

# HOUSING FOR PERSONS WITH DISABILITIES





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Housing Corporation  
supports the Government  
policy on access to  
information for people  
with disabilities. If you  
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# HOUSING FOR PERSONS WITH DISABILITIES

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# Table of Contents

<b>■ Introduction</b>	<b>1</b>	<b>■ 4 Features Unique to Ground-oriented Housing</b>	<b>39</b>
Foreword	1	Carports, Garages and Parking Spaces	39
Descriptions of Users	2	Garbage and Garden Storage Areas	40
Housing Definitions	3	Entrances	40
Housing Alternatives	4	Laundry	41
Basic Design Principles	5	Workshops and Hobby Areas	41
		Home Elevators and Lifts	41
		Ceiling-mounted Hoists	42
<b>■ 1 Exterior Areas</b>	<b>6</b>	<b>■ 5 Interior Design</b>	<b>43</b>
Site Selection	6	Floor Finishes	43
Site Planning	6	Maintenance of Floors	44
Vehicular Access and Parking	6	Wall Finishes	44
Pedestrian Access	7	Other Considerations	44
Gardens and Landscaped Areas	8	Colour and Pattern	45
Sitting Areas	8	Furnishings	45
Special Features	8		
Children's Play Areas	8	<b>■ 6 Appliances</b>	<b>46</b>
Balconies, Terraces and Decks	9	Ovens and Cooktops	46
Garden Storage and Waste Removal	10	Microwave Ovens	46
		Refrigerators and Freezers	47
		Washers and Dryers	47
<b>■ 2 Interior Public Areas</b>	<b>11</b>	<b>■ 7 Building Systems</b>	<b>48</b>
Basic Guidelines for Multiple-unit Buildings	11	Heating, Ventilation and Air Conditioning	48
Circulation Areas	11	Lighting	49
Ramps	13	Controls	50
Elevators	14	Security Systems	50
Doors	15	Communication Systems	52
Windows	19	Signage Systems	53
Service Facilities	19	Other Technologies	54
Social and Recreational Facilities and Amenities	20		
Washrooms	21	<b>■ Appendix A</b>	<b>55</b>
		Unit Designs	55
<b>■ 3 Living Spaces</b>	<b>22</b>	<b>■ Appendix B</b>	<b>57</b>
Interior Circulation	22	CMHC Resource Information	57
Living and Dining Areas	22	Other Sources of Resource Information	57
Kitchens	23		
Bedrooms	27		
Bathrooms and Washrooms	28		
Other Rooms and Facilities	35		
Doors and Doorways	36		
Windows	37		
Hardware	38		





A well-designed kitchen suits everybody.



# Introduction

■ *Foreword*

■ *Description of Users*

■ *Housing Definitions*

■ *Housing Alternatives*

■ *Basic Design Principles*

## ■ *Foreword*

As long ago as 1976, Canada was instrumental in the formulation of policy statements on human rights at the United Nations Human Settlements Conference in Vancouver. Even before that, CMHC had provided facilities for paraplegic veterans (1946) and, in the late sixties, undertook research for the first edition of *Housing for Disabled Persons*, which was published in 1974.

In the prologue to that first edition, the distinguished Canadian physician and rehabilitation pioneer, Dr. Gustave Gingras, wrote, "Too often, after being prepared at great cost to fill a role in society, the physically and psychologically rehabilitated handicapped are prevented from filling that role; so-called architectural barriers often frustrate the best laid plans for the future. A couple of steps, too narrow an exit, a small room, and the individual becomes a prisoner of the environment."

He also added: "The architect, builder and resident will profit from using this manual. It can also serve as a reference manual for rehabilitation teams: doctors, physiotherapists, work therapists and social workers, for whom one of the most important roles, if not the most important, is to reintegrate the handicapped into the family environment."

The International Year of Disabled Persons, in 1981, followed by the Decade of Disabled in Canada, all served to inspire increased awareness of the issues. As a result, many programs have been developed and various groups have contributed to the *Canadian Human Rights* legislation as well as to various building codes and standards for barrier-free design and construction. Consequently, we now have a wealth of information available on the residential accommodation needs of persons with varying disabilities.

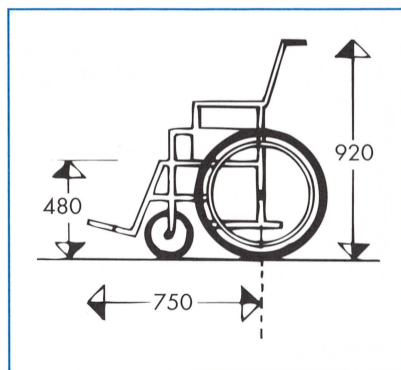
The intent of this publication is to provide supplementary design information that will stimulate appropriate solutions in a broad range of residential accommodation, for persons with single or multiple disabilities. We would like to express our appreciation to the Canadian Standards Association (C.S.A.) for allowing us to use some information and ideas from the C.S.A. *Barrier-Free Design* standards in revising this publication.

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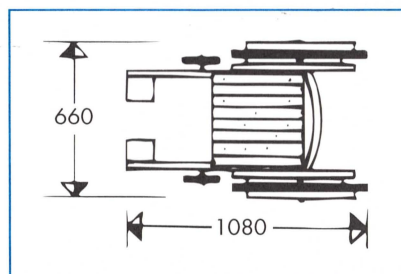


## ■ *Descriptions of Users*

When the United Nations proclaimed 1981 the International Year of Disabled Persons, it was after a lengthy discussion on the uses of the words "handicapped" and "disabled." It was agreed that a disability refers to a person, while a handicap is caused by an obstacle or barrier that obstructs or restricts a person's ability to perform certain activities. Today, the way in which these words are used in the language is undergoing constant change, and, generally, persons with disabilities have expressed their displeasure at being labelled "handicapped" or "disabled." Throughout the text of this document, every attempt has been made to avoid these verbal pitfalls, and "persons with disabilities" has been used to describe people who are "limited" by specific barriers in the built environment.



Side elevation of typical manual wheelchair. Note: Many powered wheelchairs are taller.



Basic floor space requirement for a standard wheelchair. Note: Some chairs are longer with extended footrest.

In order to understand who might be considered as having a disability in residential environments, the following basic "functional" limitations have been considered.

## ■ *Mobility Impaired*

This group includes all persons who because of age, illness or other disabling condition have difficulty in walking or getting around. It includes, but is not limited to, persons using wheelchairs, walkers, canes or motorized scooters, as well as persons who walk slowly or with great difficulty.

## ■ *Visually Impaired*

This group includes persons who have low vision, or have difficulty in discriminating the boundaries of objects, as well as persons who are colour-blind, who perceive light and dark poorly, or who are considered totally blind. Care should be taken to recognize the wide range of impairments in this category and to avoid the assumption that the strategies for one are appropriate to all. For example, those who use braille represent only about three per cent of all people who might be considered visually impaired.

## ■ *Hearing Impaired*

Many people function with limited hearing capacity. For some, the hearing loss is limited to certain portions of the audible frequency range. For others, discriminating audio information is difficult where other background noise exists, such as fans and motors. In all cases, care should be taken to ensure that background noise is minimized and supplementary visual information is provided to offset hearing loss.

### ■ **Co-ordination Impaired**

This category includes persons with arthritis, or spasticity, affecting the use of their hands, as well as persons who have difficulty with hand-eye co-ordination. For this group, the selection of hardware and controls of all kinds is particularly important.

### ■ **Comprehension Impaired**

This functional classification is also significant, as it includes various persons who have developmental disabilities and seniors who are suffering from memory loss or confusion. For such individuals, way-finding, or understanding instructional signage, may be particularly difficult. Therefore, every attempt should be made to ensure that all signage is simple and easy to understand, by using graphics, colours or other cues to the location or use of the space or equipment, wherever possible.

### ■ **Strength and Endurance Impaired**

Many seniors and other adults may have problems with walking long distances, standing for any length of time and climbing stairs. Their abilities may be limited by a variety of conditions such as high blood pressure, a heart condition, asthma and emphysema. Such individuals are strength- and endurance-impaired. Solutions which meet their needs to pause and rest on walkways, long corridors or even working in their own apartment, house or garden should be part of the design solution.

### ■ **Environmentally Hypersensitive**

The number of people affected by airborne particles, noxious fumes or contact with certain materials and finishes is increasing significantly. Designing for people who suffer from environmental hypersensitivity may involve special care in the selection of materials and

finishes used inside the home, as well as in the choice of the heating and ventilation systems and fresh water supply.

While these categories are not all inclusive, they provide an indication of the wide range of disabling conditions that might need to be addressed in creating any built environment.

## ■ ***Housing Definitions***

Like all Canadians, persons with disabilities may prefer to live in specific areas of the country, in housing appropriate to their personal needs or preferences. The majority are housed in typical homes available to everyone. For those with special needs or limitations, the following definitions are suggested by CMHC in referring to housing or dwelling units. These definitions are presented in order of increasing levels of accessibility.

### ■ **Unit with Access for Visitors**

A unit which can be entered by persons with mobility impairments, including those who use wheelchairs, and in which they can enter at least some of the rooms, including a bathroom or washroom. This type of unit is not, however, designed to meet all the needs of an occupant with disabilities but may accommodate visitors with disabilities.

### ■ **Barrier-free and Adaptable Unit**

A unit designed to be easily adaptable to the needs of persons with disabilities. It provides space for manoeuvring a wheelchair to gain access to all rooms, areas and facilities. Electrical receptacles, switches, handles and controls are mounted at heights that allow them to be operated from a standing or seated position. It includes provisions to simplify the installation of grab bars, special cabinets and other customized devices should these be



required to meet the special needs of occupants with particular disabilities, including hearing and visual impairments. In two-storey units, provision may be made for the future installation of an elevator or lift.

#### ■ **Accessible (Custom-designed) Unit**

A unit in which all rooms, areas, facilities and fittings are specially designed for independent use by occupants with a particular type, or types, of disability, including those who use wheelchairs and those with hearing and visual impairments.

### ■ ***Housing Alternatives***

Persons with disabilities should be able to choose from a wide variety of accommodation both in terms of location, type and size of housing, and the degree of specialized design requirements.

Today, the majority of persons with disabilities, like the rest of Canadians, prefer to live in their own homes, either in an apartment or house designed or adapted to meet their needs. Such housing options should be located within well-developed communities offering an array of services. Since people with disabilities may have modest incomes, many live in subsidized housing suited to their economic and personal support needs.

#### ■ **Supportive Living**

Various tenure and support options are available for persons who need personal care or social support. Solutions include group homes and clusters of accessible units integrated into typical residential apartment blocks. The residents frequently receive informal care, or formal care and support services from government agencies or non-profit organizations. In some cases, residents purchase their own care services.

#### ■ **Congregate Living Solutions**

These types of residential units are generally suitable for persons with disabilities who require the mutual support of a closely knit, small group, or who would benefit from an intermediate or transitional living option. Depending upon the disabilities, ages and wishes of the residents, a congregate living option may function as short-term transitional accommodation or as a permanent residence.

#### ■ **Co-ops**

Co-op housing offers people with disabilities the opportunity to join with others who have similar interests and goals in sponsoring, locating, managing and maintaining a housing co-operative.

#### ■ **Single-family Homes**

Finally, there are those persons with disabilities who have the means and desire to build or modify a family house for their own use.

It is becoming evident that designers and developers of housing are likely to find people with disabilities in all forms of housing. This book provides guidance on the design principles and details to be considered in creating appropriate accommodation for a wide variety of persons with disabilities.

## ■ ***Basic Design Principles***

Regardless of the type of functional disabilities to be accommodated, or the housing form provided, certain common principles should be adopted in designing accommodation for persons with disabilities.

1. Within a residential development, all access routes to main entrances from the street, the parking lot, exterior activity areas and other on-site facilities should be accessible to persons with limited mobility or vision.
2. Many people with disabilities rely heavily on personal vehicles or special transit services. Therefore, sufficient appropriate parking spaces and drop-off points should be provided within easy access to the main building entrance.
3. Effective accessibility requires a barrier-free access route and sufficient clear approach space (e.g., 750 mm x 1200 mm) to enable people with disabilities, including those using wheelchairs, to approach and use facilities and equipment.
4. All residents of a building should have access to communal facilities. These include lobbies, offices, social and recreational facilities, mailboxes, laundry rooms, garbage deposit areas, storage areas and indoor garages, where provided.
5. All rooms, spaces and amenities in a dwelling unit should be readily accessible to the occupants. In a dwelling for a person using a wheelchair, space should be provided to permit easy movement and lateral transfer to the toilet, bathtub and bed, and around furniture.
6. The need for supplementary storage within a dwelling unit must be considered for equipment, such as wheelchairs, and supplies.
7. All built-in storage, including cupboards and drawers should be accessible.
8. All controls and hardware should be operable with one hand, as the second hand may be needed to maintain balance.
9. All elements within the unit and building should be selected to minimize bending and reaching, as these may be difficult, exhausting or hazardous for many persons with disabilities. Also, the limited reach of a person using a wheelchair must be considered.
10. All areas of the dwelling should be easy to maintain, since many persons with disabilities are limited in their ability to perform essential household tasks.
11. All communication and emergency warning systems should meet the needs of people with varying disabilities.
12. Potential sources of injury, such as sharp corners, projections that could be hazardous to persons with visual impairments, slippery floors, unprotected hot surfaces and heavily sprung door closers, should be avoided.

The foregoing principles are reflected in the design guidelines presented in this publication.



# 1 Exterior Areas

- *Site Selection*
- *Site Planning*
- *Vehicular Access and Parking*
- *Pedestrian Access*
- *Gardens and Landscaped Areas*
- *Sitting Areas*
- *Special Features*
- *Children's Play Areas*
- *Balconies, Terraces and Decks*
- *Garden Storage and Waste Removal*

## ■ *Site Selection*

Many factors determine the suitability of sites for new or renovated accommodation for people with disabilities. Generally, there should be ready access to shopping and cultural facilities as well as local community services. The land in the immediate neighbourhood should be relatively level. Hilly sites may be difficult for those who use a wheelchair or have other mobility problems.

## ■ *Site Planning*

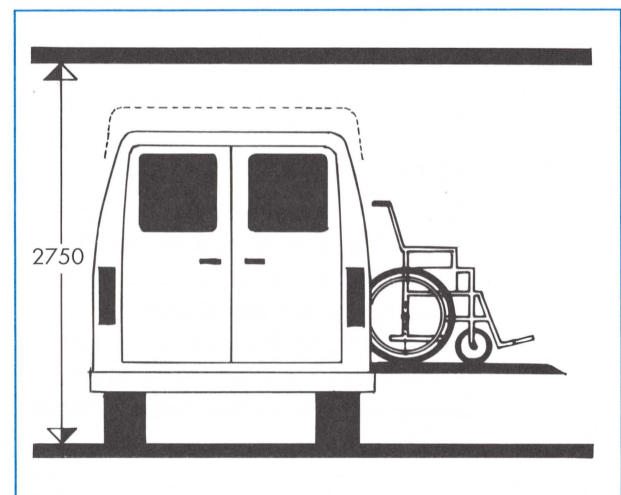
The site layout should be easy to comprehend by persons with limited vision. Access to entrances, parking and other site services and amenities should be clearly evident from all normal approach routes.

Buildings should be oriented to ensure that exterior walking, sitting and activity areas have sunny exposures and are protected from winter winds. Windbreaks, in the form of fencing, trees, shrubs or terraces, may be needed for this purpose.

## ■ *Vehicular Access and Parking*

Approaches to the building should be designed to make it possible for a person with a disability to be dropped off directly in front of a main entrance. Shelter from the elements should be provided and the route to the entrance should be short and direct.

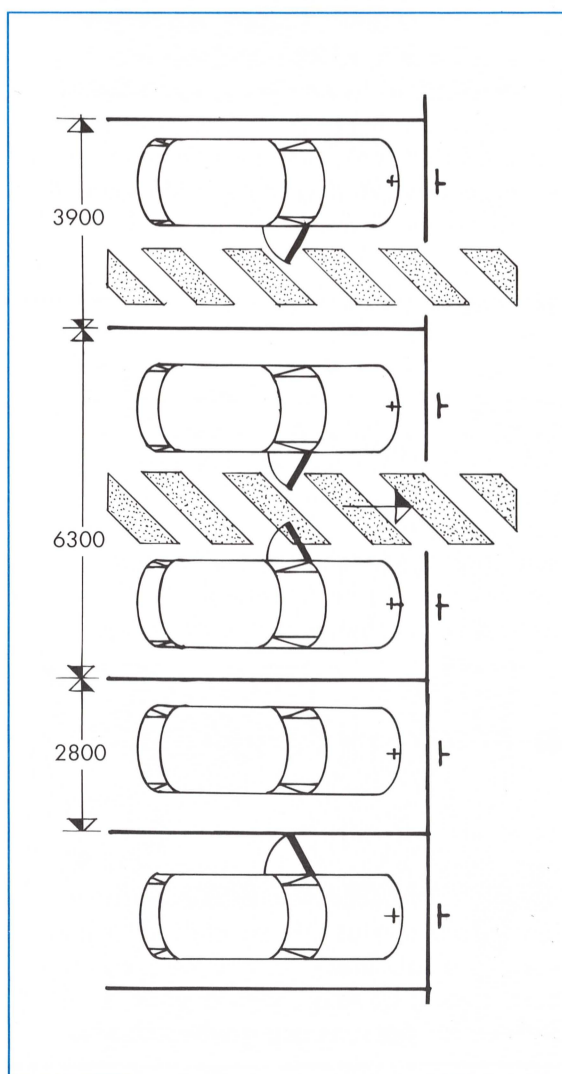
Many persons with disabilities also drive and park their own cars. While outdoor parking is not ideal, it may be unavoidable. However, in parts of the country with severe winter conditions, sheltered parking should be considered. Wherever possible, indoor parking, for both cars and vans, should be included in medium- to large-size apart-



Various van sizes, heights and configurations are used by persons in wheelchairs. Van parking spaces and garages need to be large enough to accommodate either side or rear lifting devices.

ment buildings with elevators. Where indoor parking is provided, accessible parking spaces and routes to these spaces should have a clearance of 2750 mm for vans operated by persons using wheelchairs, with this clear height measured below all beams, pipes and sprinklers.

Designated parking spaces should be located close to an accessible entrance or accessible elevator. These should be linked by an accessible route that does not cross vehicular paths of travel.



Where parking spaces for wheelchair users are side by side, walking aisles may be shared. Where van parking is provided, additional space may be required for vans with side-door lifts.

