upper and lower body)	Wheelchair users
Difficulty in interpreting information							
Poor or complete degradation of sight							
Poor or complete degradation of hearing							
Prevalence of poor balance							
Prevalence of poor coordination and orientation							
Poor or inability in handling and fingering							
Poor or inability in using upper extremities							
Poor or inability in using lower extremities							

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Chart Outlining the Profile of People of Different Abilities (cont'd)

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User Group Special characteristics requiring attention	Infants and children (up to 8 years old)	Expectant mothers	Elderly (more than 50 years old)	Hearing impaired persons	Sightless or partially sighted persons	Physically injured persons (upper and lower body)	Wheelchair users
Limitations of stamina							
Limitations of strength							
Vertically and horizontally challenged (in terms of height or size)							
Require physical assistance/ supervision							
Require family- friendly facilities							
Use of movement aids							
Others		Increased visit to toilets		Use of walking cane to detect obstructions			

Categories adapted from the Enabler Model.³

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3. David Driskell, ed. Design Guide: Universal Access to Outdoor Recreation, PLAE, Inc., Berkeley, California, USA, 1993, p. 20.

Introduction

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Use of the Guide

Each chapter of this guide begins with an introduction on the design concern. The guidelines are provided in point forms with CAD drawings and sketches illustrating the concerns. Photographs are added to further explain the intent. References to existing relevant Singapore Codes and guidelines are also indicated for ease of cross-referencing. They include Code on Accessibility in the Built Environment 2007, Code of Practice for Fire Precautions in Building 2007 and A Guide to Better Public Toilet Design and Maintenance 2002.

Framework

Section	Title	Objective
1	Introduction	Presents the definition and principles of Universal Design and provides the background, objectives and scope of this guide.
2	Access to Building	Provides recommendations for the design of car parks, accessible lobbies, alighting and boarding bays, signage, building entrance doors, etc. that are related to the accessibility to buildings
3	Horizontal Circulation	Provides recommendations for transitional spaces such as corridors and their physical detailed dimensions with safety precautionary considerations
4	Vertical Circulation	Provides recommendations for transitional spaces such as staircases and ramps, and their physical detailed dimensions with safety precautionary considerations

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Section	Title	Objective
5	Mechanical Circulation	Provides recommendations for assistive technologies such as lift cars and escalators, and their physical detailed dimensions with safety precautionary considerations
6	Sanitary Facilities	Provides recommendations for sanitary facilities such as wash basin, urinal, doors, and their physical detailed dimensions with safety precautionary considerations
7	Indoor Public Facilities	Provides recommendations for the design of indoor public facilities such as family rooms, shops and kiosks and supermarkets for the convenience of all users
8	Outdoor Public Facilities	Provides recommendations for the design of outdoor public facilities such as accessible footpaths, parks and communal areas, shelters and pavilions and outdoor seating. Considers the interconnectivity between these exterior spaces Considers such facilities and their interface with buildings
9	Recreational Facilities	Provides recommendations for recreational facilities, such as clubhouses, gymnasiums, swimming pools, game courts and children's play areas, that are catered to the convenience of all users
10	Residential Units	Elaborates on the basic design considerations for different spaces, such as the living room, the bedroom and the kitchen, within a typical residential unit to facilitate ageing Considers the best practices for fittings, materials and finishes

Introduction



Buildings

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Car Parks Entrances

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Car Parks

A well-designed parking space makes a building more usable to people of varying abilities. The convenience and safety of drivers and their passengers in accessing a building are critical issues that must be considered in the design of a building.

Accessible Parking Lots

- Recommendations for an accessible parking lot to give better access to its users:
 - It should be located next to or near the car park lobby.
 - It should not be located across the driveway from the car park lobby.
 - It should have a blue background for easy identification from a distance.



Plan view of an accessible parking lot

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Example of an accessible parking lot located next to or near a car park lobby

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Examples of accessible parking lots in blue background for easy identification

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Access to Buildings

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Kerb Ramps

Where the vertical rise is not more than 175 mm, a kerb ramp of at least 900 mm wide should be provided to allow for ease of wheelchair movement.

Code on Accessibility 2007, Clause 3.4.1.3 and 3.4.1.4

- Tactile warning indicators should be provided at the start of a kerb ramp.
- The gradient of a kerb ramp, including its flared sides, should be gentler than a gradient of 1:10. The flared sides should have colours that are in contrast to the background.

Code on Accessibility 2007, Clause 3.4.1.2 and Clause 3.4.3.2



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Plan view of a kerb ramp

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Example of a kerb ramp

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Access to Buildings

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Accessible Lobbies

- There should be an accessible lobby at every car park floor.
- The access pathway from the car park to the accessible lobby should be level. If this is not possible, a kerb ramp should be provided.

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Code on Accessibility 2007, Clause: 9.6.1

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Example of an accessible lobby

An automated glass door for easy access and to provide a visual link between the car park and the accessible lobby is preferred.

At least one top-up machine should be located beside the entrance of an accessible lobby and within the reach of wheelchair users.

Code on Accessibility 2007, Clause 9.7.1



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Example of a top-up machine within the reach of wheelchair users



Example of an automated glass door for easy access

Access to Buildings

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Signage

 Electronic signage systems showing the numbers and floors of available accessible parking lots should be provided.

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 Signage should be clearly visible from all parts of the car park to assist orientation.



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Examples of directional signs leading to accessible parking lots

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If the locations of accessible parking lots are distant or not apparent from the approach, directional signs should be provided and placed along the accessible routes leading to the lots.

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To minimize reflection, all forms and types of signage should not have reflective materials or set behind glass.



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Example of an electronic sign showing the numbers and floors of available accessible parking lots

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Access to Buildings

Safety

 Designated pedestrian walkways and crossings leading to the accessible lobby should be provided.

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Tactile warning indicators, preferably in contrasting colours, should be provided to warn of either a hazard or a destination at locations such as doors, ramps and changes in direction.

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Example of designated pedestrian walkways and crossings leading to the accessible lobby

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 Adequate lighting is important in accessible lobbies, in accessible parking lots and along accessible routes to minimize accidents.

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- Where there is no change in levels between the accessible lobby and the driveway, it is recommended that bollards
 - be provided with a minimum clear spacing of 900 mm to demarcate the pedestrian zone; and

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- should not be chained as chaining may impede human traffic flow.



Example of designated pedestrian walkways at a car park

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Example of an accessible lobby with bollards

Access to Buildings

Entrances

Entrances to buildings are often busy areas with a continuous flow of people walking, waiting, alighting and boarding concurrently. To allow for these activities, adequate space should be provided based on user volume and sufficient directional devices should be provided at visible locations to orientate users.

Alighting and Boarding Bays

- A designated accessible and sheltered alighting and boarding bay is recommended for each building or development. The bay should be provided at the level of approach and or adjacent to accessible entrances.
- A buffer zone of greater than 2500 mm between the accessible entrances and alighting and boarding bay is recommended. Seating and safety rails should also be provided.
- Alighting and boarding bays, buffer zones and accessible entrances should all be at the same level to allow for easy movement. A kerb ramp should be provided where there is a change in level.

Code on Accessibility 2007, Clause 3.1.2.2

Signage should be provided to announce the building from afar, with additional signage nearer the approach and accessible entrances.

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Example of an accessible and sheltered alighting and boarding bay

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Provision of seating and safety rail



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Plan view of an alighting and boarding bay

Access to Buildings

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Accessible Lift Lobbies

To be visually prominent from a distance, the walls of accessible lift lobbies should be of textural material and in a contrasting colour with the background.

Seating is recommended at accessible lift lobbies for the elderly, the ambulant disabled and expectant mothers so they can rest comfortably while waiting for the lift.

Accessible Entrance Doors

- All accessible entrance doors should be automated for easy access to the building.
- A visual link between internal and external is highly recommended to be provided for accessible entrance doors.

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Changes in level at accessible entrances should be avoided.



Example of an accessible lift lobby

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Access to Buildings

Letterboxes

To facilitate reach for wheelchair users, the highest row of letterboxes should be not higher than 1200 mm and the lowest row of letterboxes should be not lower than 600 mm above finished floor level.

Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 60

- To assist the visually impaired, tactile or Braille markings should be provided on individual letterboxes.
- To facilitate the manoeuvring of wheelchairs, a clear space of 1800 mm by 1800 mm is recommended if letterboxes are located at a 90° end corner within the lift lobby area.



Example of letterboxes located at a 90° end corner within the lift lobby

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Front elevation showing the height of letterboxes within reach of wheelchair users

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Access to Buildings

Signage

Tactile ground surface indicators from accessible entrances to major destination points in a building should be used sparingly and in a planned manner,. Too many of such indicators may confuse rather than inform and should be avoided.

Code on Accessibility 2007, p. 171, Clause F.3.12.1

- Clear signage should be provided to direct users to accessible routes.
- A building directory with Braille directions and maps showing the building layout should be prominently displayed at the accessible entrance lobby.

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Safety

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- Non-slip floor finishes should be used throughout the accessible area.
- There should be good drainage to prevent ponding.

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Example of tactile ground surface indicators at the entrance of a building



Example of tactile ground surface indicators from accessible entrances to major destination points in a building

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Access to Buildings



SECTION 3 Horizontal Circulation

Corridors

Corridors

In the design of corridors, it is important to consider safety precautions and the different pace of user movement. These factors determine the physical dimensions and influence the placement of furniture and other objects.

The layout of a building is crucial in getting people to their destinations. Architects and designers are encouraged to provide clear visual cues for orientation throughout the building.

Physical Design

- Accessible corridors should have a minimum width of 1800 mm to allow both an assisted person and a wheelchair user to pass. The corridor width should be adjusted proportionately to the projected traffic volume.
- Accessible corridors should have non-slip floor finishes. Colours and/or textures may be used to aid orientation.
- There should not be any protruding objects along corridors. If this is unavoidable, ensure strict compliance with the code.

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Code on Accessibility 2007, Clause 3.7.4.1.1 and Clause 3.7.4.5.1



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Example of an accessible corridor



Plan view of different configurations of accessible corridors

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Horizontal Circulation

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Example of an accessible corridor

Orientation

- Reference points are recommended to aid users in orientation. Atriums, external views and focal elements such as sculptures and or architectural features are effective devices.
- Dead end spaces should be avoided as far as possible. If they cannot be avoided, adequate space should be allowed for a wheelchair user to make a turn.

Code on Accessibility 2007, Clause A.1.2.3

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Atrium

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Focal elements

Plan view of examples of reference points for orientation



Orientation with aid of an atrium



Water feature serving as an orientation device

Horizontal Circulation

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Safety

Handrails with upturns should be provided to aid the visually impaired to identify the location of openings and doors along corridors.

Handrails and/or trailing bars should be provided where possible, on at least one side of a corridor, for the visually impaired to trail along without impediment. Signage with corresponding Braille markings along handrails or trailing bars should be provided to indicate the location of facilities.

Code on Accessibility 2007, Clause 3.7.2.2

 Any changes in levels, including steps or ramps, should be located at least 1000 mm away from doorways.

Old Aged Residence Foundation, Guideline for the Design of Home for the Aged, Japan, 2005, p. 100

 Adequate lighting is important. A sudden change in light intensity along circulation pathways is hazardous and should be avoided.



Example of handrails with upturns along a corridor



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Example of a corridor with changes of level located 1000 mm away from doorways

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Horizontal Circulation



SECTION 4 Vertical Circulation

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Staircases Ramps

Staircases

The staircases is one of the most important means of movement between different levels. Staircases should be designed with great sensitivity and attention should be paid on appropriate dimensions, materials and the detailing of treads and risers for a comfortable and safe transition between levels in both directions. In addition, accessible refuge areas are vital for occupants to evacuate in any emergency. The design of escape staircases should provide all occupants with a safe and efficient exit.

Dimensions

- The minimum width of stairs is 1200 mm and should be adjusted according to the expected flow of traffic.
- A flight of stairs should have a minimum of three risers. For safety reasons, the provision of one or two steps should be avoided.
- An intermediate landing should be provided after a maximum of 16 risers.
- Floor landings should have a level platform of the same width as the stairs.
- Staircases of widths wider than 2400 mm should be divided into segments using handrails.



Example of a staircase of width wider than 2400 mm divided into segments using handrails

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Vertical Circulation

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Treads and Risers

 Risers should not exceed 150 mm in height and treads should have a minimum dimension of 300 mm.

Code on Accessibility 2007, Clause 3.9.2.1a

- Risers and treads should be of consistent dimensions throughout the flight of stairs.
- Treads and staircase walls should be of contrasting colours to alert the visually impaired to the presence of steps.

Code on Accessibility 2007, Clause 3.9.2.2

- The treads screed should be level and outward sloping treads should be avoided.
- Treads should have a non-slip finish, with special non-slip nosing of permanent contrasting colour with the tread.

Code on Accessibility 2007, Clause 3.9.3.2

- Nosings should be an integral part of the steps. If nosing strips are used, they should be securely fastened to the steps.
- Protruding nosings should be avoided as they may be hazardous.

Code on Accessibility 2007, Clause 3.9.3.1

 Rake-back risers should be provided. Open risers and transparent treads should be avoided for staircases that form part of the main accessible route.

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Code on Accessibility 2007, Clause 3.9.2.1b

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Example of treads with a depth of 300 mm and risers with a height of 150 mm

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Vertical Circulation



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Example of a typical staircase



Special non-slip nosing of permanent contrasting colour with the tread



A carpet for good slip resistance

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Vertical Circulation

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Handrails

Handrails should be provided on both sides of the stairs.

Code on Accessibility 2007, Clause 3.9.5.1b

The height of a handrail should be between 800 mm and 900 mm, measured from the pitch line vertically to the top of handrail.

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Code on Accessibility 2007, Clause 3.9.5.1c



Side elevation of a typical handrail extension for a staircase

There should be additional handrails for children. The height of a handrail for a child should be between 580 mm and 700 mm from the pitch line vertically to the top of the handrail.

A handrail should be continuous throughout its entire length and extend at least one tread depth or 300 mm beyond the top and bottom steps.

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Example of a typical handrail with an additional handrail for children



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Examples of handrails extended to one tread depth or 300 mm beyond the top and bottom steps

Vertical Circulation

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Accessible Refuge Areas

A designated accessible refuge area should be provided for emergency situations and located at the following areas:



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- Adjacent to staircases

Plan view showing a designated accessible refuge area at a protected accessible lobby adjacent to staircases



- Smoke-free enclosed staircases



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Plan view of a designated accessible refuge area in smoke-free enclosed staircases

- Ventilated stairway landings

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Plan view of a designated accessible refuge area at a ventilated stairway landing

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Vertical Circulation

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- To help the visually impaired locate the accessible refuge area, tactile warning indicators should be provided at the entrance of the accessible refuge area.
- Accessible refuge areas have to be lit adequately via an emergency power supply.

A communication device such as a telephone or an intercom should be provided at each allocated accessible refuge area to facilitate communication with the building management (or rescuer).

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Example of an accessible refuge area at a ventilated stairway landing

Signage

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 Directional signage should be provided and placed along accessible routes to direct users to accessible refuge areas.

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Example of an accessible refuge area that is lit adequately during an emergency



Example of a communication device provided at an accessible refuge area

Vertical Circulation

Safety

 Protruding steps and handrail extensions are not recommended at intersections between stair accesses and corridors.

◆ The minimum clear headroom for all vertical circulation routes is 2000 mm.

Code on Accessibility 2007, Clause 3.7.5.1.1

A detectable guardrail or any other permanent barrier should be provided where the headroom is lower than 2000 mm. Such elements should be at a maximum height of 580 mm so that they can be detected by the visually impaired.

Code on Accessibility 2007, Clause 3.7.5.2.1



Plan view of a staircase with tactile floor indicators

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Tactile or Braille markings should be provided on the horizontal extended handrails of staircases to allow people with visual impairment to determine the storey number.

Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 57

 Tactile warning indicators should be provided at the start and end of every flight of stairs.



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Example of steps that are not protruded at intersections between the stair access and the corridor

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Old Aged Residence Foundation, Guideline for the Design of Home for the Aged, Japan, 2005, p. 61

Vertical Circulation



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Side elevation showing a safety rail underneath a staircase



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Example of a safety rail underneath a staircase

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Example of horizontal extended handrails of staircases with tactile or Braille markings

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Vertical Circulation

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Ramps

To provide universal access to all users, ramps should be designed as an integral part of the circulation of a building to facilitate the smooth flow of human traffic. Ramp design should reconcile space limitations and accessibility requirements. Ramps should satisfy the needs of the users by having the appropriate gradient, regular landings, comfortable travelling distance, as well as safety precautions to provide safe, easy and comfortable access to all.

Width

Ramps should have a minimum width 1200 mm.

Code on Accessibility 2007, Clause 3.3.3.1

Gradient and Maximum Run

The gradient of a ramp should not be steeper than 1:12 and should be consistent between landings. Wherever possible, gradients gentler than the recommended gradients for lengths of a single run (shown below) should be adopted.

Code on Accessibility 2007, Clause 3.3.2

Recommended length of a single run

Gradient of ramp	1:12–1:14	1:15	1:20	Not gentler than 1:25
Intervals (maximum length of horizontal run in metres)	9	11	15	18

Where the change in level results in having multiple ramps and landings combination, other solutions should be considered.

Code on Accessibility 2007, Clause 3.3.1.2, Note 2

Landings

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- Where the ramp exceeds the maximum length as specified earlier, landings should be provided.
- Level landings should be provided at the top and bottom of each run as well as where a run changes direction.

Code on Accessibility 2007, Clause 3.3.5.1

- To facilitate easy manoeuvring and resting, a of landing 2000 mm by 2000 mm is recommended for straight and 90°-turn ramps. A landing of 2500 mm by 2500 mm is recommended for a 180°-turn ramp.
- Landings should not encroach on any circulation routes.

Example of landings that do not encroach on other circulation routes



Vertical Circulation



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Plan view of different layouts of ramps with recommended landings
Handrail Provisions

♦ Handrails are recommended for ramp runs with a rise more than 175 mm.

Code on Accessibility 2007, Clause 3.3.6.1

Handrails should be placed at 800 mm to 900 mm above the finished floor level.

Code on Accessibility 2007, Clause 3.3.6.1c

Handrail Extensions

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Handrails should be continuous throughout the entire length of the ramp and be extended at least 300 mm at the end of a horizontal run.

Code on Accessibility 2007, Clause 3.3.6.2a

Handrails extensions should not project into another path of travel.

Code on Accessibility 2007, Clause 3.3.6.2b



Example of handrail extension for a ramp

Vertical Circulation



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Example of handrail extension at the end of a run

Safety

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 Outdoor ramps and their approaches should be sheltered where possible and should have good drainage to prevent ponding.

Code on Accessibility 2007, Clause 3.3.8.1

 Ramp and landing surfaces should be made of non-slip materials and should not obstruct the use of moving aids.

Code on Accessibility 2007, Clause 3.3.4.1

Tactile warning indicators in contrasting colours should be provided at 300 mm away from the edge of ramps. Markings to indicate the direction of human traffic flow are also recommended.

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Code on Accessibility 2007, Clause 3.2.2

Vertical Circulation

- Ramps and landings that are not adjacent to a wall should have an edge protection in the form of one of the following.
 - A kerb of at least 75 mm high;
 - A raised barrier with its lower edge not more than 75 mm between the protective barrier and the ramp surface; or
 - A handrail with the bottom edge not more than 75 mm from the ramp surface.

Code on Accessibility 2007, Clause 3.3.7.1



Example of a sheltered outdoor ramp ()

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Kerb with a minimum height of 75 mm

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to align with handrail

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Rail with bottom edge not more than 75 mm

Sections of different edge protections for safety

Vertical Circulation



SECTION 5 Mechanical Circulation

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Lifts Escalators

Lifts

Lifts are the most common form of vertical transportation and are an integral part of the accessible route. As such, attention should be paid to the design of lifts in order to accommodate the needs of people with different abilities.

Location

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Where lifts and escalators are provided, they should be located near each other to encourage the transportation of baby prams, strollers and wheelchairs using lifts instead of escalators.

Lift Provisions

 Accessible lifts should be provided at the ground level near the entrance of a building.

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Code on Accessibility 2007, Clause 5.2.1

✤ Accessible lifts should serve all levels intended for access.

Code on Accessibility 2007, Clause 5.2.2

◆ Accessible lifts should have a minimum clear door width of 900 mm.

Code on Accessibility 2007, Clause 5.2.5.1



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Front elevation of lifts with user-friendly provisions

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Mechanical Circulation

Landing Call Buttons

The approach to the landing call button at a lift lobby should have an unobstructed space of at least 900 mm by 1200 mm.

Code on Accessibility 2007, Clause 5.2.6.1a

The landing call button should be placed at a height of 900 mm to 1200 mm to accommodate wheelchair users.

Code on Accessibility 2007, Clause 5.2.6.1b

 Braille markings should be placed at a minimum distance of 4 mm from tactile markings.

Code on Accessibility 2007, Clause 5.1.3.1.c

Indicators

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- There should be tactile ground surface indicators on the floor leading to accessible lifts.
- There should be Braille and tactile floor indicators on both door jambs of the lift entrances to all floors and at a height of 1500 mm above the finished floor level.

Code on Accessibility 2007, Clause 10.5.3.4

 All accessible lift doors should have vision panels of not smaller than 0.05 m² and placed at eye level.

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Code on Accessibility 2007, Clause 3.8.11.1



Example of an accessible lift lobby



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Example of landing call buttons with Braille and tactile marking indicators

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Example of tactile ground surface indicators at a lift lobby

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Mechanical Circulation

Lift Car Provisions

- The lift control buttons should be designed and located for easy access by people of all abilities. They should not prevent any user from having full control of the lift movement.
- ◆ The minimum size of a lift car should be 1200 mm wide by 1400 mm deep.

Code on Accessibility 2007, Clause 5.2.4.1

✤ A visual information display system should have good colour contrast between the wordings and the background to facilitate readability.

Code on Accessibility 2007, Clause 5.1.3.7

All accessible lift interiors should be fitted with at least one mirror. In a crowded lift, the mirror enables a wheelchair user to see the lift location display without having to turn around.



Example of a lift car with a mirror Grab bars should be placed at 800 mm to 900 mm above the finished floor level and be fixed on both sides and at the rear of the lift car to provide support for the aged.

Code on Accessibility 2007, Clause 5.1.4.1

Braille and tactile marking indicators should be provided and placed to the left of or on the lift call and control buttons. Such markings should not be placed below the call and control buttons. Tactile markings should have a minimum dimension of 15 mm to 20 mm, be raised a minimum of 1 mm and have contrasting colour with background.

Code on Accessibility 2007, Clause 5.1.3.2 and 5.1.3.3

The control buttons inside the lift car should be placed at 900 mm to 1200 mm above the finished floor level and may be placed vertically or horizontally or both vertically and horizontally.

Code on Accessibility 2007, Clause 5.2.7.1

 Lift call and control buttons should not be touch-sensitive but may be activated by a light positive pressure.

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Code on Accessibility 2007, Clause 5.1.3.5

Mechanical Circulation



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Interior side elevation of a lift car



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Examples of lift car control buttons with Braille and tactile marking indicators



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Typical dimensions of lift car

Mechanical Circulation

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Escalators

Escalators are efficient in moving large numbers of people. Attention should be paid to ensure safety on escalators as well as the landings. The provision of a buffer area at the landings is recommended for slowermoving passengers and to avoid congestion.

Escalator Provisions

- Escalator width should be specified according to the projected traffic volume.
- Moving handrails should be at a height of 900 mm and be provided on both sides of the escalator.
- The edge of the escalator steps should be clearly differentiated with markings of contrasting colour.
- A minimum of three flat steps at the beginning and end of the escalator run should be provided.
- Escalators should be arranged to facilitate continuous floor-to-floor movement.