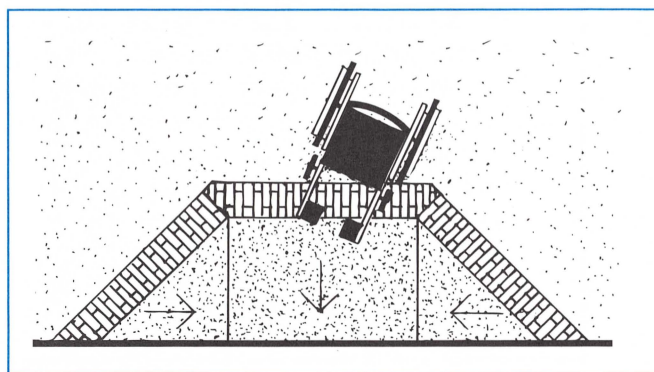
Designated parking spaces for vans should be at least 4600 mm wide to allow side loading into vans. This extra-width space can best be achieved by allocating two standard-width spaces for this purpose. Designated parking spaces for cars should be at least 3900 mm wide and identified with a sign or symbol.

## ■ **Pedestrian Access**

Accessible routes must be provided from the site boundary to the main entrance. All pedestrian routes should be separate from vehicular traffic. Wherever pedestrian routes cross vehicular routes, suitable curb cuts and safe, clearly marked crossing zones should be provided.

Walkways should be at least 1200 mm wide with 1500 mm x 1500 mm spaces, at intervals, to enable wheelchair users to pass or turn around. Cross gradients on walkways should be avoided wherever possible, and no walkway should have a slope greater than 1:20.

Where the link between two levels exceeds a 1:20 slope, it must be designed as a ramp, with nearby stairs for those who prefer them. Ramps and stairs should be designed in accordance with the criteria outlined in Section 2.0 (pages 12 and 13).



Textural changes at curb cuts should be clearly defined and constant throughout the site.



In regions with severe winter weather, exterior ramps should be protected from ice and snow accumulation either by an overhead cover or a built-in snow-melting system. Where these requirements cannot be met, arrangements should be made for thorough and immediate removal of snow and ice.

The surface of paths should be firm and even. Pavers with large joints and crushed stone or gravel paths are not suitable. The edges of pathways should be clearly marked by a contrasting material, texture or colour. Stand-up curbs may also be useful for defining paths and minimizing problems with adjacent sloping areas.

### ■ *Gardens and Landscaped Areas*

Many persons with disabilities, particularly those who are elderly, spend much of their time in and around their dwelling unit. A garden or other outdoor recreation area is desirable to provide opportunities for visual stimulation, fresh air, exercise and perhaps the pursuit of a satisfying hobby.

The garden area should be as level as possible, while ensuring adequate drainage. If it is terraced, pedestrian access to the different levels should comply with the requirements in the previous subsection.

Trees, shrubs and planting areas should be located with sufficient open space around them to facilitate easy movement and use of the garden. Because gardens may be used by persons with visual impairments, prickly and toxic plants, if provided, should be located in areas that are not easily accessible.

Where access is desirable for examining or tending plants, raised planting areas 600 mm to 700 mm high are recommended, particularly for elderly persons or those using

wheelchairs. For persons with visual impairments, fragrant and tactile plants are desirable, as are trees with leaves that flutter in light winds, and therefore provide audible stimulus.

Exterior hose connections should be located 600 mm to 1000 mm above ground and be accessible from a paved area.

### ■ *Sitting Areas*

Sitting areas are recommended in gardens and along pathways at intervals of 30 metres, for those with limited strength and endurance. Seats should be set to one side of paths, and spaces of 1830 mm x 1525 mm deep are recommended to accommodate wheelchairs or scooters. It is important to ensure that both sunny and shaded sitting areas are available, with some protection from the rain and wind.

### ■ *Special Features*

Where special features, such as fountains, pools, birdbaths, feeder stations and bird houses, are provided, these should be easily approachable by persons with disabilities. If facilities such as exterior swimming pools and sun decks are included, they should be designed to be accessible and usable by people with a wide range of disabilities.

### ■ *Children's Play Areas*

Play areas for children should be both accessible and visible from nearby dwellings and recreation areas. All play areas and equipment should be accessible and usable by children with various disabilities. Part of the play area should be level, with a smooth surface for persons using wheelchairs.

## ■ **Balconies, Terraces and Decks**

Many people with disabilities living in apartment buildings may be confined to the building or their individual unit for considerable periods of time. Both communal and private balconies can, therefore, offer a welcome change of air, a chance to see local activity, and a place to grow flowers and enjoy the sun. They may also be desirable as safe holding areas in case of fire.

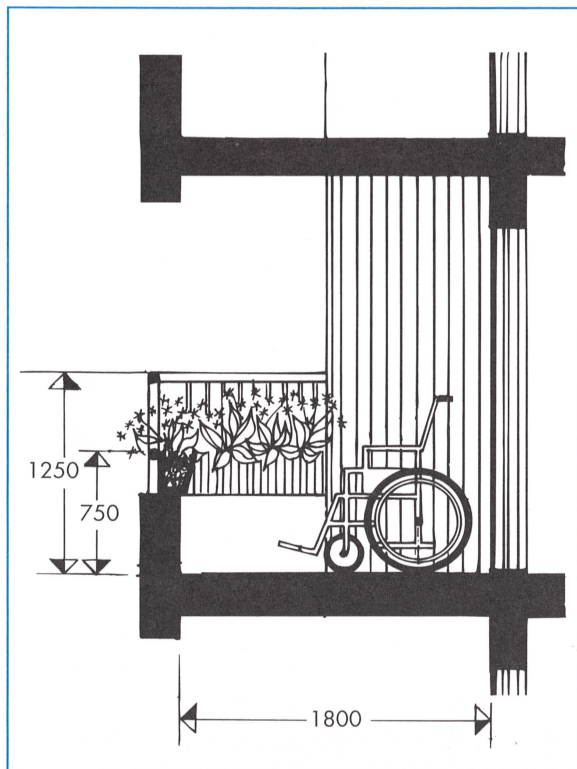
The inclusion of balconies in high-rise buildings has not always been successful. The usefulness of balconies depends on location, height and personal preferences. Today, an enclosed sunroom is one alternative that some people prefer.

Balconies should be designed to ensure physical and psychological security. Such factors are particularly

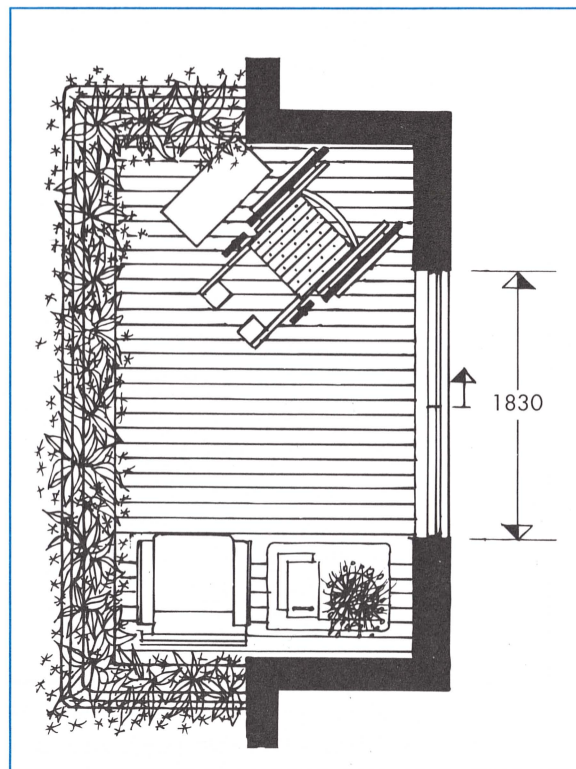
critical in highrise apartment buildings. Semi-recessed balconies are one option which offers a combination of a view, privacy and a sense of safety.

Balconies to be used by persons in wheelchairs should be at least 1800 mm deep. Access to the balcony is impeded if there is a high threshold. A sloped threshold no higher than 19 mm will not restrict access and is sufficient to minimize problems of water penetration. Surface finishes for terraces, balconies or decks should be smooth, non-slip, have minimum joints and be well drained.

Railings or guards should be designed to allow views both outward and downward from a sitting position. Safety standards require an upper rail at a height of about 1250 mm, and spaces between vertical elements must not be more than 100 mm. These should not interfere with the view from



For many persons with disabilities, the balcony offers a view of the community.



Ensure that door access to the balcony does not inhibit furniture arrangements or easy wheelchair access.



a seated position. The top of planters should be no higher than 750 mm if the plants are to be tended from a seated position. As a preventive measure against accidents, such as children passing through or over guardrails, it is recommended that horizontal elements be avoided where these could be used for climbing.

The following basic guidelines are suggested for balcony design:

- protect the users from cold prevailing winds;
- allow maximum sun penetration;
- provide privacy from adjacent balconies;
- provide space for planters and flower pots as well as seating space;
- allow a clear view from a seated position; and
- terraces, balconies and decks should be usable by persons using wheelchairs, canes or other walking aids.

### ■ ***Garden Storage and Waste Removal***

An accessible storage unit for garden tools, outdoor furniture and equipment should be provided in all communal outdoor recreation and play areas. Exterior waste containers should be located to one side of public walkways, and be easy to use.

# 2 *Interior Public Areas*

- *Basic Guidelines for Multiple-unit Buildings*
- *Circulation Areas*
- *Ramps*
- *Elevators*
- *Doors*
- *Windows*
- *Service Facilities*
- *Social and Recreational Facilities and Amenities*
- *Washrooms*

## ■ *Basic Guidelines for Multiple-unit Buildings*

At relatively low cost, apartment buildings can be constructed or modified to permit access and use by persons with various disabilities. The design guidelines outlined in this section will allow most persons who have visual, hearing or mobility impairments, including those using wheelchairs, to enter and move around the building safely, and live in the apartment units in reasonable comfort.

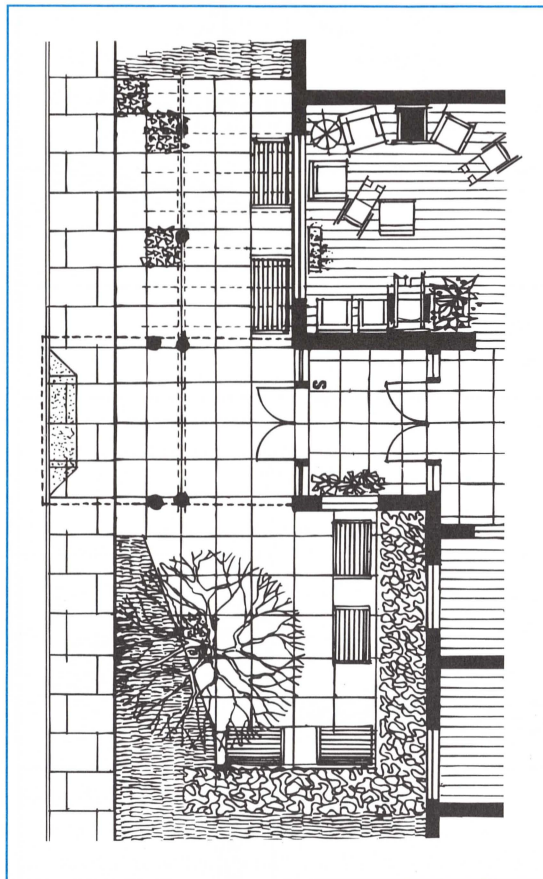
These guidelines are most easily applied to all types of apartment buildings served by elevators. Even walk-up buildings can be designed so that at least the ground floor is accessible to wheelchair users, with other floors accessible to persons with other disabilities.

## ■ *Circulation Areas*

### ■ *Building Entrances and Vestibules*

An exterior level paved area at least 1500 mm x 1500 mm, sheltered by a roof or canopy, should be provided at building entrances to facilitate access by persons with disabilities. Entrance doors should provide a minimum clear opening of 810 mm, however, an 860-mm door opening is recommended to minimize damage to door frames by wheelchairs and to facilitate the movement of furniture and appliances.

Automatic sliding doors with speed control are ideal, but swing doors that are easy to open and slow to close are also satisfactory.



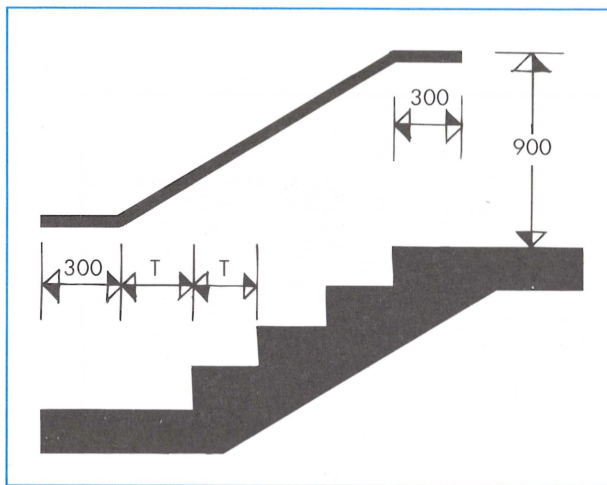
Main entrance areas can be busy, attractive places for casual observation and conversation. Some sheltered seating or waiting areas will enhance their use.



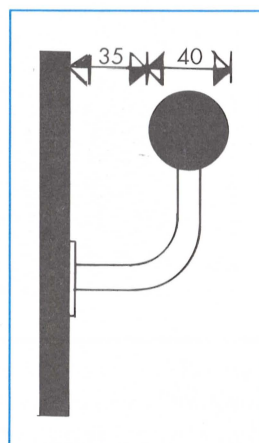
Where doors swing into a path of travel, protective guardrails should be provided at a cane-detectable height to alert persons who have visual impairments.

All entrance doors should be easy to distinguish from adjacent wall surfaces. Glass doors and any adjacent or nearby glass walls should have suitable safety markings on the glass at or just below eye-level.

(Refer to pages 15-18 for further guidelines on doors, hardware and wheelchair access at doors.)



Handrails should extend as shown beyond both top and bottom risers to provide adequate warning to visually impaired persons.



Handrail sections should be easy to grasp, and knuckles should be kept away from the wall surface.

## ■ Public Corridors

Public corridors should be at least 1200 mm wide. Where corridors are over 10 m long, turning areas of 1500 mm x 1500 mm should be provided to allow a wheelchair user to turn around easily. These wider sections may be provided at suite entrances.

Where changes in level are unavoidable, both stairs and ramps should be provided, as not all persons with disabilities prefer, or need, to use ramps.

It is also wise to use corner guards and high baseboards, or other wall protection, where wheelchairs travel close to walls.

## ■ Public Stairs

Stairways should consist of short, straight flights, with a minimum of three risers and a maximum of 12 risers per run. Risers should preferably have plain faces. Where nosings are included they should project no more than 38 mm and must not have sharp or abrupt angles that prevent the foot sliding up the riser. Open risers are hazardous and should not be used.

A flight of stairs should have uniform riser heights and tread depths. Risers should be not more than 180 mm high and treads should be not more than 280 mm deep (measured from riser to riser).

Treads should be slip resistant with either an abrasive surface or inset abrasive strips. Nosings of contrasting colour should be used over carpeting. For other stair finishes, treads and risers should contrast in colour to ensure visual clarity in ascending or descending.

Handrails should be provided on both sides of stairs at a height of between 800 mm and 920 mm above the nosing. If the building is to accommodate elderly persons, a height of 860 mm is preferred. Handrails

should extend at least 300 mm, plus the depth of a tread, beyond the bottom riser in a flight and at least 300 mm beyond the top riser. Handrails should be continuous around landings. Tubular or oval handrails, with a diameter of 30 mm to 40 mm, are recommended to provide a comfortable grip. Endings of handrails should turn inwards or downwards to alert persons with visual impairment and to avoid catching clothing.

## ■ Ramps

### ■ Public Ramps

Where a slope steeper than 1:20 is required to accommodate unavoidable level changes, it must be designed as a ramp.

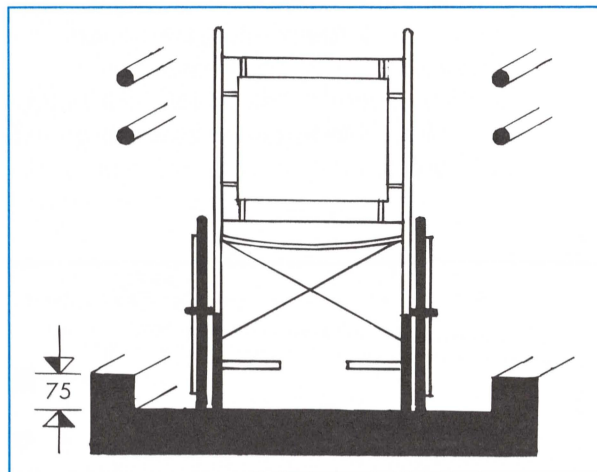
Ramp slopes no steeper than 1:12 may be used for a maximum length of 9000 mm between landings. If steeper ramps are required in some interior renovations, they must be no steeper than 1:10 or longer than 1830 mm.

An upstand of curb 75 mm high, or a guardrail mounted at a height of 200 mm, should be provided at each side of the ramp to prevent wheelchairs from slipping over the edge.

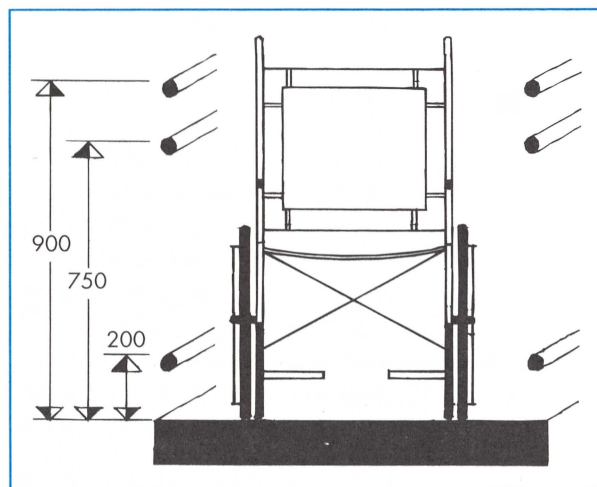
Ramps should have level landings at the top and bottom of each run, where the ramp changes direction, and at intervals of 9000 mm in the length. Ramp landings should be at least 1500 mm long by the full width of the ramp. Landings should have a minimum clear area of 600 mm x 1500 mm free of door swings.

Ramps should have slip-resistant surfaces. The junction between a ramp and the landing should provide a smooth transition. Tactile strips or a different texture should be used to identify the bottom and top of a ramp so that persons with visual impairments are alerted to the change in slope.

Ramps should be equipped with handrails on either side to provide support for ambulatory and semiambulatory persons and those using wheelchairs. Two sets of handrails are recommended: one mounted at 900 mm, and the other at 750 mm, above the ramp's surface.



An upstand curb is also suitable to retain wheelchair

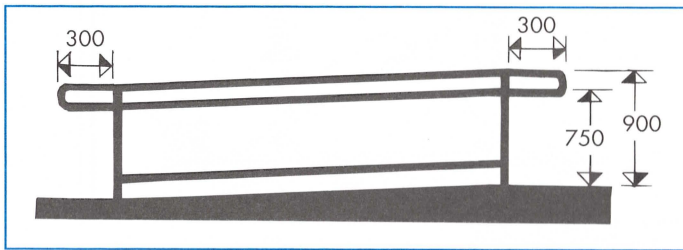


Ramp handrails at two levels provide support for people who are standing or in wheelchairs. A lower rail prevents a wheelchair's small front wheels from tipping over the edge of the ramp.



Handrails should extend a minimum of 300 mm beyond the end of the ramp. Tubular or oval handrails, with a diameter of 30 mm to 40 mm, are recommended to provide a comfortable grip.

Generally, an unobstructed width of at least 920 mm should be provided between the handrails on a ramp. In cases where ramps must be steeper than 1:12, the space between handrails should be between 850 mm and 1015 mm to allow a person to use both hands.



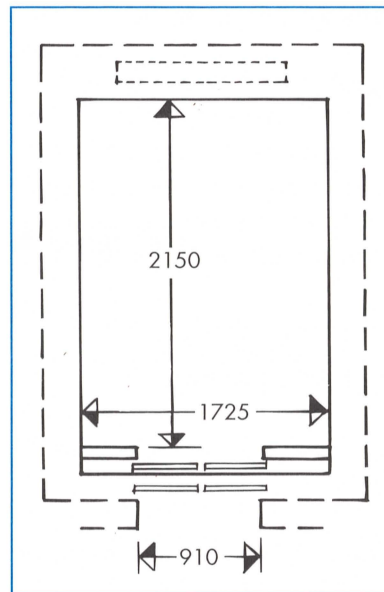
Handrails must extend beyond the top and bottom edge of the ramp.

## ■ Elevators

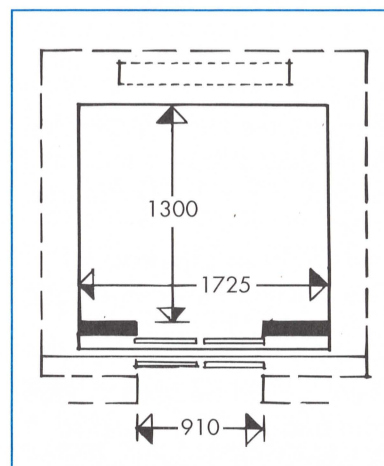
Elevators are essential in buildings with two or more floors intended to accommodate persons in wheelchairs. These elevators must be designed so that all people with disabilities, including those with visual and hearing impairments, can operate them conveniently and safely. Safety and reliability are more important than speed. At least one elevator should be designed as a fire-fighter's elevator.

Elevator installations must comply with local code requirements. For buildings designed to accommodate people with disabilities, reference should also be made to CSA B44-M90 *Safety Code for Elevators*, CSA B355-M93 *Lifts for Persons with Physical Disabilities* and CSA B613-M87 *Elevating Devices for the Handicapped in Private Residences*.

In larger buildings, at least one elevator should have an interior cab size of approximately 1500 mm x 2150 mm to accommodate a wheelchair or furniture. There should also be access to a secondary building entrance from this elevator. Cabs in other elevators should be a minimum of 1300 mm deep. Handrails should be provided



At least one elevator should be capable of accommodating a person in a stretcher.

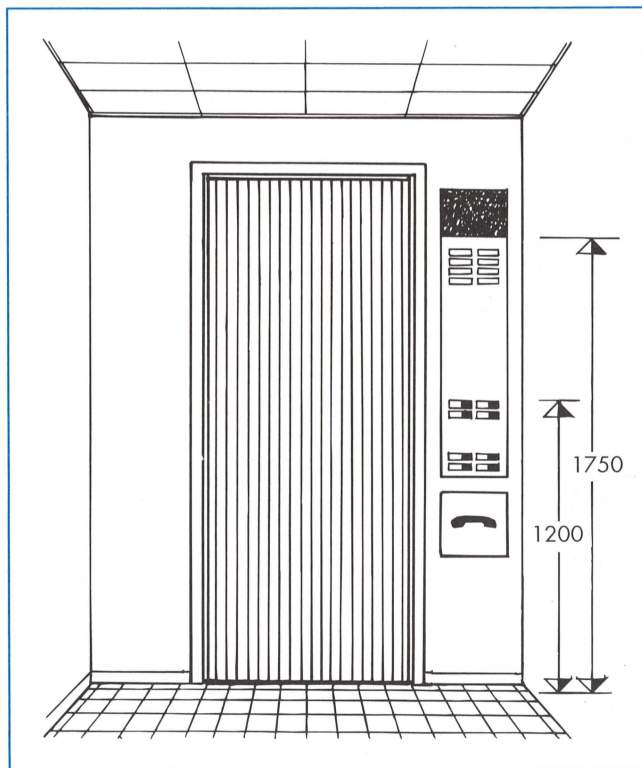


Smaller elevators should accommodate at least one person in a wheelchair plus one other passenger.

on three sides of the cab at a height of between 800 mm and 920 mm. The minimum clear door opening should be 910 mm.

Elevator doors should remain open for at least five seconds and should close slowly to allow extra time for people with disabilities. Elevator equipment should, therefore, allow regulation of the speed of the elevator, the time the door remains open and the door-closing speed. A quick-response photoelectric sensor on the entrance jambs and rubber bumper guards are also recommended.

In elevator lobbies, call buttons should be located not more than 1200 mm above the floor. There should be both audible and visual signals of cab arrival. Floor levels should be indicated by raised numbers mounted at eye level on the door jambs.



All controls must be within reach of persons in wheelchairs. In large elevators, control panels on either side of the door are useful.

Control buttons inside the cab must be located not more than 1400 mm above the floor. The control panel is best located on the side wall of the cab, preferably mounted at least 400 mm from any corner. Ideally, control panels should be provided on both side walls. Floor numbers on the panel should be raised and braille should also be provided, so that the controls can be identified by touch.

There should be both audible and visual signals identifying cab location. Emergency systems should include an alarm bell and a voice intercom system connected to a monitoring station.

Lighting levels in elevator cabs and in the adjacent lobbies should be at least 100 lux measured at floor level.

## ■ Doors

### ■ Doors in Public Areas

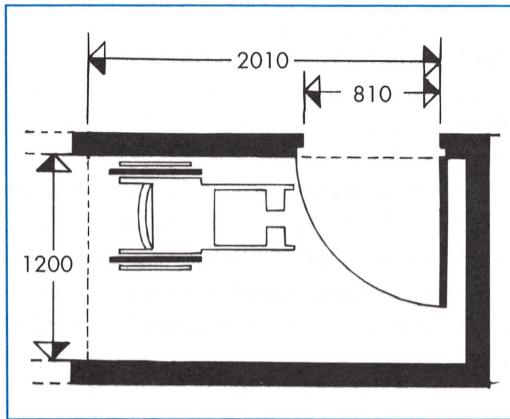
For doors in common access or egress routes, door closers are generally required for smoke control and fire safety. The closing period (of door closers) should be adjusted so that from an open position of 90°, the door will take not less than 3 seconds to move to a semi-closed position of approximately 12°.

The maximum force for pushing or pulling open a hinged door shall be 38N for an exterior door and 22N for an interior door. Since the exterior doors can seldom meet these force requirements, there should be a power-assisted or automated door at the main entrance to a residential building.

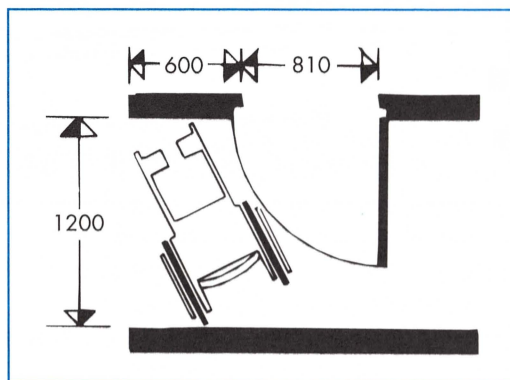
### ■ Automatic Doors and Power-assisted Doors

Where automated doors swing into a path of travel, it is desirable to have guardrails at a cane-detectable height, placed at right angles to the wall containing the door, and close to the door swing area, to minimize hazards for persons with visual impairments.





Where wheelchair users must approach doors at right angles to the direction of travel, corridor widths should be at least 1200 mm; alternatively, the doorway itself can be increased to 915 mm.



Adequate clearance of at least 600 mm should be provided on the latch side of the door.

Sliding automatic doors do not need guardrails for protection and are more convenient for persons in wheelchairs as well as for people with visual impairments. However, some people with severe visual impairment have cautioned that there may be a hazardous situation if they pass through an automated door without knowing it. Although textural, visual and audible warning signals have been recommended, there is no generally accepted standard at this time.

Activating devices for automated and power-assisted doors come in many forms and may include push buttons, push plates, infrared or light-beam electronic sensors, radio signals, and pressure-sensitive floor mats. Floor mats require proper maintenance and should be used only where they are well protected from ice, snow, water and mud.

Push plate actuators are preferred over push buttons for operating power-assisted doors. Actuators should be operable by a closed fist. Push buttons should be at least 20 mm in diameter and should be recessed or raised. Buttons or push plates should be located clear of a door swing. The preferred location is on the latch side, not more than 1800 mm from the latch edge of the closed door. Only where there is a clear space of at least 600 mm beside the latch side of a door should the button or plate be on the door jamb, otherwise the door swing may interfere with wheelchair manoeuvring.

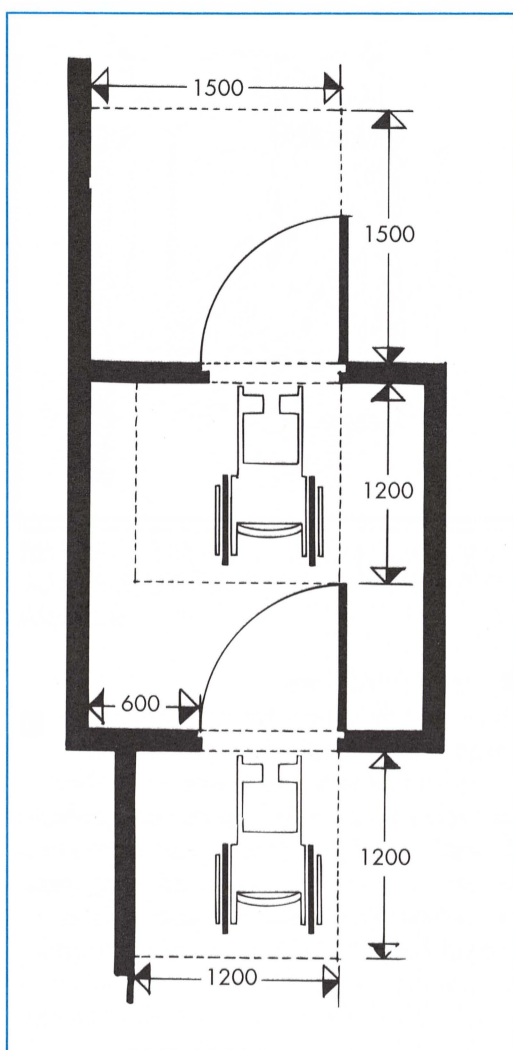
### ■ Wheelchair Access

There must be adequate manoeuvring space for wheelchairs on both sides of a doorway and a clear space beside the latch edge of the door. Space requirements depend on the type of door, the way in which it is approached and whether it opens into a confined space, such as a vestibule.

Table 1 contains the minimum space requirements for **hinged doors that are approached from the front**.

**Table 1**

	Floor Space (mm)		Space beside Latch (mm)
	Depth	Width	
Pull side	1500	1500	600
Push side	1200	1200	300

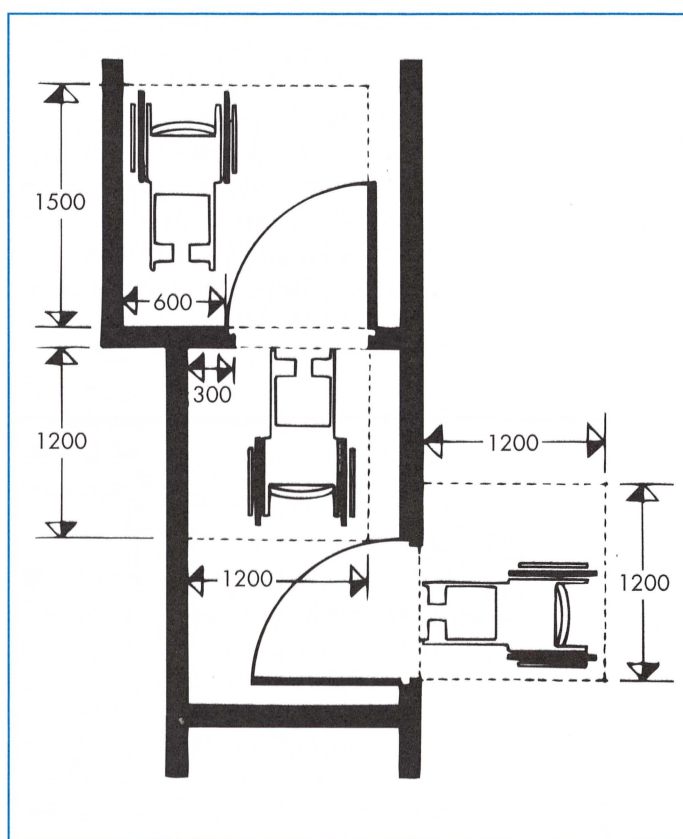


Vestibule and corridor doors often occur in series. Care should be taken to ensure that necessary approach clearances are always provided.

Table 2 contains the minimum space requirements for **hinged doors that are approached from the side**.

**Table 2**

	Floor Space (mm)		Space beside Latch (mm)
	Depth	Width	
<b>Latch side approach:</b>			
- pull side	1200	1500	600
- push side	1050	1500	600
<b>Hinge side approach:</b>			
- pull side	1500	1200	600
- push side	1050	1350	450



Where access to vestibules and corridors can be achieved only by turning through 90°, ensure that sufficient wheelchair standing space is provided clear of all door swings.

Table 3 shows the minimum space requirements for **sliding doors**.

**Table 3**

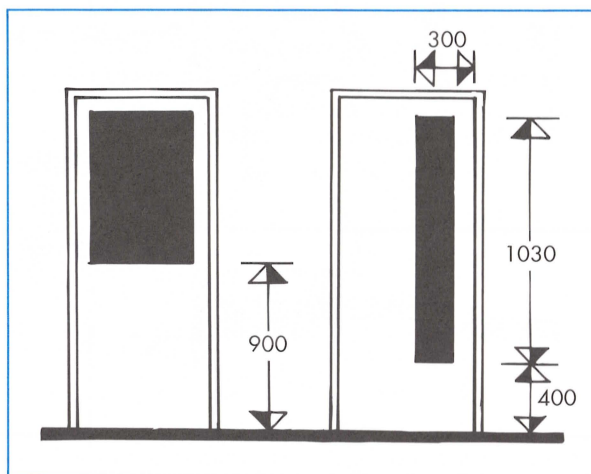
	Floor Space (mm)		Space beside Latch (mm)
	Depth	Width	
Front approach	1200	900	50
Side approach	1050	1350	540

Doors and doorways must provide a minimum door opening of 810 mm to permit clear passage of a wheelchair. Where it is not possible to meet the foregoing manoeuvring requirements for hinged doors approached from the side, the minimum clear door opening should be increased to 860 mm.

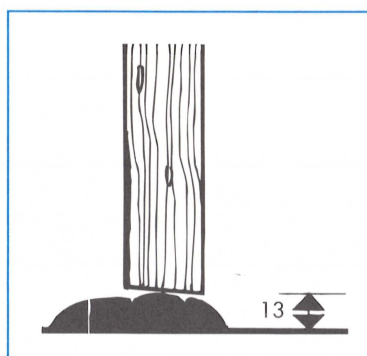


Wherever possible, thresholds should be avoided. Where they must be provided, they should have a low profile, with bevelled edges, and should not exceed 13 mm in height.

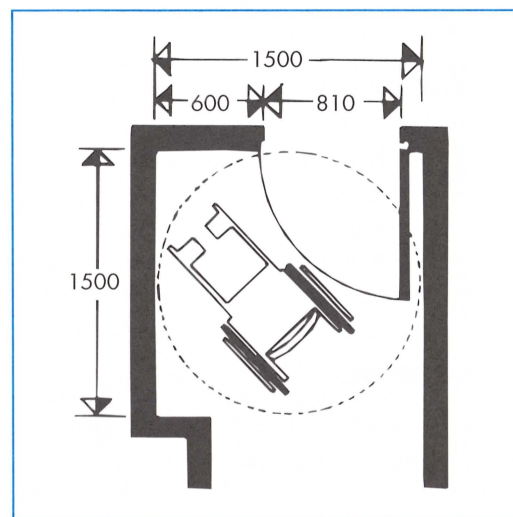
If a glazed observation panel is incorporated in a door, it should extend low enough (900 mm to 1000 mm above the floor) to permit persons in wheelchairs to see through.



Vision panels in doors provide a view of what, or who, is on the far side of the door. For slow-moving persons, this information is critical.



All interior thresholds, including those with different flooring materials on either side, should not exceed 13 mm in height.



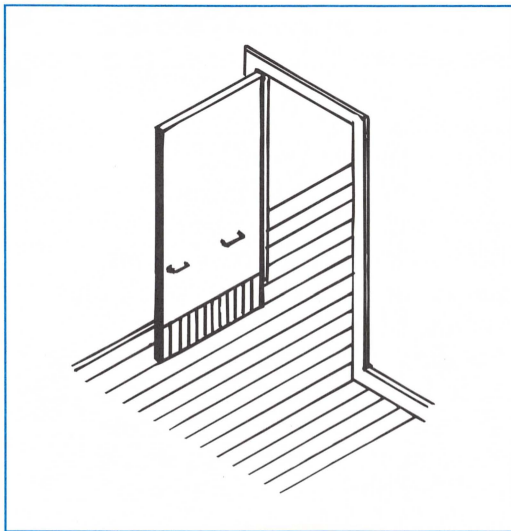
In entrance ways or halls, ensure that sufficient space is provided for turning the wheelchair.

#### ■ Door Hardware

Door handles must be easy to grasp. Large lever handles are preferable. Such handles should be angled or turned inward at the open end so that they do not catch clothing or cause injury. Where door pulls are required, easy-to-grasp D- or lever-type pulls should be used. The mounting height for handles, pulls, latches and locks should be 750 mm to 900 mm above the floor.