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Side elevation of a typical escalator

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Examples of escalators showing yellow markings on steps with three flat steps at the beginning and end of the escalator runs

Mechanical Circulation

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Safety

- Railings around the escalator void should be designed to abut the escalators.
- Additional railings extending from the escalator handrail should be provided at landings to increase the buffer zones in crowded areas.
- Visual and tactile warning indicators should be provided at landings to indicate the presence of an escalator.
- Clear signage should be provided to indicate the direction of escalator movement.
- Headroom warning should be provided under the escalator.
- Additional signage should be provided to discourage the transportation of baby prams, strollers and wheelchairs on escalators.



Example of additional railings extended from the escalator handrail



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Example of headroom warning provided under the escalator



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Example of an escalator with safety provisions

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Mechanical Circulation



Section 6 Sanitary Facilities

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Planning and Design Ambulant Disabled Wheelchair Users Doors Urinals Wash Basins Accessories

Planning and Design

Toilets are necessary provisions that should be included as part of the facilities in public buildings. It is important to place toilets discreetly and yet easily identifiable and accessible.

✤ At least one accessible compartment in both male and female toilets or one accessible common individual washroom should be provided at every level.

Code on Accessibility 2007, Clause 4.1.1

- All corridors leading to accessible toilets should have adequate manoeuvring space for wheelchair access.
- Signage at accessible washroom entrances should be of tactile finish, clearly visible and be of contrasting colour.

Code on Accessibility 2007, Clause 4.1.8a

- Entrance layout, where possible, should be designed without doors and yet able to provide users with privacy.
- All accessible toilets should have non-slip floor finish and be provided with adequate lighting.
- Corridors leading to the accessible compartment within a toilet should be at least 1200 mm wide.

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Toddler seats, where possible, should be provided within every compartment.



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Plan view of different layouts of toilet entrances



Example of a toddler seat provided within a compartment



Example of toilet entrances with signage and tactile ground surface indicators

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Sanitary Facilities

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The Ambulant Disabled

Most standard toilet compartments have minimum dimensions that do not normally serve the ambulant disabled well. Toilet compartments should be designed to cater to the convenience and safety of users with different abilities.

- There should not be any change in the floor level from the area leading to the accessible toilet as well as within the toilet.
- An accessible toilet compartment should have a minimum width of 920 mm and be provided with outward swinging door.
- L-shaped wall-mounted grab bars should be provided on both sides of the water closet at 280 mm to 300 mm above the top of the water closet seat to facilitate usage by the ambulant-disabled.

Code on Accessibility 2007, Clause 4.3.1b



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Example of a ramp provided for change in level from the area leading to the toilet and within the toilet area

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Example of an ambulant disabled toilet compartment with L-shaped wall mounted grab bars

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Sanitary Facilities

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Doors

A door can be the largest obstacle and yet a necessary item in a toilet, especially in the case of a wheelchair-friendly toilet. As such, there is a need to install doors that allows users to open with ease, without impeding other users.

- ✤ A clear opening of at least 900 mm when the door is in its fully opened position is recommended.
- Outward swinging doors should not obstruct circulation paths. If space is limited, a sliding or bi-fold door is recommended.

Code on Accessibility 2007, Clause 3.8.4.2

A horizontal pull-bar of at least 600 mm long should be provided on the inside of an outward-swinging door and be located 130 mm from the hinged-side of the door, fixed at a height between 900 mm and 1100 mm.

Code on Accessibility 2007, Clause 4.2.1c

A vertical or horizontal pull-bar of at least 140 mm long should be provided on the outside, nearer the latch side of the door, and fixed at a height of between 900 mm and 1100 mm.

Code on Accessibility 2007, Clause 4.2.1d

Doors should be capable of being locked from the inside by a device that is easily operable with one hand.

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Code on Accessibility 2007, Clause 4.2.1e



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Example of a wheelchair-friendly washroom with a sliding door



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Example of a wheelchair-friendly washroom with an outward swinging door

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Example of a vertical pull-bar on the outside (nearer the latch side) of the door

Sanitary Facilities

Wheelchair Users

Accessible toilets are meant to cater specially to wheelchair users. Therefore, the design should take into consideration their special needs. The layout of the sanitary equipment and other fittings should facilitate wheelchair users who use them.

The internal clear dimensions of an individual accessible toilet should be at least 1750 mm x 1750 mm.

Code on Accessibility 2007, Clause 4.9.1a

The water closet should be located at 460 mm to 480 mm from the centre line of the water closet to the adjacent wall and have a minimum clear dimension of 750 mm from the front edge of the water closet to the rear wall to facilitate side transfer.

Code on Accessibility 2007, Clause 4.7.1a

The flip-up grab bar mounted on the wide side of the compartment adjacent to the water closet should be 280 mm to 300 mm above the top of the water closet seat. It should extend not more than 100 mm from the front of the water closet seat and be 380 mm to 400 mm from the centre line of the water closet.

Code on Accessibility 2007, Clause 4.3.1d and Clause 4.3.2

One vertical bar is to be provided on the side wall closest to the water closet. If possible, one horizontal grab bar, at least 700 mm long, should also be mounted on the wall behind the water closet.

Code on Accessibility 2007, Clause 4.3.1e and f

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Toilet roll dispensers should be mounted below the grab bars and not more than 300 mm from the front edge of the seat and at 50 mm to 250 mm above the top of the water closet seat.

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Code on Accessibility 2007, Clause 4.10.1f



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Plan view of an accessible toilet

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Sanitary Facilities

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Section of an accessible toilet





Example of an accessible toilet

Sanitary Facilities

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The hand-operated flush control should be located on the transfer side of the water closet.

Code on Accessibility 2007, Clause 4.7.1f

Seats should not be spring-activated.

Code on Accessibility 2007, Clause 4.7.1c

The water closet should have a back support where there is no seat lid or tank. A back support reduces the chance of imbalance or injury caused by leaning against exposed valves or pipes.

Code on Accessibility 2007, Clause 4.7.1d

- ✤ A dispenser of disposable seat covers is recommended.
- The water closet should be preferably of the wall-hung type as it provides additional space at toe level.

Code on Accessibility 2007, Clause 4.7.1e

The hand-operated flush control should be located at a height of between 800 mm and 1100 mm above the finished floor level.

Code on Accessibility 2007, Clause 4.7.1f

The water closet should be equipped with a self-closing water spray head connected by a flexible hose beside the water closet seat for cleaning purposes.

Code on Accessibility 2007, Clause 4.7.1g

If a squatting-type water closet is not provided, a child-sized water closet at 350 mm above the floor should be provided within both the female and male toilets.

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Code on Accessibility 2007, Clause G.3.1.1 and Clause G.3.1.2.1



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Front elevation of an adult-sized water closet of an accessible toilet

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Example of a sensoroperated flush control



Front elevation of a child-sized water closet of an accessible toilet



Example of a child-sized water closet in an accessible toilet

Sanitary Facilities

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Urinals

Besides the provision of standard urinals, there is a need for the installation of vertical grab bars on top of the urinal to assist the ambulant disabled. Urinals for children should also be provided.

Urinals should be of wall-hung type with a rim not more than 400 mm from the floor. There should be an unobstructed minimum floor space of 750 mm wide by 1200 mm deep and no change in levels in front of the urinals.

Code on Accessibility 2007, Clause 4.8.1a and b

 Privacy shields should not extend beyond the front edge of the urinal rim unless they allow a clear width of 750 mm or more.

Code on Accessibility 2007, Clause 4.8.1c

Wall-mounted grab bars with a gap of 120 mm from the walls and at 1000 mm to 1500 mm above the finished floor level should be provided on both sides of the urinal.

Code on Accessibility 2007, Clause 4.8.2

Flush controls should be located not more than 1200 mm above the floor.

Code on Accessibility 2007, Clause 4.8.3

 If a separate child-friendly toilet is not provided, at least one urinal mounted at 400 mm above finished floor level should be provided in the male toilet.

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Code on Accessibility 2007, Clause G.3.1.3.1



Side elevation of a urinal

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Example of a urinal with wallmounted grab bars for adults



Plan view of urinals



Example of a urinal for children

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Sanitary Facilities

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Wash Basins

Wash basins are important components in toilets. They are normally installed outside water closet compartments for the convenience of users. The arrangement should be extended to suit wheelchair users and children alike.

 Wash basins should be of a standard size with dimensions of approximately 520 mm by 410 mm.

Code on Accessibility 2007, Clause 4.6.1a

It should be mounted such that the minimum distance between the centre line of the fixture and the side wall is 460 mm and the top edge is 800 mm to 840 mm above the floor.

Code on Accessibility 2007, Clauses 4.6.1b and 4.6.1c

Wash basins should have a knee space of at least 750 mm wide by 200 mm deep by 680 mm high, with an additional toe space of at least 750 mm wide by 230 mm deep by 230 mm high. It should also have a minimum clear floor space of 750 mm wide by 1200 mm deep, of which a maximum of 480 mm in depth may be under the basin.

Code on Accessibility 2007, Clauses 4.6.1d and 4.6.1e

 Grab bars at 800 mm above the finished floor level should be provided on both sides of the wash basin.
Side elevation of a wash basin with knee and toe clearance space





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Example of a wash basin with grab bars

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Sanitary Facilities

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Hot water pipes and drain pipes located within the knee or toe spaces should be properly insulated for protection.

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Code on Accessibility 2007, Clause 4.6.2

 Faucets and other controls should be sensor operated. If they are hand operated, they should be easily operable with one hand.

Code on Accessibility 2007, Clause 4.6.3

The front apron of a vanity counter should have a minimum clearance of 750 mm wide by 720 mm high.

Code on Accessibility 2007, Clause 4.6.4

 It is recommended to provide at least one child-friendly wash basin of not more than 550 mm high.

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Code on Accessibility 2007, Clause G.3.1.4.1

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Example of a wash basin for children

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Front and side elevation of a wash basin for children

Sanitary Facilities

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Accessories

Toilet accessories are essential components for the functioning of toilets. Therefore they should be installed at appropriate positions to ensure universal usage.

Towel and soap dispensers, hand dryers, waste bins and sanitary bins should be in contrasting colours and tones. They should be positioned such that the operable parts and controls are 1000 mm to 1200 mm above the floor.

Code on Accessibility 2007, Clause 4.4.1b

Accessories should be placed in close proximity to the accessible wash basin so that a wheelchair user does not have to wheel the wheelchair with wet hands.

Code on Accessibility 2007, Clause 4.4.1 Note 1

- All accessories installed should not hinder the main circulation path within the toilet.
- All compartments should be equipped with a coat hook mounted on a side wall not more than 1300 mm above the floor and projecting not more than 40 mm from the wall.

Code on Accessibility 2007, Clause 4.10.1g

✤ At least one compartment should be fitted with a child protection seat.

Code on Accessibility 2007, Clause G.3.2.2

 Half-height mirrors should be positioned at not more than 1000 mm from the bottom edge of the mirror to the floor.

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Code on Accessibility 2007, Clause 4.4.1a

- ✤ An additional body-length mirror should be provided.
- For wheelchair users, a mirror with an inclined angle and positioned above the wash basin should be provided.



Front elevation of a toilet with accessories



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Example of an inclined mirror above the wash basin

Example of a body-length mirror in the toilet

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Sanitary Facilities

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SECTION 7 Indoor Public Facilities

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Family Rooms Supermarkets Shops and Kiosks Information Counter Seating Facilities

Family Rooms

With the increasing number of nursing mothers, special facilities that cater to their needs have become essential in most public buildings. Such facilities should be conveniently located and provide privacy and comfort for the users.

Diaper-changing Stations

 All diaper-changing stations and counters should be positioned 755 mm above the finished floor level.





Examples of diaper-changing stations





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Example of a collapsible diaperchanging station in a family room



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Example of a diaper-changing counter in a family room

Indoor Public Facilities

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Nursing Rooms

✤ A separate nursing area with partitions should be made available to mothers to protect their privacy.

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Code on Accessibility 2007, Clause G.3.3.2.1

 Seats, preferably of the armchair-type, should be provided for the comfort of nursing mothers.

Code on Accessibility 2007, Clause G.3.3.2.3

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The nursing area should be adequately fitted out with a wash-hand basin and a hot water dispenser

Signage

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Signage should be provided to indicate opening hours of the nursing room.

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Example of a nursing room with a partition for privacy

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Example of a nursing room with a sliding door



Example of a family room with opening hours

Supermarkets

Supermarkets tend to be crowded and even cluttered, especially during peak shopping hours. As such, the narrow aisles may be barriers to some users. The design of supermarkets should cater to the convenience of all users, through well-designed routes and signage as well as thoughtful arrangement and layout.

Aisles and Shelves

- An accessible aisle of at least 1800 mm wide should be provided to allow for a wheelchair and a shopping cart to pass in different directions.
- Checkout lanes should have a minimum clear dimension of 900 mm.

Code on Accessibility 2007, Clause 3.7.1.1b

- There should not be any dead-end aisles. If this cannot be avoided, turning points at the end of lanes must be wide enough for a wheelchair to turn around.
- Same product items should be displayed on different reachable shelving levels. Alternatively, a call button should be provided in prominent areas so that assistance can easily be requested.

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Front elevation of a supermarket shelf

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Adequate width provided for aisles

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Counters

Service and paying counters should not be higher than 800 mm.

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Visibility

- ✤ All goods displayed should be visible to all users.
- Signage to products should be clear and of contrasting colour with the background.
- ✤ Adequate lighting should be provided.

Safety

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Floors of wet sections should have non-slip surfaces and be well-drained.

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Example of a paying counter

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Shops and Kiosks

A pleasant shopping experience can be easily ruined by inconsiderate design and planning layout. Shops that try to display as many items as possible often impede the movement of some shoppers. Greater attention should be paid to the circulation in and around shops and kiosks.

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Shops

- Access corridors to shops should be unobstructed.
- There should be no change in levels from the access corridors to the shops. In cases where a change in level is inevitable, a ramp of suitable gradient should be provided.

Kiosks

- Vending machines should be located along accessible routes.
- The clear width of corridors around the kiosks should not be impeded. Refer to Section 3 on Horizontal Circulation (Corridor) and Section 7 on Indoor Public Facilities (Supermarkets) for details on the dimensions of shelves and counters as well as the field of view and signage.

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Section of a shop entrance

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Example of a shop with automated doors

Example of a shop with no change in level

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Information Counters

Information counters provide essential information and customer service. It is therefore important to ensure that they are visible and accessible to all users.

Location

- Information counters should be placed at a prominent location where it is highly visible upon entry. Otherwise, signage should be provided to guide users to the counter.
- Queue zones should not encroach into the circulation path, including the clear width of its adjacent corridor.
- Signage should be clear, easy to understand and of contrasting colour with the background.

Services

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Storage in the form of lockers for prams and other heavy belongings is recommended for shopping centres and clubhouses. Services such as loan of wheelchairs should also be made available.

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Example of an information counter with queue zones

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An example of clear signage

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Counter Tops

Counter tops with two varying heights are recommended. The lower counter (maximum height of 800 mm above the floor) should be provided with adequate knee space for wheelchair users.

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Code on Accessibility 2007, Clause 3.11.3.1

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Front elevation of an information counter

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Example of an information counter

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Seating Facilities

Apart from ease of accessibility, the comfort of users moving along circulation path should also be taken into design consideration.

 Seating should be provided at lobbies and atriums, and along corridors and/or designated areas. Each interval between successive clusters of seats should not exceed 30 m.

Code on Accessibility 2007, Clause 3.7.4.6.1

- The number of seats to be provided should be based on the use and traffic flow.
- Designated sitting areas should be easily accessible and visually linked to the main accessible pathways.
- For safety reasons, seats should be placed away from railings overlooking a void.
- Seats with armrests or grab bars are recommended to assist the elderly get up and out of the seats. The height of the seat should be between 440 mm to 470 mm.

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Code on Accessibility 2007, Clause 3.7.4.6.2

Seating along corridors should not interfere with circulation paths.