To make it possible for a person in a wheelchair to close an outswinging door from the inside, an auxiliary pull handle may be provided. It should be located about 180 mm from the hinged side, at the same height as the door hardware.

Kickplates, 250 mm high, are recommended on all doors in high-use areas to protect both sides of doors from damage caused by wheelchair footrests and to make it easier for persons in wheelchairs to open doors.



The extra pull handle on the hinge side of the door allows a wheelchair user to close the door easily.

### ■ **Windows**

In selecting windows for public and recreational areas, care should be taken to ensure that both the sill height and operating hardware are suitable for and reachable by people using wheelchairs. In particular, the operation and location of the opening sections of windows must be safe and convenient for persons with disabilities. (Refer to pages 37 and 38 for further guidelines on windows and window hardware.)

### ■ **Service Facilities**

#### ■ **Garbage Chutes and Laundry Rooms**

Certain service facilities, such as a garbage chute and a laundry room, are normally provided in residential buildings. Special consideration should be given to the design of these facilities to permit access and use by persons with disabilities.

Garbage chutes should be easily accessible to persons in wheelchairs. Where a chute is located in a separate room, a minimum area – 600 mm x 1500 mm – should be provided clear of the swing of the door. The handle

of the chute should be reachable from a seated position and easily operable with one hand.

Central laundry rooms require generous floor space to allow easy movement of wheelchairs. Consideration should be given to providing more than one laundry room in highrise apartments to provide more convenient access and use.

Washers and dryers with side-hinged, front-loading doors are desirable for easy access, and controls should be reachable and easy to manipulate (see also Section 6, Appliances).

#### ■ **Central Storage Areas and Lockers**

Central storage areas for tenants, including lockers, should be in accessible locations. Some individual lockers should be usable by persons in wheelchairs. Adjustable shelving is desirable in all storage areas used by tenants, including bulk, recreational and garden storage areas (see also page 35 for storage in dwelling units).

#### ■ **Office and Support Staff Space**

Office space for management and maintenance personnel, as well as personal-care providers, may be required in some buildings. Such spaces should be fully accessible to persons with disabilities and have internal communication links for access by occupants. A good location is close to the main entrance lobby.

#### ■ **Mailboxes**

Where mailboxes are provided, a proportion of boxes should be reachable from a seated position. Mailbox numbering and keys should be suitable for use by both visually and co-ordination-impaired persons. Several large boxes should be provided to facilitate delivery of braille publications.

#### ■ **Communication Systems**

Intercom systems and public telephones are dealt with on page 52.



## ■ ***Social and Recreational Facilities and Amenities***

It is important to consider the types of social and recreational facilities and amenities that should be provided in buildings intended for use by persons with disabilities. These should be designed to provide both accessibility and convenient use for persons using a wheelchair, as well as for persons with visual, hearing or other impairments.

The types of facilities or amenities provided will depend upon the size of the building and the proportion of persons with disabilities amongst the occupants. In the case of a small group residence designed exclusively for people with disabilities, only a few facilities or amenities may be provided. Where persons with disabilities are living in larger integrated settings, a wide range of facilities and amenities could be considered.

In some residential buildings, particularly sheltered or congregate housing projects, a **central dining room** or **snack area** may be provided. The design should permit easy access to the food serving or dispensing areas, as well as to seating areas. An **out-door dining area** with level access should also be considered.

**Lounges, sitting areas, multipurpose rooms, party rooms, meeting rooms** and other recreational spaces may be desirable to accommodate a wide range of activities. Since the ways in which residents will use these spaces cannot easily be predicted by the architect, it is wise to ensure that any such spaces can accommodate a variety of activities. Generous storage space is an essential component of any social or recreational facility.

In some apartment buildings, small **sitting rooms** may be useful in addition to the main lounge. These rooms should be located close to high activity areas wherever possible.

It should be recognized that people with disabilities are potential users of facilities such as **exercise rooms, games rooms, swimming pools** and **saunas**, as well as the associated **changing rooms, showers** and **lockers**. These facilities must, therefore, provide sufficient space to accommodate wheelchairs. Bench seats should be provided at a height of 450 mm and should be fixed to a wall. Special equipment for entering and leaving a **swimming pool** may also be required: for example, a chute or a mechanical lift in addition to shallow steps or a portable ramp. Where such equipment is likely to be required, it is best to consult with knowledgeable suppliers, as well as occupants who have disabilities, to ensure that any equipment selected is appropriate and safe in use, and that required construction details can be accommodated.

Other facilities that promote interaction between persons with disabilities and other residents may also be desirable. An example is a **shop** or **store** on the ground floor of the building with access both from within the building and from the street.

An accessible **roof garden, solarium** or **green house** may also be desirable to allow people who enjoy this kind of environment and the cultivation of plants or flowers to experience this year round.

## ■ Washrooms

### ■ Public Washrooms

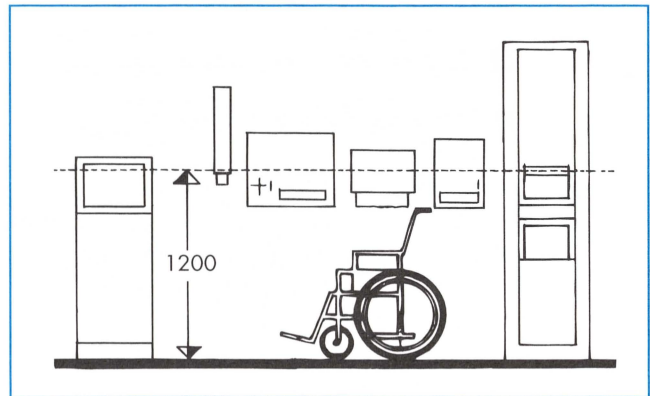
Accessible washrooms should be located close to recreational facilities and lounges. Where provided, these facilities should be designed in accordance with the National Building Code or CSA Guidelines.

Where separate washrooms are provided for men and women, there shall be at least one accessible toilet stall for each sex, with a floor area of 1500 mm x 1500 mm and an outswinging door. Where possible, it is also desirable to include a wash-basin in accessible toilet stalls. For persons with disabilities, an accessible two-piece, unisex washroom may be provided as an alternative to separate male and female washrooms.

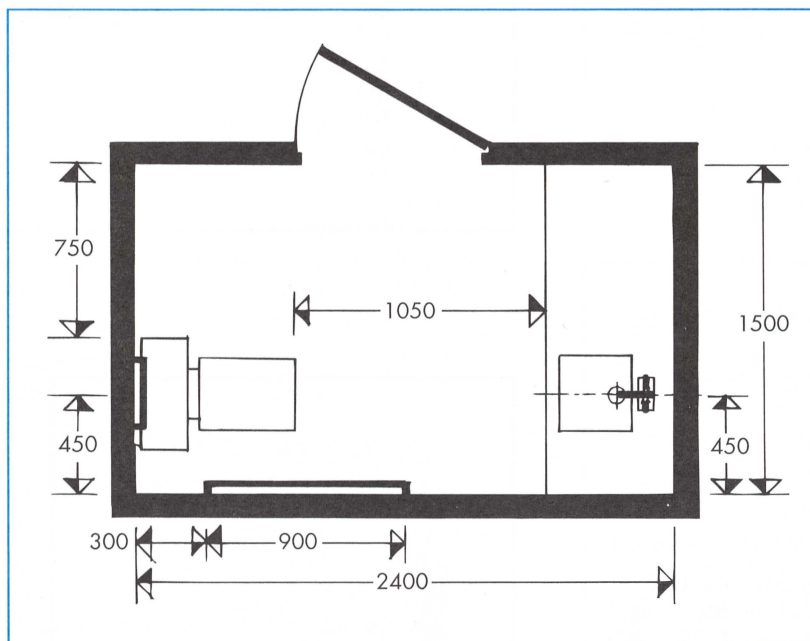
The doors to public washrooms and accessible toilet stalls should provide at least 810 mm clearance.

Toilets should be provided with a lid or a permanent backrest. Grab bars should be provided on one side and at the back. There should be a nearby shelf for supplies and an accessible coat hook.

Where urinals are provided, they should be floor mounted, with no step.



All accessories in public washrooms should have controls or operating components within easy reach of wheelchair users.



In two-piece or unisex washrooms, sufficient space should be provided to allow a frontal or lateral transfer onto the toilet.



# 3 *Living Spaces*

- *Interior Circulation*
- *Living and Dining Areas*
- *Kitchens*
- *Bedrooms*
- *Bathrooms and Washrooms*
- *Other Rooms and Facilities*
- *Doors and Doorways*
- *Windows*
- *Hardware*

## ■ *Interior Circulation*

### ■ *Entrance Halls and Internal Corridors*

An entry hall at least 1500 mm x 1500 mm should be provided. This will allow easy access by persons using wheelchairs, as well as space for removing outdoor clothing.

Entry doors should provide a minimum clear opening of 810 mm. However, an 860 mm clear opening is recommended to minimize damage to door frames by wheelchairs. Peep holes should be located at both 1500 mm and 1065 mm above the floor to allow persons using wheelchairs to view who is outside.

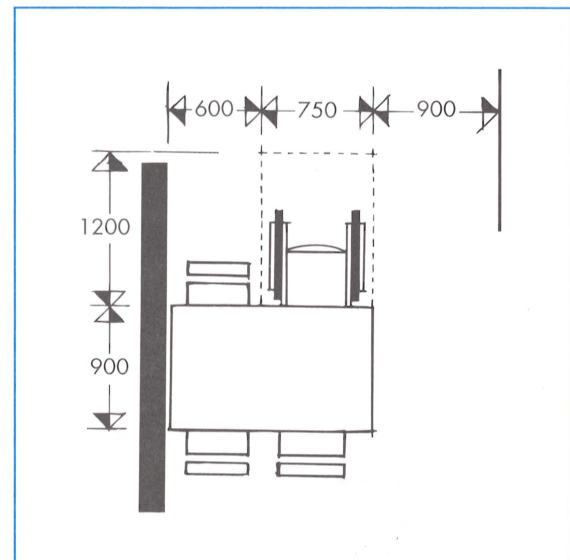
Internal corridors should be at least 920 mm wide, except where they must be wider to meet the requirements for wheelchair access at doors, as described on page 16.

### ■ *Living and Dining Areas*

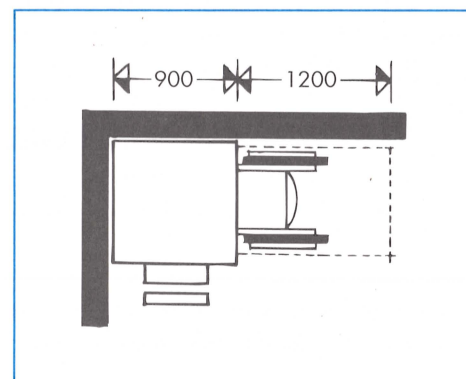
Living rooms and dining areas should be large enough to permit easy manoeuvring and "parking" for a wheelchair, in addition to providing space for normal furnishings.

The floor space in the dining area should allow clearance of 900 mm between walls and furniture for wheelchair circulation. An area of 750 mm x 1200 mm should be provided at the table for at least one person using a wheelchair. If there is a separate dining area, it should be directly accessible from the kitchen.

A pass-through, level with the kitchen counter, is desirable between the two rooms.



In dining rooms or breakfast areas, there should be clear floor space for at least one wheelchair user.



Floor space for wheelchairs should be free of other traffic movement.

## ■ **Kitchens**

### ■ **Kitchens and Breakfast Areas**

A kitchen that may be used by persons with various physical disabilities can present specific challenges to the designer. For example, a kitchen ideally suited to a person using a wheelchair may not be ideal for someone with a different disability, and may also be inconvenient for an able-bodied person. Alternative approaches to kitchen design must, therefore, be considered.

One approach would be to design a kitchen that will be usable by the majority of people, although it may not be ideal for particular users. For example, setting counters, sinks and cooking tops at a height of 865 mm and mounting upper cabinets correspondingly lower.

A second approach would be to provide cabinets that can be adjusted in height to meet the needs of specific occupants. Cabinets would be set on brackets so that they can be positioned for the initial occupants and be manually adjusted if the occupants, or their needs, change.

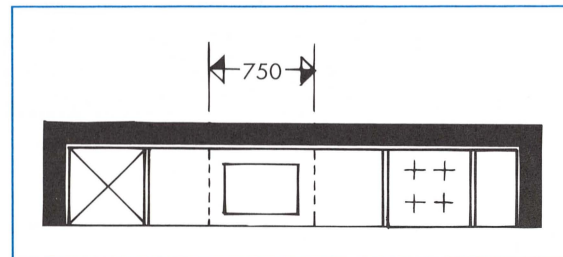
A third approach would be to provide for motorized adjustment, so that heights can be quickly adjusted to meet the needs of several individual occupants with diverse needs. However, this approach is expensive.

Where provision is made for height adjustments, plumbing and electrical installations must be designed to accommodate such changes.

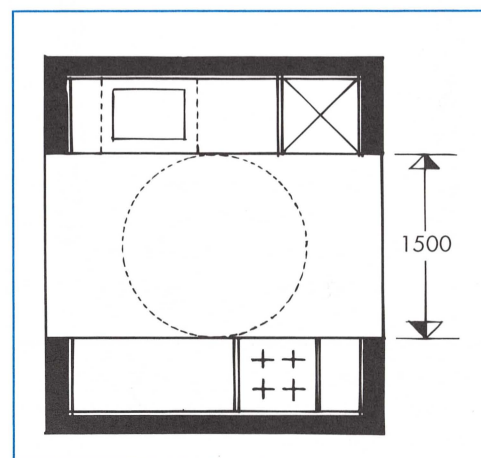
The layout of the kitchen is often dictated by the overall planning of the dwelling, but it is useful to understand the basic advantages and disadvantages of the various alternatives. To provide manoeuvring and working space for people using wheelchairs, all plans require a 1500 mm clear floor space in front of counters and appliances. Another key objective is to provide a good working relationship

between the refrigerator, sink and stove, which can best be achieved in a triangular layout.

- The in-line kitchen does not generally provide a convenient layout of facilities and equipment, but access to all below-counter storage space and equipment is simplified.
- The open-ended corridor or galley kitchen provides ready access to all equipment but can separate the main work surface and the sink from the cooking and storage units. This means that food and utensils have to be carried from one counter to the other, an arrangement that increases the risk of spills and other mishaps. It is difficult to include a pantry cupboard in this layout.



In-line kitchen arrangement.

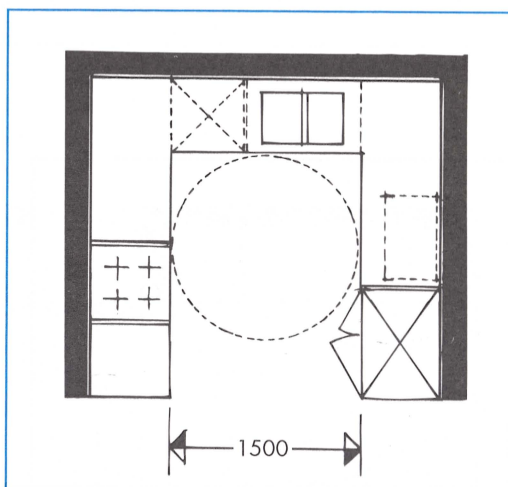


Galley kitchen suitable for wheelchair user.

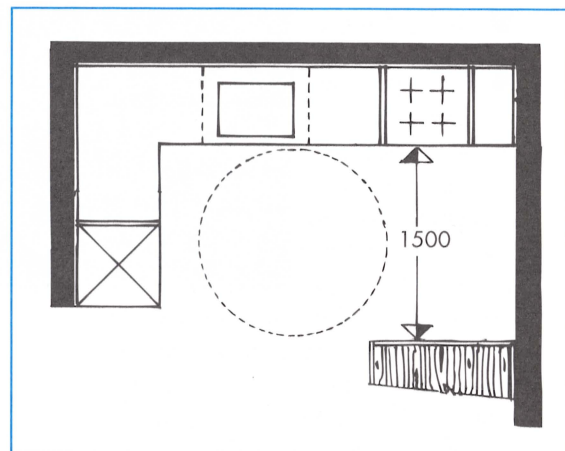


- The U-shaped kitchen concentrates the work areas and equipment, making it easy to move utensils from one surface to another. The disadvantages of the arrangement are that lower counter storage space at the two internal corners is difficult to use and a pantry cupboard can be included only if one leg of the U is extended.
- The L-shaped kitchen provides convenient access, concentrated work functions and has only one internal corner. It satisfies most people's needs and fits into most plan types. A pantry cupboard can easily be included. If the internal corner under the kitchen counter can be opened into an adjoining room, this space becomes a readily accessible storage cupboard; it may also be accessible in the kitchen by using a lazy susan.

Many people prefer a kitchen large enough to include some dining space. A small breakfast table or an extension of the counter may serve this purpose.



U-shaped kitchen with floor space for wheelchair user. Note triangular relationship of stove, sink and refrigerator.



L-shaped kitchen with clear floor space.

### Counters and Cupboards

Kitchen counters should be as continuous as possible, at a uniform height and level with a cook-top or the top of the stove. The counter surface adjacent to the stove or cook-top should have a heat resistant covering. There should be a splash back at the rear of the counter. Some people prefer a slightly raised, rolled edge to contain spillage. A finger-hold provided under the lip is useful to persons using wheelchairs to pull themselves close to the counter. Alternatively, a grab bar may be fixed to the cabinet face just below the counter. For persons who are visually impaired, a contrasting colour at the counter edge helps define counter boundaries.

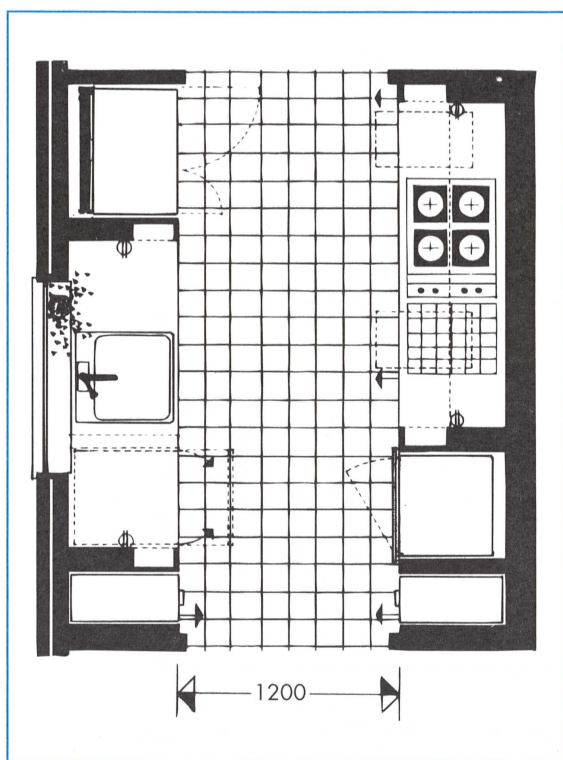
Knee space under the counter is desirable, especially at the sink and cook-top, to allow easy access for people working in a seated position, including persons using wheelchairs. The space should be at least 680 mm high, 750 mm wide and 250 mm deep.

Drawers on roller guides should be provided to store things under the counter, as fixed shelving is almost totally inaccessible to a person in a wheelchair and to people with flexibility impairments. A recessed toe space at least 200 mm high and 200 mm

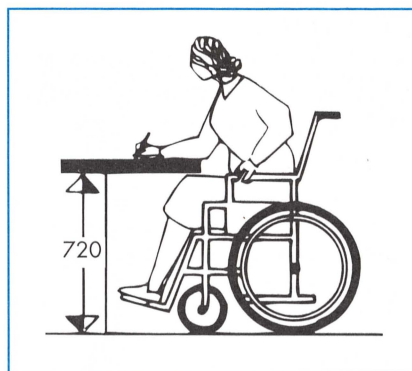
deep is required for all base cabinets to accommodate the footrest of a wheelchair.

Below-counter storage units on casters are also useful. These may be moved out for easy access and cleaning, or to provide knee space under the counter. In corner cupboards, a lazy susan may be installed, or access to the space may be provided from an adjoining room or area.

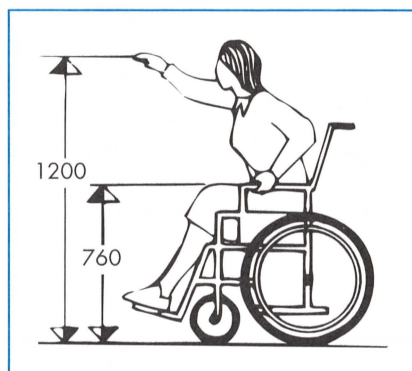
Pull-out work boards (e.g. chopping boards) are very useful and at least two should be provided, preferably at a height of about 750 mm. Where two or more pull-out work boards are provided, one should contain a hole, about 200 mm in diameter, to hold a mixing bowl. A pull-out work board should always be provided under a wall oven to receive hot pans.



Below-counter roll-out cabinets provide added convenience. Stovetop units and built-in wall ovens are preferred where space allows.



Wheelchair clearance required below tables, counters or vanities.



Maximum forward reach for women, into kitchen shelves or other storage.

### ■ Overhead Cupboards

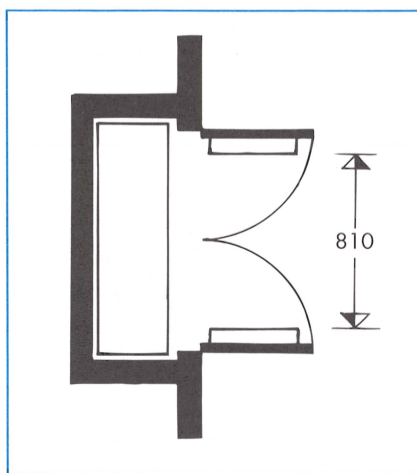
Although overhead cupboards may not be totally accessible to people with various disabilities, they can provide useful storage which can be accessed by other occupants. To provide some accessible overhead storage for people using wheelchairs, the lowest shelf should be no higher than 1300 mm from the floor.

Since the upper kitchen cabinets are only partially accessible to persons in wheelchairs, an open narrow shelf mounted below the upper cabinets can provide additional useful storage.

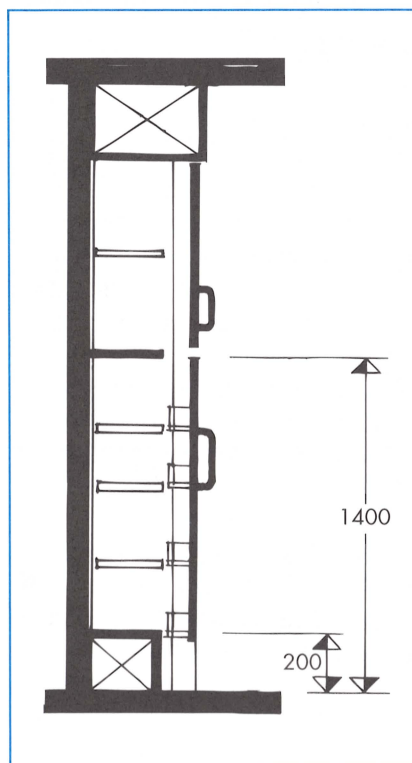


### ■ Pantry Cupboards

To compensate for the limited value of overhead cupboards to a person using a wheelchair, a full height pantry with adjustable shelving is desirable. Narrow shelves with upstand edges should be installed on the inside face of the pantry doors for easy storage and access to supplies.



Accessible kitchen storage is a major concern. A full-height pantry with adjustable shelving answers most food storage needs.

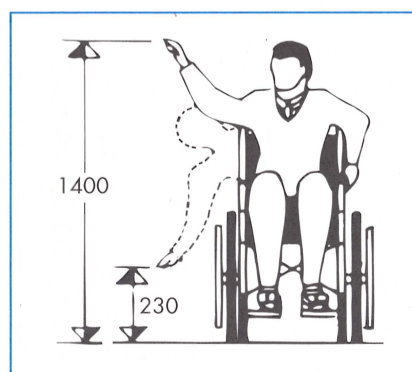


For wheelchair users, upper shelves and cupboards may only be used for occasional storage. Therefore, access to lower sections is very important and should include a suitable kickspace for wheelchair access.

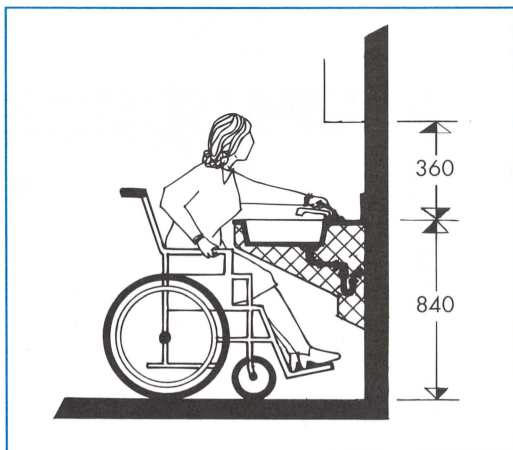
### ■ The Kitchen Sink, Dishwasher and Garbage Disposal Units

The sink should be stainless steel, preferably with a double bowl. It should be about 125 mm to 175 mm deep, so that a seated person can use it in comfort. In addition to knee space provided under the sink as previously described, the trap should ideally be located close to the rear wall, and the following features should be considered.

For the safety of persons whose skin is insensitive to heat, hot water temperature should be limited to not more than 43°C, through the use of either central or individual thermostatic controls. The bottom of the sink and the trap should be insulated to prevent burns to knees and legs if temperature controls are not used.



Lateral reach from a wheelchair to controls, upper shelves and cupboards. Note: Women generally have a shorter reach.



Where hot water temperature is not controlled, the trap area below sinks should be insulated. Ensure that adequate knee clearance is maintained.

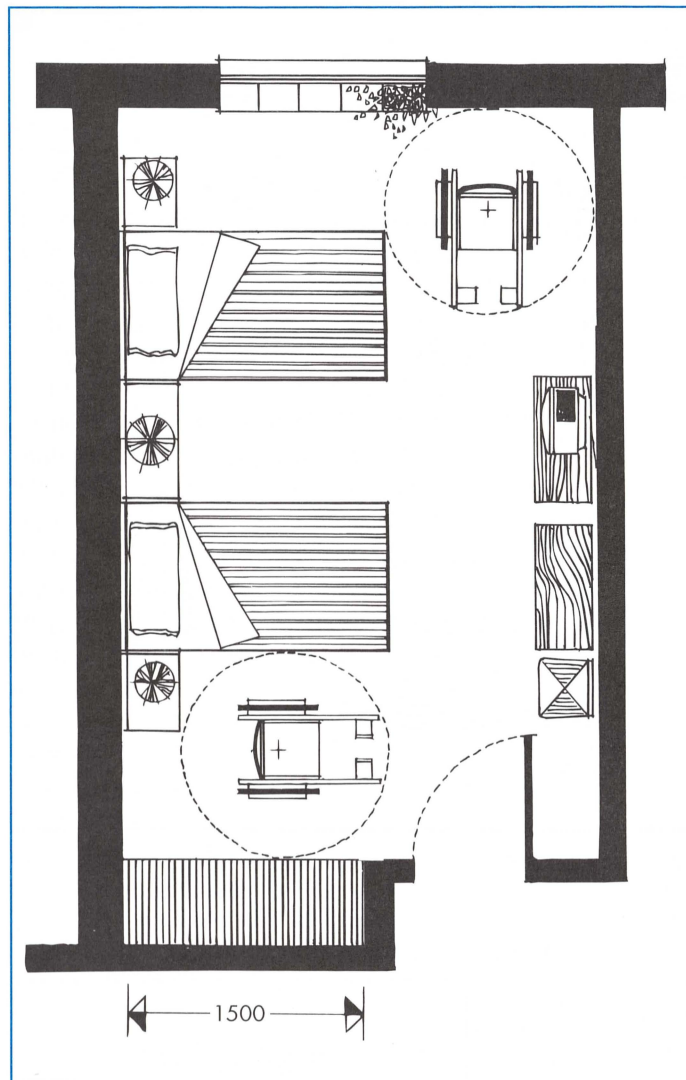
Lever faucet handles are recommended and a single-lever mixing valve is preferred. A flexible hose-mounted spray, operable by one hand, provides an easy way to clean vegetables in either sink.

A garbage disposal unit and a dishwasher are two items which are highly convenient for people with disabilities. In both cases, controls should be mounted close to the front of the counter, and the dishwasher should be front-loading (see also Section 6, Appliances).

## ■ Bedrooms

In dwellings designed for use by a person in a wheelchair, one bedroom should be generous in size to accommodate a double bed and allow for both the use and storage of a wheelchair. It should have direct and convenient access to a bathroom. All other bedrooms should be accessible to the person who uses a wheelchair.

Clearances around beds are based on the need for a 1500 mm x 1500 mm wheelchair turning area on one side of the bed, a comfortable clearance of 900 mm where access or circulation by wheelchair is necessary, and a minimum clearance of 750 mm in other

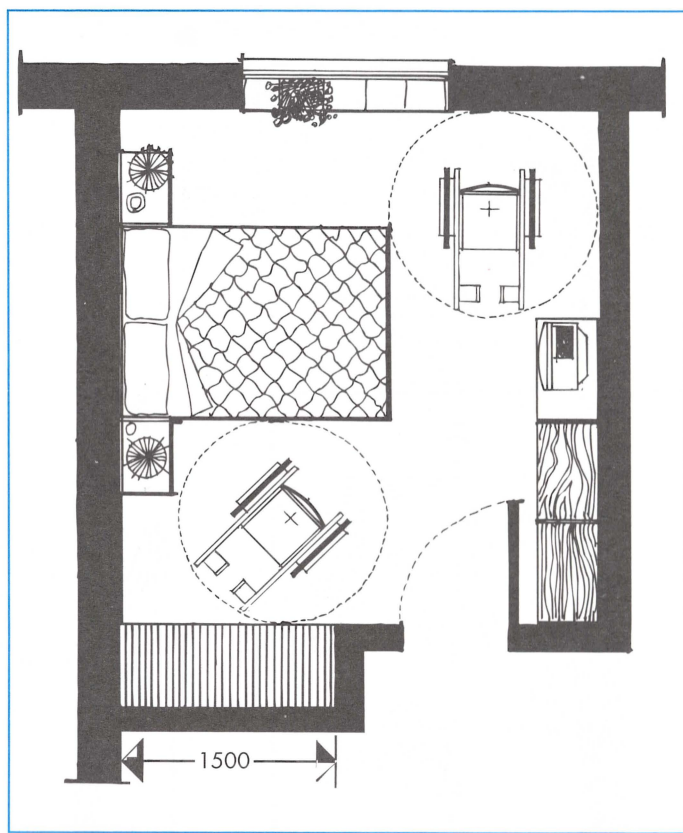


Sufficient space should be provided so that persons using wheelchairs can navigate easily around all items of furniture, whether in their own unit or in public areas.

areas. The plans of furnished bedroom units are intended as examples only. Many variations are possible using the recommended clearances.

People who are confined to bed for extended periods of time should be provided with outlets and controls that enable them to operate the following types of equipment and systems from their beds: a **telephone**, a **radio**, a **television**, a **two-way intercom system** to the entrance with a **remote control unlocking device** for the front door, an **emergency call system** to alert the

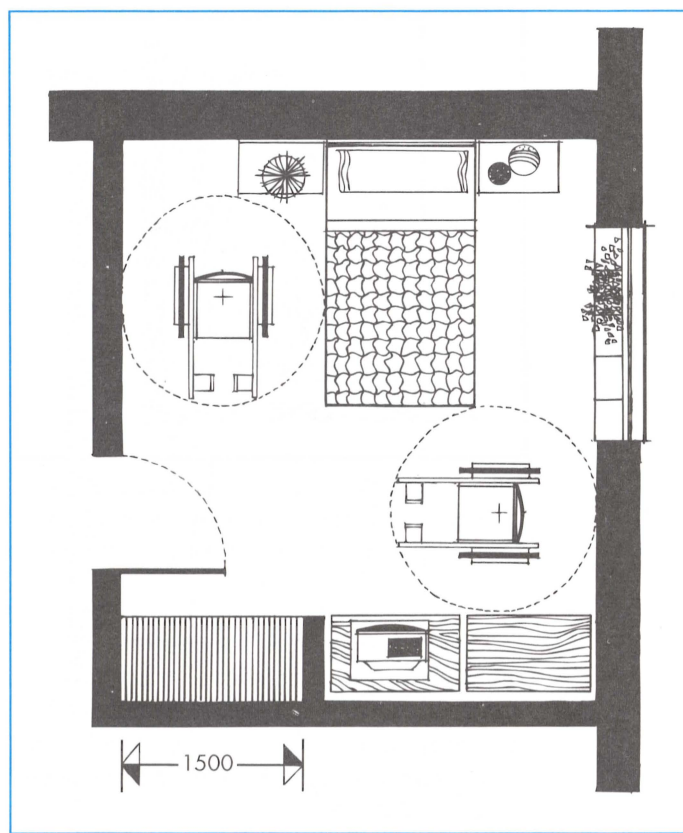




For wheelchair users to be able to use the clothing storage space, there should be a clear turning space in front of the clothes closet, and the coat rod should be adjustable in height from 1200 mm to 1400 mm above the floor and upper shelf.

superintendent or a neighbour, and **lighting** in the bedroom and the bathroom (see also Section 7, Building Systems).

Many people with disabilities use a trapeze attached to the bed or a wheeled mobile lifter to help them in transferring. A permanent ceiling eyebolt designed to hold a trapeze is not recommended, since it may inhibit future changes in furniture arrangement – in particular, the location of the bed. Some people with severe disabilities may require a ceiling-mounted hoist and transfer rail which could extend from the bed to a toilet and bathtub. Such a rail must be secured to structural elements and have a minimum load capacity of 225 kg.



Bedroom layouts should allow a variety of furniture arrangements, while ensuring wheelchair access to all necessary areas of the room.

## ■ **Bathrooms and Washrooms**

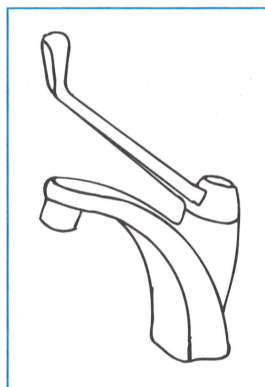
Bathrooms and washrooms generally should be designed to be wheelchair accessible and hazard free. This will involve consideration of the following:

- A person in a wheelchair must be able to pass through the doorway, close the door and manoeuvre to use the toilet, bathtub or shower, and washbasin.
- There should be grab bars at the toilet, bath and shower to permit safe use.
- There might be a need for extra space for special transfer equipment or assistance by a helper, as well as for storing additional supplies and medications.

- In homes with two bathrooms, it may be appropriate to design or modify only one bathroom for use by a person with disabilities.

#### ■ Faucets

All faucets should be lever type and should be easily accessible to persons with disabilities. For safety, hot water temperature should be limited to not more than 43°C through the use of either central or individual thermostatic controls.

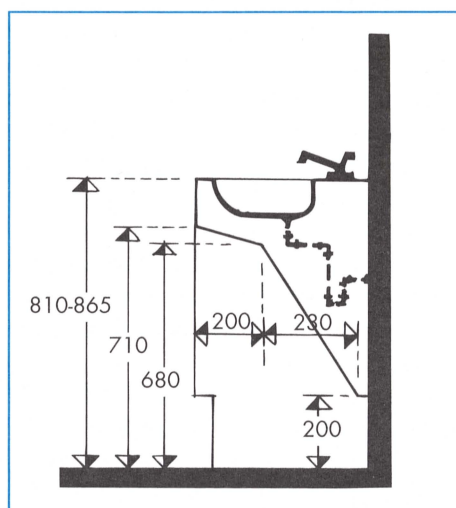


Single-action, lever-handled faucets are the easiest to use.

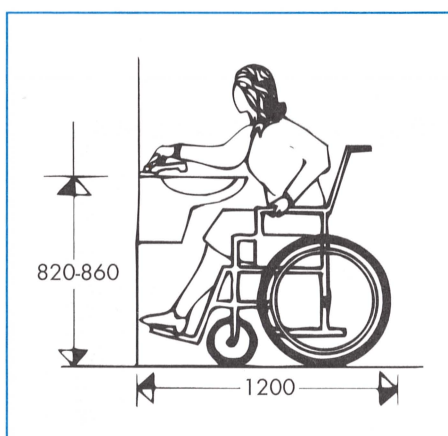
#### ■ Washbasin

Washbasins may be either cantilevered or mounted in a vanity. For a person using a wheelchair, the preferred height of the top of the basin is 810 mm, but for a standing person who has difficulty bending, the preferred height is 900 mm. An intermediate height of between 840 mm and 865 mm is acceptable to most people.

Whether the basin is cantilevered or in a vanity, a person in a wheelchair requires a clear knee space at least 710 mm high, 200 mm deep and 750 mm wide. There should also be additional toe space, 230 mm high and 230 mm deep, extending across the full clear width of the knee space. To provide the clear space, the waste pipe should be extended to the rear so that the trap is close to the wall. To protect against burns, the basin and pipes should be insulated if there is no thermostatic control that limits the water temperature to not more than 43°C.