Plan view of seating at a designated area visible from the main circulation space



Plan view of recessed seating with wheelchair parking space at intervals



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Plan view of seating along a typical corridor without interference to the circulation path

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Seating placed within a wide corridor



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Seating placed around a pillar



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Seating at an atrium





Examples of seats placed away from railings overlooking a void

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Examples of seats with armrests or grab bars



Outdoor Public Facilities

SECTION 8

Accessible Footpaths Gratings Park and Communal Areas Pavilions Outdoor Seating $(\mathbf{0}$

Accessible Footpaths

In the design of accessible footpaths, it is important to consider the physical dimensions and the safety of users.

- Accessible routes should be provided between a development and the nearest public facilities.
- All main footpaths connecting to facilities within a development should be accessible to all users.
- Floor surfaces of the main accessible footpaths should be stable, firm, slipresistant and durable.

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Plan view of a development with sheltered accessible routes leading to a bus stop



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If the width of the main accessible footpath is 1200 mm, a manoeuvring space of at least 1800 mm by 1800 mm should be provided every 30 m to facilitate the turning of wheelchairs.

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1800 min 1800 m

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Code on Accessibility 2007, Clause A.1.2.3

Plan view of examples of a main accessible footpath with manoeuvring space

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Outdoor Public Facilities

- For the pleasure of the visually impaired, different types of flowers with contrasting colours and tones should be provided along main accessible footpaths.
- Trees with low branches should not be planted along main accessible footpaths to minimize hazards to the visually impaired.
- Adequate lighting should be provided along accessible routes at all times.



Example of a main accessible footpath with different types of flowers in contrasting colours and tones

Gratings

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Where gratings are provided, care should be taken to ensure the safety of all users at all times.

 Gratings should be flushed and be level with the finished floor level to prevent tripping hazards.

Code on Accessibility 2007, Clause 3.6.2.1c

Gratings located on walking surfaces should be located outside accessible routes. If this cannot be avoided, the long dimension should be placed across the dominant direction of travel and the grating gap should be less than 12 mm wide and in one direction.

Code on Accessibility 2007, Clauses 3.6.2.1a and 3.6.2.1b



Example of gratings



Outdoor Public Facilities

Parks and Communal Areas

These areas are set aside for interaction and bonding through recreation. They should be made safe and accessible to all users.

- Entrance gates to such areas should be provided with visual and tactile profile elements.
- For easy identification of park entrances by the visually impaired, different types of flowers of varying fragrances should be planted near the entrances.
- Way-finding cues such as sculptures, fountains and pillars should be used to direct users to accessible routes.



Example of entrance gates provided with visual and tactile profile elements



Example of a park entrance planted with different types of flowers of varying fragrances



Examples of pillars and planter pots used as way-finding cues to direct users

Outdoor Public Facilities

- For the convenience of the visually impaired, Braille and tactile markings should be used on display boards, directional signage, plant information plates, etc.
- The layout of parks and communal areas should be presented both tactilely and visually in the same informational board with standard print, Braille and tactile map, and a push-button audio system for all users.
- Provisions of foot reflexology areas, tai chi areas, light exercise stations and 3G (Three Generation) equipment corners are recommended to encourage exercise, particularly among the elderly.
- Ponds that are elevated above the walking surface are recommended for users to enjoy the multiple, sensory experiences of contact with water and aquatic plants.



Example of relief tiles with Braille and tactile markings on entrance walls



Example of 3G (Three Generation) equipment

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Example of an elevated pond above the walking surface

Outdoor Public Facilities

Planter boxes should be elevated, at a height between 750 mm and 800 mm, with a knee space of between 460 mm and 480 mm deep and a height of between 600 mm and 650 mm, for wheelchair users.

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Section showing an elevated planter box



Example of an elevated planter box
For the safety of the visually impaired, tactile ground surface indicators on footpaths should be located 450 mm to 600 mm away from the planter box.



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Plan view showing the distance between tactile ground surface indicators on a footpath and a planter box



Example of the distance between tactile ground surface indicators on a footpath and a planter box

Outdoor Public Facilities

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Pavilions

In the design of park and communal areas, pavilions should be provided for users to pause and rest, or to seek shelter from the weather.

- It is recommended to locate Pavilions should be strategically located along accessible routes.
- Pavilions should be flushed and be level with the main accessible footpath.
- ✤ A space of at least 900 mm by 1200 mm for wheelchair users is recommended at every pavilion.

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Plan view of a pavilion with space for wheelchair users



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Example of a pavilion with space for wheelchair users

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Outdoor Public Facilities

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Outdoor Seating

Providing sufficient seats is important for users to pause and rest.

✤ A wheelchair space of at least 900 mm by 1200 mm should be provided beside every seat for resting if required.

- Seats should not have protruding corners and edges and should be at locations that do not obstruct the main accessible route.
- Seating should be provided every 30 m for persons with disabilities or special needs to pause and rest.

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Plan view of a seat with space for the wheelchair user



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Example of a seat with space for the wheelchair user



Example of seat location that does not obstruct the main accessible circulation

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Outdoor Public Facilities



Amenities

SECTION 9

Recreational Facilities Children Play Areas Food Courts and Cafés

Recreational Facilities

Recreational facilities such as clubhouses, gymnasiums, swimming pools, sports courts and stadia, and cinemas and theatres that include activities such as sports, leisure and entertainment are to be made accessible to their fullest to cater the needs of all users.

General Provisions

- Public toilets should be centralized or strategically located within reasonable walking distances from the main recreational facilities.
- ✤ At least one accessible toilet and one child-friendly toilet should be provided.
- At least one accessible shower cubicle and one child-friendly shower cubicle should be provided.
- A family room with a diaper-changing station and a nursing room should also be provided.
- Lockers should be provided at designated public toilets. Handles and keyholes of the lockers should not be more than 1200 mm above the finished floor level.

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Front elevation of lockers with handles and keyholes



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Example of lockers with handles and keyholes

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Clubhouses

To promote interaction, community facilities such as KTV rooms, health spas, reading rooms, shops, childcare centres and function halls should be made accessible to all users.

- Accessible seating and social areas should be provided extensively in clubhouses to encourage socializing among all users.
- Where possible, grab bars should be provided near seats to assist the elderly, expectant mothers and people with disabilities in getting up and out of the seats.

Gymnasiums

- Gymnasiums should be made accessible to the elderly and people with disabilities for them to do light exercise.
- Supervision by full-time trained personnel within the gymnasium is recommended.

Swimming Pools

To provide interaction opportunities among all age groups, at least one wading pool should be provided in every swimming pool.

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Example of a function hall made accessible to the elderly and people with disabilities

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Amenities

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Sports Courts and Stadia

- Floor surfaces should be stable, firm, slip-resistant and durable.
- Spectator stands with shelters and designated wheelchair spaces should be provided.
- Adjustable hoops should be provided at courts (e.g. basketball and netball courts). They should be between 2100 mm and 3000 mm above the finished floor level for wheelchair users and young children.

Time-saver Standards for Landscape Architecture Second Edition, 1998, USA, pp. 240–23

Cinemas and Theatres

- There should be handrails for side aisles at 800 mm to 900 mm above the finished floor level. If a cinema or theatre hall has a central aisle, handrails should also be provided where space allows.
- There should be at least two allocated wheelchair spaces for every 200 seats or part thereof. Subsequently, there should be an additional wheelchair space for every 150 seats. Acceptable sight-lines for wheelchair users are also recommended.

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Section showing a basketball court with adjustable hoops

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Example of a basketball court with adjustable hoops

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Amenities

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Children Play Areas

The design of the children play areas should accommodate children of all ages and abilities and, at the same time, provide them with a safe playing environment.

Play Equipment

- Outdoor or indoor play equipment for children of various ages should be provided. The floor surface of the children's play areas should be cushioned or shock-proofed to ensure the safety of children.
- Play equipment should be made of non-toxic materials and have rounded edges.

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- All raised platforms and steps should be fitted with handrails or handholds for children to grab and climb safely.
- There should be enough room at the platforms for wheelchairs to manoeuvre.
- Ramps leading to playground equipment should have handrails. It should also be provided with edge protectors such as kerbs of not less than 75 mm high to prevent wheelchair users from slipping off the sides.
- Transfer platforms are recommended to aid users get onto elevated play equipment.
- All elevated play equipment should be safely connected through accessible components such as tunnels and tubes.
- Play equipment with touch panels or play components with sound should be provided.