Where cantilevered basins or vanities are used, knee space clearance must be assured for wheelchair users.



The type and position of faucets may be critical for many persons with disabilities. Wheelchair clearance below basins and vanities must be maintained.

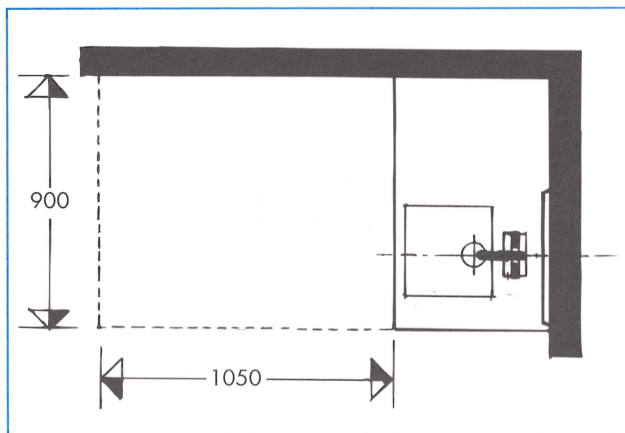


When cantilevered washbasins are used, they should be designed for a minimum edge load of 100 kg.

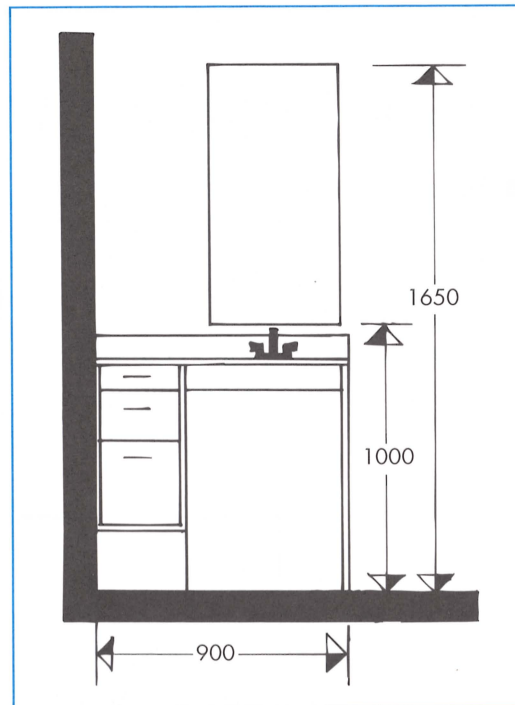
Vanities offer both improved stability and counter space. A bank of drawers or shelves, clear of the knee space, could prove more accessible than a medicine cabinet. However, one drawer should be lockable for storing medicines or dangerous objects. The vanity counter can also be extended, in a narrow form, over the top of the toilet tank. This will provide additional counter space and, if adequately secured, support for people standing near the toilet.

A washbasin placed within reach of a person seated on the toilet is preferred by some people with disabilities. However, this should only be provided where sufficient space is available for a frontal approach to the toilet by persons using a wheelchair.

To minimize hazards for persons with visual impairments, cabinets with outward-opening doors or shelves over basins, are not recommended. Soap dishes, toothbrush holders, etc. should be mounted clear of the basin area.



Sufficient clear floor space for a wheelchair should be available in front of the vanity or basin.



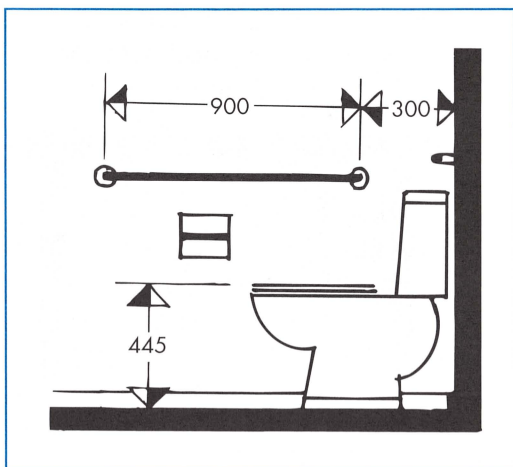
Bathroom vanities need adequate approach space and knee clearance for wheelchair users. Mirror height should be carefully selected for standing or seated users.

## ■ Toilet

A standard domestic toilet with a seat height of about 400 mm should be used. Separate and removable seat attachments provide the flexibility to accommodate people with different needs. Special toilets with high seats do not provide this flexibility and should be avoided.

To provide access to the toilet for persons in wheelchairs, there should be a clear space, at least 750 mm wide, on at least one side of the toilet, to allow for lateral transfer. Alternatively, the space in front of the toilet should be at least 1050 mm deep to permit a frontal approach. Ideally, both of these spaces should be provided to allow a choice of access.

Where space for lateral transfer is provided, the left- or right-handedness of a person with disabilities may be a



Strongly mounted grabrails behind and beside the toilet allow for lateral or frontal transfer from a wheelchair.

problem. Therefore, where two washrooms or bathrooms are provided, each toilet could be positioned differently.

The centre line of the toilet should be located 460 mm to 480 mm from an adjacent wall, on which grab bars can be mounted, if required.

The toilet paper dispenser should be placed within easy reach of the seated person. Holders that are not recessed are preferred by many people with co-ordination difficulties, and can be easily located to suit the needs of a particular individual. The best location for normal use is about 250 mm in front of the seat and about 550 mm above the floor. This location will not interfere with the use of a grab bar.

#### ■ Bathtub

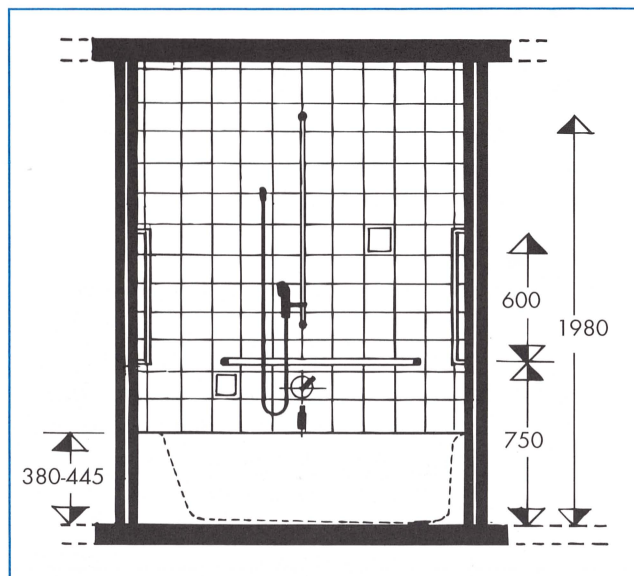
To provide easy access to the bathtub for persons using wheelchairs, there should be a clear floor space at least 750 mm wide and 1200 mm along the length of the tub. Additional space may be necessary if a person with disabilities requires personal assistance or special equipment to transfer.

Special bathtubs are rarely required. However, this should be checked with intended users. A raised tub may be desirable if the person with disabilities needs assistance in bathing, so that the helper will not strain his or her back. This can be achieved by raising the tub 100 mm from the floor. Clear space below the tub may be required for mobile transfer equipment, such as a Hoyer lift. Occasionally, a ceiling-mounted lift may be desirable.

Two recessed soapdish units should be provided – one mounted low, for use from the bath, and the other set at a height of about 1200 mm, for use while taking a shower.

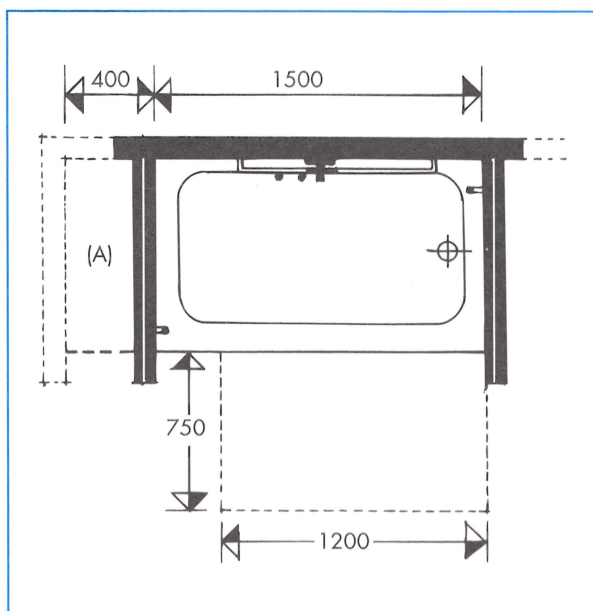
A flexible, telephone-type shower unit should be provided, which can be either hand-held or set on an easy-to-adjust sliding mount. Shower-curtain rods should be of sturdy construction and securely fastened.

Sliding doors to provide a bath enclosure are not recommended.



Telephone-type shower heads with flexible positioning can be located at the head of the bath or on the long wall. Grab rails provide security for proper transferring, showering or bathing. Two soapdishes should be provided, accessible from a standing or seated position.





The dotted lines indicate the position of a transfer seat at the head of the tub (A) (where space allows). If seat is provided, adjacent clear floor space is also required.

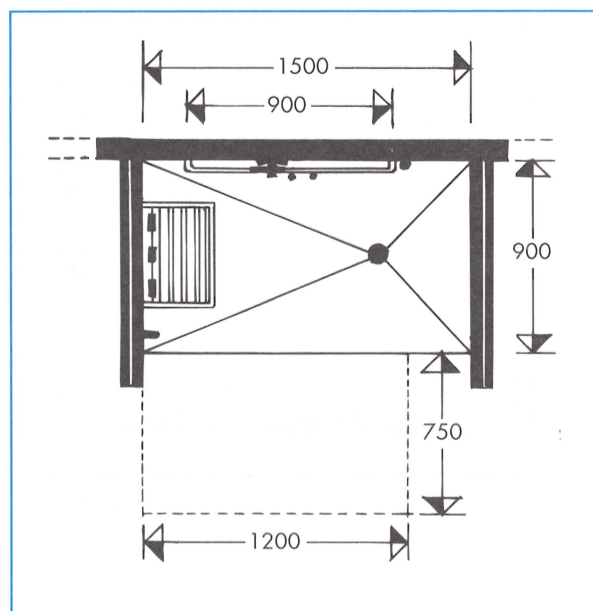
#### ■ Built-in Transfer Seats

A transfer seat built at the head of the bath is desirable for many people with disabilities. It should have a waterproof, non-slip finish with rounded edges. The surface should be flush with the top of the tub or never more than 125 mm higher. Transfer seats should be a minimum of 380 mm deep and preferably 460 mm.

#### ■ Shower

Many people with disabilities prefer a shower to a bath. Standard manufactured units are available, but many are unsuitable for persons with certain disabilities because of their small size and relatively high curbs.

Roll-in showers are preferred. Any threshold should be not more than 13 mm high, with a rolled or bevelled edge, and should be designed to prevent water spillage. The floor in the shower should be sloped slightly towards a drain. A minimum area of



Clear floor area for a wheelchair should be provided beside the shower area. A built-in flip-up seat provides stability for many who cannot stand up and shower.

750 mm x 1500 mm is recommended for a roll-in shower, with a clear floor area in front, 900 mm x 1200 mm, for wheelchair access.

For people who can transfer to a seat, a shower area of 900 mm x 900 mm, with a clear floor space in front, 900 mm x 1200 mm, for wheelchair access, is acceptable.

When a manufactured unit is not used, it is recommended that a continuous waterproof membrane be included behind waterproof drywall on all three sides of the shower pan, to at least 460 mm high. Waterproof grout is essential for all glazed or ceramic tile finishes. In some settings, the total floor area of the bathroom and shower could be depressed, with all floor surfaces sloping to the floor drain in the shower. This solution is particularly appropriate where the individual user requires personal assistance, or space is extremely limited. In such settings, the entry threshold to the bathroom

should be not more than 13 mm high, with a rolled or bevelled edge, and should be designed to prevent water movement to adjacent areas.

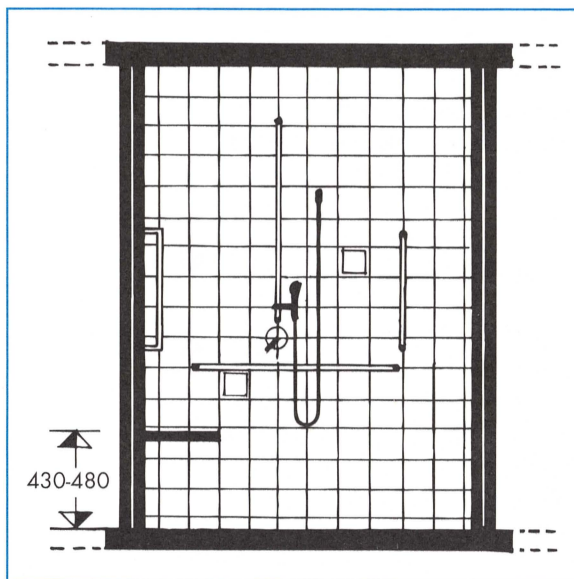
In all shower enclosures, a telephone-type shower should be provided, which can be hand-held or set on a sliding mount. It should be located on the back wall in a roll-in shower and on the end wall facing the seat in a non-roll-in shower, easily reachable from a seated or standing position.

Two soapdishes are also desirable – one reachable from a seated position and the other from a standing position.

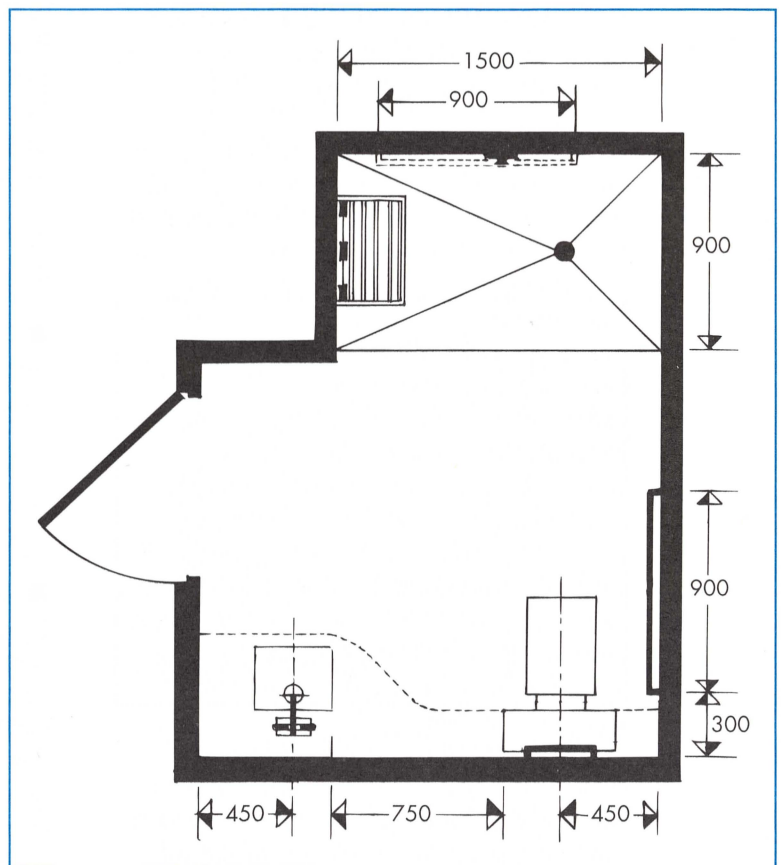
### ■ Shower Seats

Shower seats are essential for the safe use of showers by many persons with disabilities. Such seats should flip up or be removable to allow use of a commode or bathing-type wheelchair within the shower enclosure.

The seat height should be between 430 mm and 480 mm from the floor, and the seat should be constructed to take a minimum load of 150 kg. Seat materials should be easy to clean and quick draining. Some persons with disabilities may require a removable cushioned seat for comfort.



A telephone-type shower, with flexible positioning, should be placed at the centre of the long wall, with grab bars and soapdishes positioned for seated or standing users.



Many persons with disabilities prefer a roll-in shower in lieu of a bathtub. Many seniors find a continuous counter top aids in transferring from the toilet to a standing position at the basin.



### ■ Grab Bars and Towel Rails

Grab bars are important transfer and stability aids in all bathrooms, showers and washrooms used by persons with disabilities. The need to accommodate the needs of individual users must be considered in positioning grab bars. It is generally recommended that in new bathrooms, showers and washrooms, continuous reinforcement be provided behind the drywall (or finish), between 600 mm and 1200 mm from the floor, on all fixture-related walls to ensure flexibility in installing and relocating grab bars.

Grab bars and towel rails must be securely fixed to structural supports and be capable of withstanding a vertical or horizontal force of 1.3 kN, since many persons with disabilities may clutch at anything if they are in fear of falling.

Grab bars and towel rails should be 30 mm to 40 mm in diameter and have a clear space of 40 mm between the bar and the wall for easy, safe use.

**To assist in using a toilet**, one grab bar should be mounted horizontally on the adjacent wall, and a second grab bar mounted horizontally behind the toilet. Both should be at least 600 mm long and be mounted between 750 mm and 850 mm from the floor. The bar on the adjacent wall should be not more than 300 mm from the rear wall and should extend to at least 450 mm in front of the toilet. Some people may require an additional vertical bar, which should be located 250 mm in front of the toilet.

**To assist in using a bathtub**, one grab bar should be mounted horizontally along the length of the tub, and a second grab bar should be mounted vertically, at the foot end, adjacent to the clear floor space. Both should be at least 1200 mm long and mounted between 180 mm and 280 mm above the bathtub rim. Some people will find a third grab bar, mounted horizontally

between 180 mm and 280 mm above the tub at the head end, useful in transferring from a wheelchair.

**To assist in using a shower**, one grab bar should be mounted horizontally on the back wall between 700 mm and 800 mm from the floor. A second grab bar should be mounted vertically between 80 mm and 120 mm from the front edge, with the bottom end between 700 mm and 800 mm from the floor. Both bars should be at least 750 mm long.

### ■ Medicine Cabinets and Mirrors

A medicine cabinet mounted behind the washbasin is not easily accessible to persons using wheelchairs. If a wall-mounted medicine cabinet is used, it should have adjustable shelves (not glass) within reach of a seated person. Sliding doors on cabinets above basins or vanities minimize risks for visually impaired persons.

A mirror should be mounted flat to the wall with the bottom edge no more than 100 mm above the washbasin.

### ■ Supplementary Storage

Supplementary storage for cleaning supplies, toiletries, etc., is desirable, because many people with disabilities need additional linen and toileting supplies, as well as special equipment and bathing aids.