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Example of a cushioned and shock-proofed floor surface

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Example of play equipment with rounded edges

Amenities

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Caregiver Supervision

 Barriers should be provided around the playgrounds that are located adjacent to car parks, driveways or potential hazards.

- Enclosed playgrounds should be designed to allow for visual supervision by caregivers.
- To facilitate caregivers to supervise children while resting at the same time, ample seating should be provided near children's play areas.

Code on Accessibility 2007, Clause G.3.5.2

Signage

 Information such as warnings, user age range and play instructions should be displayed prominently.

NOTICE

This playground is for children aged 5 to 12 years old only.

Caregivers are advised to supervise their children/ charge while they are using the playground.

Example of signage showing warnings, user age range and playing instructions

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Examples of ample seating provided near a children's play area

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Food Courts and Cafés

The food and beverage sections are usually major attractions in most buildings. It is important for all food and beverage establishments to be easily accessible by everyone through the provision of appropriate furniture, amenities and clear circulation paths.

Tables and Seats

To provide accessibility to wheelchair users, prams, baby seats, etc., at least three out of every 10 tables or 60 per cent of the seating, whichever is greater, should not be fixed. Adequate baby seats should also be provided.

Code on Accessibility 2007, Clause 7.3.1

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Plan view of different arrangements of tables and seats that are accessible to wheelchair users



Example of an arrangement of table and seats that is accessible to wheelchair users

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Example of an arrangement of table and seats with a baby seat

Amenities

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Circulation

It is recommended to provide clear circulation path of not less than 1200 mm in front of stalls and not less than 900 mm at the dining areas.

Code on Accessibility 2007, Clause 7.2.1 and 7.2.2

Dining areas should be accessible to all. However, if a dining area has a split level of less than one third of the total area, the smaller area need not be accessible to all, though whatever offered in the split-level area should also be available in the main dining area.

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✤ All raised platforms or stages should be made accessible.



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Example of a clear circulation path in front of stalls

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Amenities

Counters

The heights of serving counters and condiment shelves should be not more than 800 mm and 1200 mm, respectively.

At least 50 per cent of all tray shelves must be within reach, with a height of not less than 600 mm.

Facilities

Wash basins should be provided within dining areas, with at least one accessible basin (height of 800 mm to 840 mm above the floor) and one child-friendly basin (height of 550 mm above the floor).

Code on Accessibility 2007, Clause 4.6.1 (c) and G.3.1.4

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Visibility

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- ✤ Adequate lighting should be provided.
- Clear and distinctive signage in contrasting colours with the background should be provided to direct users.

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Safety

Walking surfaces should have non-slip floor finishes.



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Example of accessible and child-friendly wash basins

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Amenities



SECTION 10 Residential Units

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Dwelling Spaces Fittings, Materials and Finishes

Dwelling Spaces

With considerations for the different spaces required by people as they age in place, the design, configuration and furniture layout of dwelling spaces, such as living rooms, bedrooms and kitchens, within residential units that can cater to the fundamental needs of different types of users is essential.

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The Main Entrance

- The difference in levels between the floor of the entrance to the unit and the abutting common area should not be more than 25 mm.
- Tactile or Braille markings on the number of a unit should be mounted on the wall next to the latch-side of the door and at 1500 mm above the finished floor level.
- To cater to the needs of the hearing impaired, visual doorbells with vibration or light indicators in addition to audio doorbells are recommended.

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Front elevation of a unit main door with tactile or Braille markings on the unit numbering

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Example of a unit main door with tactile or Braille markings on the unit numbering

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Residential Units

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The clear opening of a doorway at not less than 800 mm should be measured between the face of the door and the face of the doorstop with the door opened at 90°.

Code on Accessibility 2007, Clause 4.16.2

If a doorway has two independently operated door leaves, at least one active leaf should be not less than 800 mm.

Code on Accessibility 2007, Clause 4.16.2

✤ A clear manoeuvring space of not less than 1250 mm by 1500 mm at the entrance within the unit is recommended.

Code on Accessibility 2007, Clause 4.16.3

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Plan view of a clear manoeuvring space at the entrance within a unit

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Example of a clear manoeuvring space at the entrance within a unit

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Residential Units

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The Living Room

To facilitate wheelchair users and young children, two eye viewers at 1350 mm to 1450 mm high and 750 mm to 850 mm, respectively, above the finished floor level should be provided on the main door.

Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 114

A vertical grab bar of 550 mm to 600 mm in length and at 700 mm to 800 mm above the finished floor level is recommended. It should be located 150 mm to 200 mm away from the main door to provide support for users when opening the door.

Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 116

A wheelchair space of at least 900 mm by 1200 mm facing the TV should be provided in the living room.

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Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 35



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Front elevation of a unit main door with eye viewers for wheelchair users and young children



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Example of a unit main door with eye viewers for wheelchair users and young children

Residential Units



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Front elevation a vertical grab bar provided to support users when opening the unit main door

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Example of a vertical grab bar provided to support users when opening the unit main door





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Plan view of a wheelchair space in the living room



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Example of a wheelchair space in the living room

Residential Units

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Planters should be placed at 600 mm to 1000 mm above the floor so that wheelchair users may also enjoy the plants.

Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 36

The height of windows should be lowered to provide a wider and unobstructed view.

- The lower panel of windows at not more than 1000 mm above the finished floor level should be securely fixed.
- Task lighting at not less than 1500 mm above the finished floor level should be provided in the wheelchair space for reading purposes.

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Thresholds should be flushed or levelled where possible. If this cannot be avoided, they should not exceed 20 mm in height.



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Residential Units

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Side elevation of windows in the living room for wider and unobstructed views



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Example of windows in the living room for wider and unobstructed views


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Front elevation of task lighting in the wheelchair space of the living room

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Example of task lighting in the wheelchair space of the living room

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Residential Units

The Bedroom

An unobstructed accessible path of at least 900 mm wide on at least one side of the bed should be provided to facilitate movement.

Universal Design Guidebook for Residential Development in Hong Kong 2005, p. 32

The height of wardrobes should not be more than 1200 mm above the finished floor level. The lowest drawer inside a wardrobe should not be less than 600 mm high and the clothes rail should not be more than 1000 mm above the finished floor level.

National Standard of Canada, Barrier-Free Design, Clause 10.2.4.12

- Sliding doors in lightweight material are recommended for the wardrobe.
- Two-way light switches at not more than 1200 mm above the finished floor level are highly recommended. One of the light switches should be installed near the bedside table or bed frame while the other should be installed near the bedroom door.



Plan view of an unobstructed accessible path on at least one side of the bed in a bedroom



Front elevation of a wardrobe (in the bedroom) of not more than 1200 mm above the finished floor level

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Example of a wardrobe (in the bedroom) of not more than 1200 mm above the finished floor level

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Front elevation of a wardrobe showing the lowest drawer inside



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Example of the lowest drawer inside the wardrobe



Example of a wardrobe using sliding doors of lightweight material

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Example of a two-way light switch installed near the bedside table or bed frame

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The Kitchen

Magnetic catches are recommended for cabinet doors, fixed D-shaped handles and hidden grooved handles that are flushed with the cabinet door to minimize the risk of catching on clothing or injury from the exposed lever end.

- Magnetic catches for cabinet doors and fixed D-shaped handles for drawers are also recommended for people with impaired dexterity.
- A swivel basket that allows easy access to items placed deep in cabinets is recommended.
- The kitchen tabletop should not be more than 800 mm above the finished floor level.
- The base of each cabinet should be provided with a toe space of 230 mm high and at least 150 mm deep.
- Any full-height kitchen cabinet should be equipped with a counter of not more than 800 mm above the finished floor level.



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Examples of magnetic catches for cabinet doors, fixed D-shaped handles and hidden grooved handles that are flushed with the cabinet door

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Examples of swivel baskets in cabinets



Front and side elevation of a kitchen tabletop showing the height



Side elevation of a cabinet showing the toe space at the base

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Front elevation of a full-height kitchen cabinet with a counter



Example of a full-height kitchen cabinet with a counter

Residential Units

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The bottom of each wall-hung cabinet should be 250 mm to 300 mm deep and installed at 1100 mm to 1200 mm above the finished floor level.