### ■ Bathroom Layouts

Given the foregoing criteria and recommendations, a variety of bathroom and washroom layouts are possible. In each of the sample plans illustrated, the recommendations for the various types of fixtures and fittings have been taken into account.

These layouts have a number of features in common:

1. The entry door is either sliding or hinged to swing outward and should leave a clear opening of 810 mm. This ensures that the door can be opened to assist someone who has fallen.

2. A generous floor area is provided to allow wheelchair entry and manoeuvring. Ideally, there should be at least a 1500 mm turning circle, clear of fixtures, at foot level.
3. Where bathtubs are provided, they are of standard type. This assumes that mechanical aids will be available to assist a person using a wheelchair to transfer to and from the tub. A telephone-style shower-head is provided, with accessible wall-mounted flow and temperature controls.
4. Grab bars are provided beside the toilet, the bathtub and the shower. These must be positioned to meet the specific needs of an occupant with disabilities.
5. Bathtubs and showers are interchangeable in the layouts illustrated. Shower thresholds do not exceed 13 mm high.

## ■ **Other Rooms and Facilities**

### ■ **Family Rooms and Dens**

Many dwellings today include family rooms or dens for recreation or working at home. Such rooms should be designed to accommodate persons with disabilities. This includes sufficient space for someone using a wheelchair and adequate lighting for reading or writing. Other requirements could include telephone and TV outlets, an intercom link with other parts of the dwelling, and sufficient duplex outlets for entertainment equipment and computers.

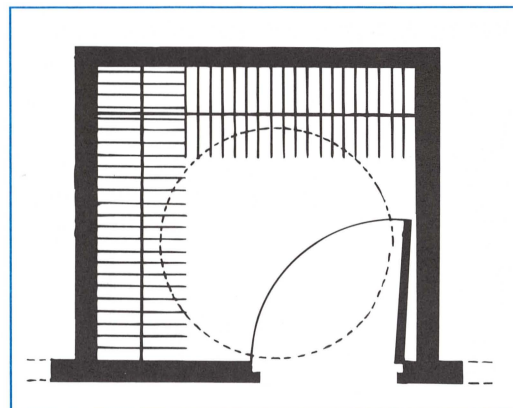
Where open fireplaces are provided, a raised hearth, between 200 mm and 300 mm high, is recommended. A nearby duplex or gas outlet is recommended to allow the use of an electric fire, a gas fire or a gas starter for an open fire.

### ■ **Laundry**

Most people with disabilities, particularly those with mobility and visual impairments, experience difficulties in getting their laundry to and from a communal laundry room. Consideration should, therefore, be given to providing laundry facilities in the dwelling unit itself. These could be located in the kitchen, a bathroom or even a closet. Stacked washers and dryers could be used for tight locations (see page 47 for washers and dryers).

### ■ **Storage Space**

Generous storage capacity within the dwelling is essential for people with disabilities, and a minimum capacity of 5.5 m<sup>3</sup> is recommended. This storage is generally required for seasonal clothing, suitcases and any equipment or spare supplies required by the occupant. It must be designed so that the contents are accessible to persons using wheelchairs.



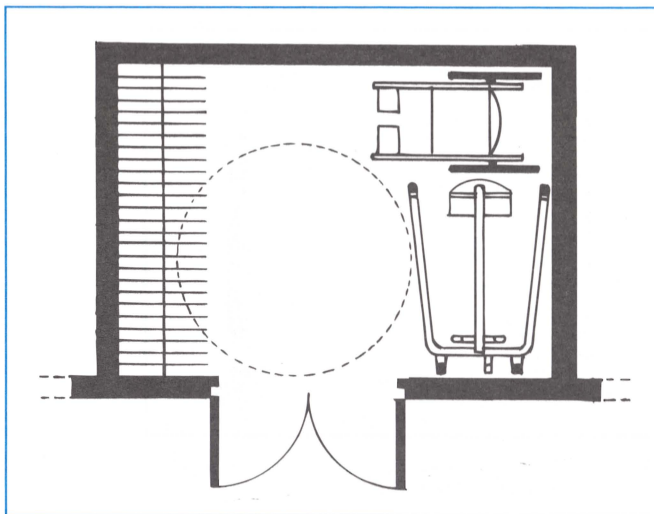
All storage areas should be accessible to wheelchair users.



Shelves are useful in making maximum use of a limited area and should be adjustable in height, with secure attachments. Such shelves are useful up to a height of about 1400 mm for persons using wheelchairs. Higher shelves should also be installed for use by others.

Ready access to clothes closets and other storage areas can be provided by accordion, bifold or sliding doors. The minimum clear opening should be 810 mm. Doors that require floor-level guide rails should be avoided.

In clothes closets, the clothes hanger rod should be adjustable in height, from 1200 mm to 1400 mm above the floor. The shelf above the rod should be placed at a maximum height of 1575 mm. Shelves built in at the side of the closet should preferably be adjustable. This shelving is convenient and helps reduce the amount of furniture required in the unit.



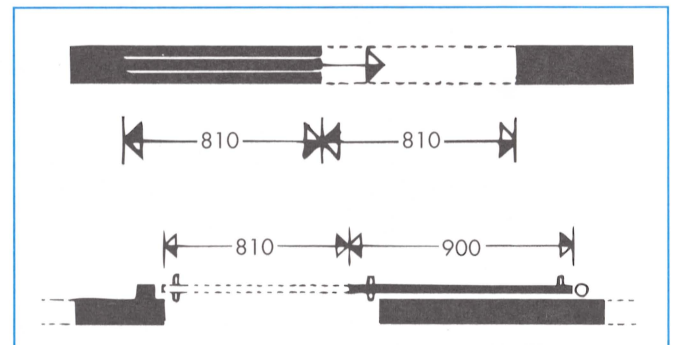
People with disabilities always need additional storage space for equipment and supplies.

## ■ **Doors and Doorways**

Doors and doorways within the dwelling may be of several types. The common hinged door is economical but difficult for some persons with disabilities to manipulate. Bifold or accordion doors are easier to use, but they are not appropriate for entrance doors and are usually too fragile to withstand daily abuse by wheelchairs. Sliding doors are easy to operate and occupy little space.

Inward-opening hinged doors reduce usable space in small rooms, such as bathrooms, washrooms and storage rooms. Therefore, it is preferable to use outward-opening or sliding doors, which also provide added safety as they still permit access if a person in the room falls across the doorway.

Refer to page 16 for requirements for wheelchair access through doors.

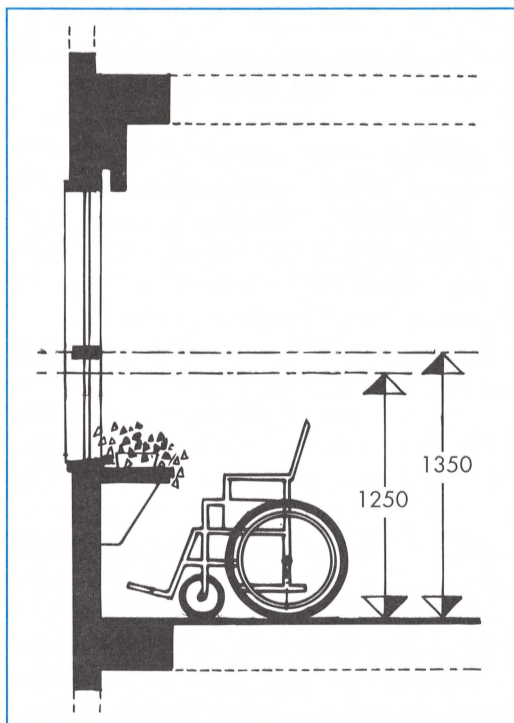


Sliding doors take the least space, but carefully selected hardware is essential.

## ■ **Windows**

Windows should be designed so that the sill is no more than 750 mm above the floor and there is a clear floor space not less than 750 mm wide along the full length of the window. This will allow a seated person to look out and down. A sturdy railing or muntin may also be desirable, at a height of about 1265 mm, to provide a sense of security to a person standing near the window.

Window sills wide enough for plants are very handy. It should also be possible to clean the outside of the windows from inside the unit, if there is no balcony or terrace.



For wheelchair users, sill heights and muntins need to be located so as not to limit the view. Deep window sills are highly desirable.

Sliding glass doors may be an additional source of natural light and air. However, because they tend to create drafts, such doors are not recommended as the only source of fresh air in the room. Double-hung windows should generally not be used unless they are counterbalanced for easy operation and operable with one hand. Hopper-type or sliding windows are preferable since they can be opened easily with one hand. Casement windows are also acceptable, providing the hardware is easy to use.

Many seniors and persons with disabilities have problems with drafts. Therefore, the opening sections of windows should be designed to minimize drafts in normal seating locations. The use of hopper-type windows or windows with draft deflectors may be appropriate in such cases.

Sliding window sashes should be selected with care as they are often difficult to weatherproof. The ease of operation also depends on the ratio of height to width, the position of the locking and operating mechanisms, the quality and maintenance of glides and sliding track (see also page 38, Window Hardware, and page 50, Controls for Windows, Drapes and Blinds).

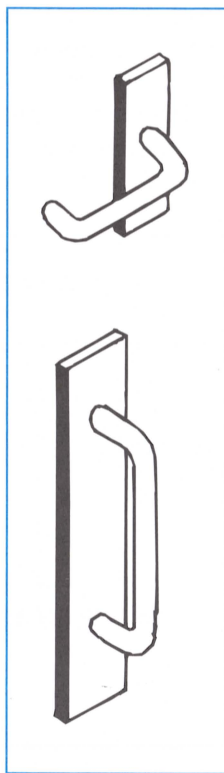


## ■ **Hardware**

### ■ **Hardware: Doors and Windows**

The operable parts of door and window hardware should be usable with one hand and should not require tight grasping, pinching or twisting of the wrist.

Since round doorknobs do not provide an adequate grip for persons with impaired hand function, large lever handles are preferable for latched or locked doors. Such handles should be angled or turned inward to reduce the risk of catching clothing or causing injury. Door handles, pulls, latches and locks should be mounted between 750 mm and 900 mm above the floor.



All door, window and cabinet hardware should be easy to grasp and use with one hand, and little or no finger dexterity.

To make it possible for a person in a wheelchair to close an out-swinging door from the inside, an auxiliary pull handle or a horizontal bar may be provided about 180 mm from the hinged side, at the same height as the door hardware. Occupants should be consulted to determine if auxiliary handles would be useful on bedroom and bathroom doors and elsewhere in the unit.

Operating hardware on sliding doors should be exposed and usable from both sides when the doors are fully open. If the door retracts fully into a wall pocket, an accessible handle is required on the exposed edge of the door to permit retrieval. (Note: the clear opening should not be reduced to less than 810 mm.)

Lever hardware on casement and awning windows, and large push and pull hardware on sliding windows, are preferred. Rotary hardware for windows is difficult for some people with disabilities to operate manually. However, it does lend itself to motorized operation. Window operating hardware should be mounted no higher than 1200 mm from the floor. Care should be taken to ensure that window screens do not impede normal hardware operation.

# 4 *Features Unique to Ground-oriented Housing*

- *Carports, Garages and Parking Spaces*
- *Garbage and Garden Storage Areas*
- *Entrances*

- *Laundry*
- *Workshops and Hobby Areas*
- *Home Elevators and Lifts*
- *Ceiling-mounted Hoists*

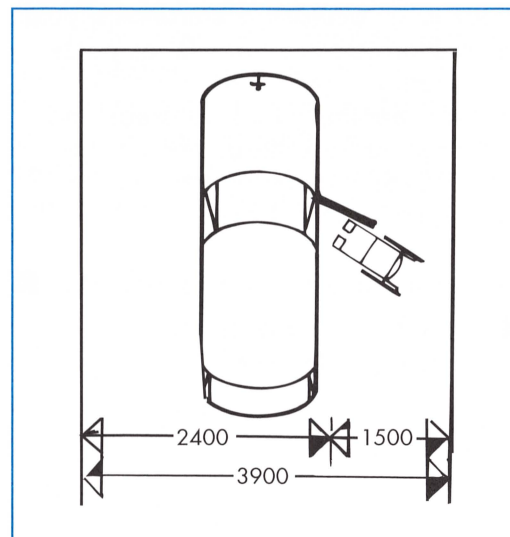
Many exterior and interior design features that apply to ground-oriented housing have already been discussed in Sections 1 and 3, which should be read to complement the information in this section.

## ■ *Carports, Garages and Parking Spaces*

People who use wheelchairs often drive or travel in private vehicles. They require parking spaces and garages that allow for the comfortable transfer of a person using a wheelchair from one side of a vehicle while, at the same time, allowing other passengers to exit comfortably from the other side. Therefore, single-car garages and driveways must have minimum widths of 3900 mm, when designed for a car or small van, and 4600 mm, when designed for a large van with a side-mounted elevator.

The chores of cleaning ice and snow from a car and starting it in cold weather are more than most drivers with a disability can manage alone. A heated garage is, therefore, preferable to an open parking space or a carport. An electrical outlet should be provided for a block heater in cold regions.

Driveways should be short to minimize snow clearance, and parking should be as close as possible to an



Space may be required on either side of a car to effect a suitable transfer.

accessible entrance to the house. Snow melting by an underground heating system is desirable where costs permit.

Electrically operated garage doors are preferable to manual doors. These should be operable by remote control and by an accessible control in the garage.

A trapeze hung from the ceiling of the garage may be needed to transfer a person with disabilities from a wheelchair to a vehicle. In such cases, a permanent eyebolt, suitably located and securely fixed to a beam or roof



truss, should be provided. The eyebolt should be capable of carrying a load of up to 225 kg. The location and type of transfer equipment required should be checked with individual users.

It is preferable that a garage be attached to, and be directly accessible from, the house. Because of differences in floor levels, it may be necessary to install ramps or lifts to provide access between the house and garage for people with mobility impairments.

The route from an outdoor parking space to an accessible entrance should be as short, direct and level as possible. Ideally, it should be protected from the weather. Parking areas and paths should have hard, smooth surfaces. Cross slopes for drainage should not exceed 1:50.

### ■ ***Garbage and Garden Storage Areas***

Any outdoor garbage holding area should be located on a hard-surfaced area, easily accessible from the house, parking area and garden. There should be a clear approach space at least 750 mm x 1200 mm on one side of the garbage cans.

Accessible garden storage should also be provided. This can be located in a garage, carport or separate storage shed. This storage area should be fairly large to allow access and use by people with disabilities who may not be able to carry tools, equipment or garden furniture to a basement storage area.

### ■ ***Entrances***

The main entrance of the house should be protected by an enclosed porch or canopy to keep the entry area dry and free from ice and drifting snow. An enclosed breezeway between a detached garage and the house can provide protection from the weather, but prevailing winds must be considered to avoid creating a wind-tunnel effect.

To ensure alternative escape routes in case of an emergency, every house requires at least two accessible entrances.

A paved area at least 1500 mm x 1500 mm should be provided immediately outside an entrance door. The surface should be smooth and hard and have a slope of not more than 1:50 to drain water away from the entrance.

House entry doors should provide a minimum clear opening of 810 mm. However, an 860 mm clear opening is recommended to minimize damage to door frames by wheelchairs. Peep holes should be located at both 1500 mm and 1065 mm above the floor to allow persons using wheelchairs to see who is outside.

It should be possible for a person to open a locked outside door with one hand. A grab bar or vertical pull, mounted on the door frame beside the lock, may provide useful support for those with mobility problems. There should be no step or other impediment at the entrance, although a 19-mm weather bar or threshold may be necessary. All such thresholds should be bevelled to allow easy access by wheelchair users.

Storm doors are not recommended because many persons with disabilities find them difficult to operate. They should, therefore, be used only where an enclosed porch or vestibule cannot be provided.

Inside the entrance, there should be enough clear space to manoeuvre a wheelchair and remove outside clothing. A minimum of 1500 mm x 1500 mm should be provided. Since this entry space will also be used to brush snow from shoes, clothes and wheelchairs, a washable non-slip flooring material should be selected.

An accessible coat closet, with racks for overshoes and shelves for hats and similar small articles, should be provided in the vestibule. There should also be space for a seat or chair for those who have to sit down to put on or take off outdoor clothes.

A lockable delivery box is recommended for mail and other articles that are brought to the house. It should be located about 850 mm above the floor and designed so that it can be easily emptied from inside the house.

### ■ *Laundry*

The laundry facilities should be conveniently accessible to people with disabilities, preferably located on the main floor of the house. In houses with two or more storeys, a laundry chute may be an asset (see page 47 for washers and dryers).

### ■ *Workshops and Hobby Areas*

Most traditional Canadian houses have space in the basement which can be used as a workshop for home repairs and maintenance or for hobbies. In homes without basements, such activities often occupy space in a spare room or in the garage. If the homeowner or occupant is mobility-impaired, consideration should be given to providing workshop or hobby space in an accessible location.

All features and amenities, such as workbenches, counters, shelves, doors, hardware, electrical and water outlets and equipment controls, should be selected and designed to meet the needs of users with disabilities.

### ■ *Home Elevators and Lifts*

Many houses have two or more floors and most have a basement. A small personal elevator or lift can give a person with a disability easy access to all of these floors. This will enable people with disabilities to live in typical multilevel houses in housing developments with conventional lot sizes. For new housing, this can be more economical than providing an equivalent floor area on one level. In existing houses, it may be possible to incorporate a shaft and install an elevator, or, alternatively, install a platform or chair lift in a stairway.

Where there is a significant difference in level between a garage floor and the main floor of a house, an elevator or a porch lift may be the only way of providing access for persons using wheelchairs. While this situation will occur in adapting many existing houses, new houses should be designed to avoid this problem.



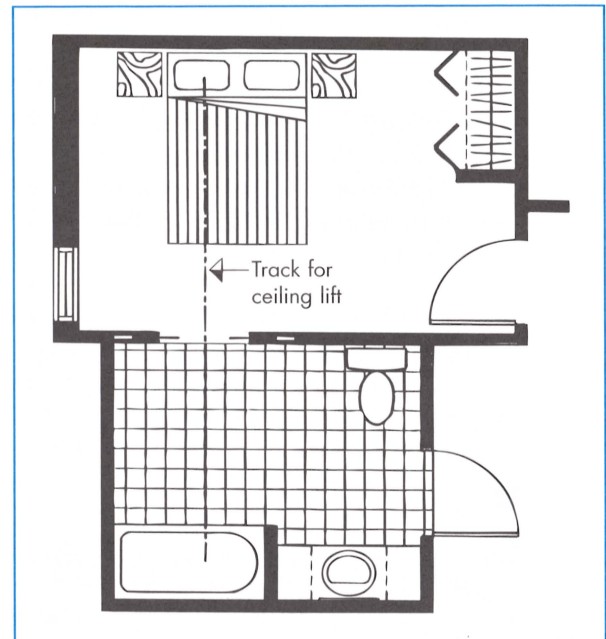
All elevator and lift installations must comply with the requirements of local building authorities, as well as the CSA requirements for residential elevators and lifts. It is also desirable to have a supplementary power supply for emergency situations. Where elevators or platform lifts are required to serve outside spaces or entrances, it is important to ensure adequate protection from the weather for passengers and equipment.