- Knee spaces of 600 mm to 650 mm high and 460 mm to 480 mm deep should be provided under the stove, kitchen sink and food preparation tabletop.
- Mobile cabinets under the kitchen tabletop are recommended to provide more storage space and free up space under the tabletop for knee spaces.
- A flip-up or pull-out food preparation tabletop is recommended for light usage if kitchen space is limited.
- Insulation or other protection should be installed on the underside of the stove where knee space is provided.
- A kitchen sink tap or faucet with a lever handle and a pull-out flexible hose that can be extended to the stove should be provided for easy filling of pots.

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Side elevation of knee spaces provided under the stove, kitchen sink and food preparation tabletop

Side elevation of wall-hung cabinets with the heights shown



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Residential Units

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The Bathroom

✤ A metal plate that permits two-way opening is recommended to be installed at the bathroom door to allow opening in both directions in an emergency.

To allow for future retrofitting for the elderly and wheelchair users, all bathrooms within a unit should have a clear floor space of more than 1750 mm between opposite walls.

Code on Accessibility 2007, Clause 4.9.1a

Easy-to-operate doors such as sliding doors, bi-fold doors and single-leaf sliding doors with a curve track are highly recommended.



Example of a typical two-way bathroom swing door with metal plates that permits two-way opening

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By pressing the metal plate, it allows the bathroom door to swing in opposite direction

✤ A shower head with adjustable heights is recommended. The shower head should also come with a flexible hose of at least 1500 mm long.

- ◆ All bathrooms within a unit should have shower seats with adjustable heights.
- A tap or faucet with a pull-out flexible hose for washing hair at the wash basin is recommended.



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Example of a shower head with adjustable heights



Example of a tap with a pull-out flexible hose at a wash basin

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The Laundry Room

A minimum clear space of 1200 mm by 900 mm wide should be provided in front of the washing machine.

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National Standard of Canada, Barrier-Free Design, Clause 10.1.7

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Plan view of a laundry room with minimum clear space



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Example of a laundry room with minimum clear space

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Residential Units

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Furniture and Layout

- An unobstructed space of at least 1500 mm by 1500 mm within bedrooms, the living room and the dining room should be provided for wheelchairs to manoeuvre.
- Furniture should be stable and sturdy without sharp and protruding corners and edges.

- Furniture with adjustable heights, widths and depths is recommended.
- The clear opening of internal doorways of not less than 850 mm should be measured between the face of the door and the face of the doorstop with the door opened at 90°.

Code on Accessibility 2007, Clause 3.8.2.1

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Example of a TV console unit without protruding corners and edges



Plan view of an unobstructed space within a unit for wheelchairs to manoeuvre

Fittings, Materials and Finishes

When installing fittings, materials and finishes such as switches and sockets, lightings, doors and windows that add to the final physical dimensions of dwelling spaces, the usability of spaces and the safety of all users have to be considered.

Switches and Sockets

- Light switches and sockets should be installed at a comfortable height, between 600 mm and 1200 mm above the finished floor level.
- Easy-touch rocker light switches are highly recommended for the elderly and people with impaired dexterity.
- Two-way light switches are recommended for the control of lighting within comfortable reach.

Lighting

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To ensure adequate illumination, a comfortable lighting LUX (SI unit of illuminance, equivalent to one lumen per m²) level for visibility should be provided according to the table below.

Type of space	LUX level required
Lift lobby	200
Corridor and stairs	200
Unit entrance	200
Living room	500
Dining room	500
Bedroom	300
Kitchen	500
Bathroom	300
Storeroom	150

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Singapore Standard 531:2006, Code of Practice for Lighting of Work Places Part 1 Indoor Lighting, Singapore



Example of a large, easytouch rocker light switch



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Elevation showing the height of light switches and sockets



Example showing the height of light switches and sockets

Residential Units

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Doors

- Sliding doors, which are easier to operate, are recommended if adequate wall space is available.
- Doors with push-pull mechanisms, U-shaped handles or lever handles are recommended to facilitate ease of use as well as to reduce the risk of catching on clothing or injury from the exposed lever.

- Door keyholes should be located between 850 mm and 1000 mm above the finished floor level.
- Semi-automatic doors with activating buttons or keypads are recommended. The top of the activating button or keypad should be located not higher than 1000 mm above the finished floor level.



Example of adequate wall space for sliding doors



Front elevation of a door with a keyhole accessible to a wheelchair user

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Example of a door with a keyhole accessible to a wheelchair user

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Residential Units

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Front elevation of a semi-automatic door with the keypad



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Example of a semi-automatic door with keypad

Windows

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 Crescent locks should be installed at 1200 mm above the finished floor level to minimize the force required in operating casement windows.

- An additional horizontal handle below the crescent lock at 1100 mm above the finished floor level is recommended to provide support for the user.
- Easy-to-operate windows, such as the sliding type, are recommended for the elderly, the ambulant disabled and expectant mothers.



Front elevation of casement windows, showing the height of crescent locks



Example of casement windows

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Front elevation of casement windows, showing the horizontal handles below the crescent locks



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Example casement windows with horizontal handles below the crescent locks

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Front elevation of sliding windows



Example of sliding windows

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Finishes

 All interior floor surfaces should be slipresistant and of colours and tones that contrast with the wall finishes.



Example of a living room with contrasting colours and tones

Vertical Grab Bars

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Grooved patterns should be provided on vertical grab bars to give extra and better grip for the elderly and the ambulant disabled.

Example of a vertical grab bar with grooved patterns

Appliances

Appliances such as stoves with front control knobs, telephones with large buttons, front load washing machines and easy-grip utensils that are easy to operate and safe for use are recommended.



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Appendix List of Useful Contacts

Building and Construction Authority

E-mail: bca_bfa_upgrading@bca.gov.sg Phone: (65) 6325 8611 Website: www.bca.gov.sg

Handicaps Welfare Association

E-mail: hwa@hwa.org.sg Address: 16 Whampoa Drive, Singapore 327725 Phone: (65) 6254 3006 Fax: (65) 6253 7375 Website: www.hwa.org.sg

Society for the Physically Disabled

E-mail: information@spd.org.sg Address: No. 2 Peng Nguan Street, SPD Ability Centre, Singapore 168955 Phone: (65) 6323 2303 Fax: (65) 6323 7008 Website: www.spd.org.sg

Singapore Association of Occupational Therapists

E-mail: info@saot.org.sg Address: Orchard Road P.O. Box 0475, Singapore 912316 Website: www.saot.org.sg

Singapore Physiotherapy Association

E-mail: gpyct@sgh.com.sg Phone: (65) 6326 5281 Fax: (65) 6326 5495 Website: www.physiotherapy.org.sg

Disability Information and Referral Centre (DIRC)

E-mail: dirc@disability.org.sg Address: 1 Tampines Central 5 #08-01/02, CPF Building Singapore 529508 Phone: 1800 347 2222 Fax: (65) 6787 8576 Website: www.thkms.org.sg

Disabled People's Association

E-mail: dpa@dpa.org.sg Address: 25 International Business Park #04-77 German Centre Phone: (65) 6899 1220 Fax: (65) 6899 1232 Website: www.dpa.org.sg

SAVH White Cane Club

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E-mail:jennifer@savh.org.sgAddress:47, Toa Payoh RisePhone:(65) 6251 4331Fax:(65) 6253 7191Website:www.savh.org.sg

Singapore Association for the Deaf (SADeaf)

E-mail: aa@sadeaf.org.sg Address: 227 Mountbatten Road Singapore 397998 Phone: (65) 6473 5866 Fax: (65) 6285 5341 Website: www.sadeaf.org.sg

List of Useful Contacts





Building and Construction Authority

5 Maxwell Road #16–00 Tower Block MND Complex Singapore 069110 Tel: (65) 6325 7720 Website: www.bca.gov.sg

We shape a safe, high quality, sustainable and friendly built environment.