In selecting stairway platform or chair lifts, particular care must be taken to ensure they meet the specific needs of the occupants with disabilities.

For people who are generally mobile but have particular difficulty in climbing stairs, a stairway chair lift can be a suitable solution, particularly in existing houses.

### ■ *Ceiling-mounted Hoists*

Some people with severe disabilities may require a ceiling-mounted hoist and rail to provide assistance in transferring to and from the toilet, bath and bed. At the time of construction, it is desirable to include structurally sound fixing points for these installations. The location will generally be based on the individual requirements of the occupant with disabilities (see also pages 28 and 39).



The bedroom should be located next to a bathroom to facilitate the installation of a transfer lift between the bed and the bathroom facilities.

# 5 *Interior Design*

## ■ *Floor Finishes*

## ■ *Maintenance of Floors*

## ■ *Wall Finishes*

## ■ *Other Considerations*

## ■ *Colour and Pattern*

## ■ *Furnishings*

For residential buildings that will be occupied by people with disabilities, it is often necessary to consider special interior design requirements. These include the selection of colours and finishes to minimize reflected glare and provide visual or textural contrast. The appropriate selection of patterns and materials can reduce maintenance requirements, minimize problems for those with visual impairments and limit unacceptable emissions.

### ■ *Floor Finishes*

Generally, all floors should be level, easy to clean and slip-resistant. People using wheelchairs often find it requires more effort to travel across carpeted, as opposed to, uncarpeted surfaces. However, many accept this disadvantage in their homes in order to gain other benefits. For instance, carpeting reduces the transmission of noise, has a pleasing appearance and contributes to the warmth of a room. It may also reduce the seriousness of falls. For children with mobility impairments who are encouraged to crawl, a carpeted floor is more comfortable and provides some traction.

Where carpeting is used, it should be of high-density, level loop nylon pile, no higher than 7 mm. Most carpets with cut pile make it impossible to wheel a chair and should be avoided.

Preferably, carpet should be glued down, with no underpad, since it increases friction for wheeled traffic,

and problems can occur as a result of carpeting that ripples or stretches under frequent use. If an underpad is used, it should be dense and of minimum thickness.

For persons with environmental hypersensitivity, carpet should generally be avoided, and hard-surface flooring with an acceptable finish should be provided.

Changes in the sound, colour or texture of floor coverings may be helpful in public areas to warn people with visual impairments that they are approaching hazards. In some situations, floor coverings should be selected for their particular sound characteristics.

Persons using canes and crutches for support are particularly susceptible to accidents on slippery surfaces. Floors in main entrances, bathrooms, washrooms, showers and kitchens should have slip-resistant qualities even when they are wet.

Terrazzo and vinyl sheet flooring can be slippery when wet unless they have slip-resistant surface treatments. Unglazed, low-sheen, ceramic tiles have excellent slip-resistant qualities, particularly if the edges are square rather than rounded. However, a good waterproof grout is essential.

In main entrance areas, or where outdoor wheelchairs may stand for any period of time, the flooring should be water-resistant and easy to clean.



## ■ *Maintenance of Floors*

Floor surfaces should be easy to clean. Waxing and polishing floors is difficult for most persons with disabilities. Surfaces that rely on special treatment for maintenance and appearance should be used sparingly. Hardwood floors or no-wax sheet vinyl with a permanent finish require minimum maintenance and are attractive.

While various waxes are available for smooth hard-surfaces, they are often difficult to apply. Waxes may also contribute to reflected glare, which is disorienting for many people with depth perception or other visual impairments. Finishes that reflect glare should be avoided.

A central vacuum system with accessible outlets mounted 460 mm above the floor may be desirable where carpet is used extensively.

## ■ *Wall Finishes*

Wall finishes generally should be soil-resistant and easy to clean. Today, a variety of easy-to-maintain finishes are available. They include low-gloss scrubable finishes, ceramic tiles and many types of washable sheet wallcoverings.

Glare, whether produced by the wall finish or as a result of extensive window surfaces, should be avoided. Large mirrors and reflecting wall surfaces are problematic for people with limited depth perception, low vision or cognitive problems. Therefore, reflective surfaces should generally not be located in busy paths of travel or public areas, such as entrances, lobbies or elevators.

Abrasive wall surfaces should also be avoided. Persons using wheelchairs may scrape their knuckles, and others with poor mobility or equilibrium problems often experience damage to skin and clothes caused by such surfaces.

## ■ *Other Considerations*

Off-gassing from glues, fibreboard, plywood, some synthetic products, plastics, carpet underlay, adhesives and fabrics may be a hazard to people with environmental hypersensitivity. If sealing these products cannot be guaranteed, they should be avoided. Consultation with occupants who have such problems is recommended before a final selection of finishes is made.

When designing for people who are hypersensitive to noise, or who are themselves likely to create an unusually high level of noise, consideration should be given to providing special soundproofing between rooms and between dwellings. In some cases, wall surfaces that absorb sound should be selected.

## ■ *Colour and Pattern*

Colour and pattern frequently have strong psychological effects on people. In addition, people with low vision or limited depth perception may have difficulty distinguishing between vertical and horizontal planes, or between parallel planes, such as stair treads and landings. To counteract this lack of depth perception, it is recommended there always be a clear colour or tone contrast between floors and walls, at door and window frames, and at stair nosings and other changes in level.

Heavily patterned floor coverings should be avoided since they may disorient people by disguising important level changes.

Contrasting colours, such as on end walls, are also highly recommended as an aid in way-finding, particularly in public areas.

Where the selection of colours is not made by the occupant, a range of light neutral colours may be desirable for the interior of individual residential units to allow the occupant maximum flexibility in the choice of furnishings.

For seniors and persons with low vision, colours at the warm end of the spectrum are the easiest to identify. Highly contrasting colours of this kind should be chosen to define clearly the boundaries of working surfaces, such as kitchen counters and vanities.

All colours should be selected under lighting conditions similar to conditions at their final location, as colours read differently under differing light sources and levels of illumination.

## ■ *Furnishings*

All accessible routes should be free of protrusions from walls, floors, ceilings and other overhead structures that could be a hazard, or obstacle, for people who have mobility or visual impairments.

In selecting and placing furnishings for public areas, care should be taken to ensure that hazards, such as sharp edges and obstacles to people who have mobility, co-ordination or visual impairments, are not created.

Shelving, counters and furniture should be sturdy, very stable and strategically placed, so that persons with limited strength, endurance or co-ordination may use counters, chair backs, cabinets and other furnishings for support as they move about their homes.

Drapery and furniture fabrics that contain incompatible fibre mixes often create lint and dust as hard fibres (synthetic) rub against soft (natural) fibres. Mites and other microscopic organisms that thrive on these conditions are a major contributor to allergies that affect breathing passages and soft body tissues. If these fabrics cannot be effectively treated, they should be avoided in the homes of people with environmental hypersensitivity.

In public areas, fabrics and finishes that are durable, fire safe and easy to maintain should be selected.



# 6 Appliances

## ■ Ovens and Cooktops

## ■ Microwave Ovens

## ■ Refrigerators and Freezers

## ■ Washers and Dryers

### ■ Ovens and Cooktops

Wall ovens and counter-top ranges generally provide a greater degree of accessibility and safety for people with disabilities, compared to stoves.

Cooking surfaces should be level with adjacent counters and adjustable if adjustable-height counters are provided. Controls should be positioned at the front or side of the cooktop, so that users do not have to reach over hot burners or elements. Burners and elements should be stable, level and easy to clean. Continuous ceramic cooking surfaces are a good way of meeting these criteria.

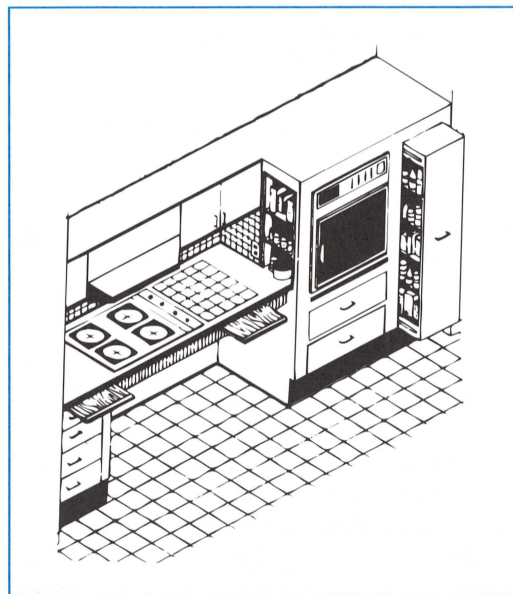
Additional features that can improve safety include offset burners and elements that make it safer to reach to the back of the cooktop, large, easily turned knobs with light indicators, tactile markings and an audible click when switched on or off.

An exhaust hood and fan over the cooktop, directly ventilated to the outdoors, is recommended. Controls should be easily reachable from a seated position.

Ovens should be wall-mounted, self-cleaning and have side-opening doors. The lowest oven shelf should be just above kitchen counter height. A pull-out work surface to receive hot pans should be provided below an oven with a side-opening door. There should be knee space at least 680 mm high under this work surface. Ovens with flip-down doors are unsuitable for people who use wheelchairs. If they are provided, there should be a pull-out work surface adjacent to the oven.

### ■ Microwave Ovens

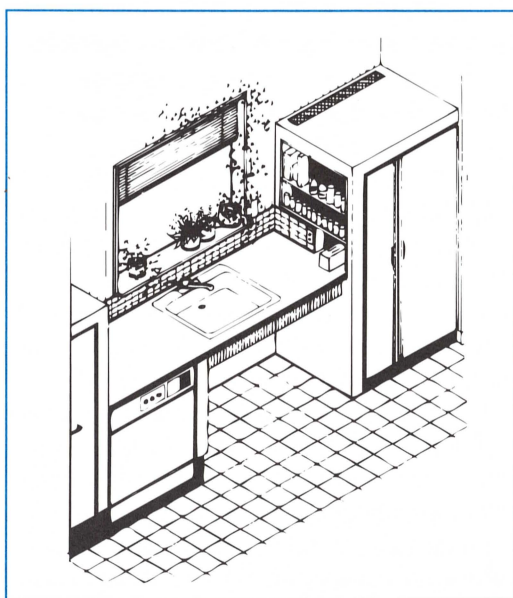
Microwave ovens are useful for many people with disabilities, as they allow easy defrosting, heating and cooking of frozen or preprepared items. They should be mounted on the counter in a location where loading and unloading is not impeded by the door swing.



Ensure that sufficient counter space for hot pots and pans is provided on either side of cooktops or ovens. Pull-out cutting boards and cabinets also provide easy access and use.

## ■ **Refrigerators and Freezers**

Most people using wheelchairs prefer a refrigerator model with a side-by-side freezer and refrigerator arrangement for easy access, although some seniors may prefer an upper freezer section. Whichever kind is used, automatic defrosting should be included for easy maintenance. Care should also be taken in designing kitchen layouts to ensure that refrigerator and freezer doors can be fully opened for easy access. The “hanging” of the door should be checked with the occupant whenever possible. A counter surface should be provided adjacent to the open side for easy transfer.



Ensure that some open counter space is available beside the refrigerator-freezer as an aid to storing and retrieving food.

## ■ **Washers and Dryers**

A combination washer/dryer eliminates the need to lift bundles of wet clothes. A front-loading machine with front-mounted controls is preferred. This may be placed on a platform to raise it to a convenient height for a person in a wheelchair or a person who cannot bend comfortably.

Where a dryer is stacked over a washing machine, the upper door should be at a height no greater than 1370 mm, about shoulder level, to provide a view into the machine and allow easy loading. Controls should be at the front of the machines and no higher than 1200 mm from the floor. There should be a 1500 mm x 1500 mm clear floor space in front of the machines.

Where a person in a seated position cannot use the top of a washer or dryer for folding clothes, a separate and nearby work surface, with appropriate knee space below, should be provided. The top of the work surface should be between 760 mm and 865 mm from the floor.

The standard portable ironing board is hard to set up. A balanced, built-in (i.e., wall-mounted) board, adjustable to heights between 600 mm and 850 mm, is preferable and can be moved out of the way easily when not in use.



# 7 *Building Systems*

■ *Heating, Ventilation and Air Conditioning*

■ *Lighting*

■ *Controls*

■ *Security Systems*

■ *Communication Systems*

■ *Signage Systems*

■ *Other Technologies*

## ■ *Heating, Ventilation and Air Conditioning*

Some people with disabilities are limited in their activity levels or in their ability to control their body temperature. In such circumstances, central-heating and air conditioning systems should provide for temperature adjustments, within a range between 19°C and 25°C, for individual rooms or floors, and should be responsive to small fluctuations in temperature.

### ■ *Heating*

In bathrooms and in changing areas associated with recreational facilities, supplementary heat may be desirable. This may be provided by radiant panels, floor heating or overhead heat lamps. All supplementary heating should be controlled by an accessible and easily adjustable time switch that is not linked to the lighting or fan switches.

Some people with disabilities are not able to detect, or quickly move away from, potentially dangerous hot surfaces. Therefore, radiators and hot pipes with surface temperatures higher than 43°C should be shielded to avoid injuries.

It is particularly important in designing housing for people with environmental hypersensitivity that any pollutants or odours from combustion heating systems are not allowed to enter living spaces.

## ■ *Ventilation and Air Conditioning*

In the selection of ventilation or air conditioning systems, the ability to control temperature, air velocity and direction could be important. For example, low-velocity diffusers and variable-speed fans can be used to control air flow around seated persons.

For some seniors and other people with breathing difficulties, the control of humidity is an important consideration. A system to maintain acceptable levels of humidity throughout the year can aid breathing and help to maintain good skin condition. It can also prevent the growth of toxic moulds in buildings.

It is particularly important for people with environmental hypersensitivity that both incoming make-up air and recycled air be filtered. Most commonly used filters only remove particles, not gases. It is, therefore, important to minimize the use of materials and equipment that give off noxious gases.

Rooms such as workshops and hobby rooms should have positive exhaust ventilation to prevent the flow of dust and fumes into the living areas.

## ■ **Lighting**

### ■ **Lighting in Public Areas**

#### **Exterior Lighting**

All pedestrian routes to the building and throughout the site should be evenly lit, between 50 lux and 100 lux, as an aid to safe mobility for persons using the building. Exterior parking areas should be lit to at least 50 lux.

Exterior signage and way-finding elements should have a level of illumination of about 200 lux to ensure legibility.

Underground garages, including routes to elevators and storage areas, should be lit to at least 100 lux.

Entrances should be lit to at least 200 lux.

Security lighting, which may be motion-activated, is recommended for driveways and other vulnerable areas.

#### **Interior Lighting**

All entrance vestibules and interior circulation routes, including elevator lobbies and cabs, should be lit to at least 100 lux at all times (200 lux is preferred).

In all exit or emergency stairs, lighting levels should be at least 100 lux at landings and 50 lux over stair treads.

At the entrances to dwelling units, lighting levels should be increased to at least 200 lux for security, identification and ease of access.

In offices, recreation and amenity areas, including public telephone locations, general lighting levels should be at least 200 lux. Additional task lighting is recommended in all high-activity, work and recreation areas.

Lighting in all service and storage areas should be at least 100 lux.

Lighting quality, as well as intensity, should be considered in selecting fixtures and lamps. Full spectrum lighting enables boundaries of objects and colour contrasts to be more easily distinguished and should be selected for most public circulation routes.

All electrical panels should be accessible and have rocker/automatic reset-type circuit breakers.

Emergency lighting should be provided in all public corridors, stairways, and enclosed parking areas.

### ■ **Lighting in Residential Spaces**

Changing light bulbs in ceiling fixtures is difficult or impossible for many people with disabilities. Ceiling fixtures with a retractable cord should be considered, so that the light may be pulled down to a lower height when the bulb must be changed. Fixtures with more than one light bulb are also useful, so that when one bulb burns out, some light continues to be provided until it is replaced. Rheostat light controls allow individuals to adjust lighting to meet their needs and preference.

The living area should have provision for high levels of lighting for such activities as reading and sewing. Overhead lighting with a rheostat control may be used, augmented by free-standing lamps or other task lighting.

The dining space often also serves as a work, hobby or play area. These activities require differing intensities of light, which may be met by providing a rheostat control.

In the kitchen, general lighting should be installed to ensure direct, shadow-free light over all horizontal work surfaces, including the stove and the sink area. Supplementary task lighting should be provided over work areas.

Provisions for lighting in the bedroom should be sufficiently flexible to permit the use of a variety of lamps and fixtures, including floor lamps, bedlights, dresser lamps and, in some cases, a ceiling lamp. Sufficient electrical outlets should be provided to make this possible. At least one light source should be controlled by three-way switches at the entrance and bedside.



In the bathroom, there should be a separate light over the washbasin as well as an overhead fixture for general illumination.

All closets and storage areas should be provided with lighting.

## ■ **Controls**

### ■ **Switches**

At the entrance to every room, there should be a switch for a light fixture or an electrical outlet, making it unnecessary to pass through an unlighted area to reach a switch.

Light switches should be mounted between 840 mm and 1050 mm from the floor. This facilitates their use by persons in wheelchairs and makes it possible to operate them with an elbow. Switches mounted over counters should be within easy reach of a seated person. Large rocker switches can be easily operated by people with limitations in manual dexterity. The switches controlling lighting in hallways, bathrooms and bedrooms should have locator lights.

Three-way switches should be provided to control lighting in stairways and to allow garage and carport lights to be controlled from inside and outside the house.

Where dimmer switches or rheostats are utilized, care should be taken to select devices that are easy to manipulate and do not interfere with hearing aids.

### ■ **Electrical Outlets**

A generous number of electrical outlets throughout a dwelling contributes substantially to the lighting system's flexibility. Outlets should be placed not less than 450 mm above the floor. Duplexes for kitchen and laundry equipment and countertop appliances should be reachable from a seated position.

## ■ **Building-system Controls**

In dwellings designed for people with disabilities, all controls for building systems to be operated by the occupant should be:

- in accessible locations;
- adjacent to clear floor space at least 750 mm wide;
- located between 450 mm and 1200 mm from the floor;
- operable with one hand;
- of a type that does not require tight grasping, pinching or twisting of the wrist;
- in positions where they can be illuminated; and
- provided with tactile markings to aid people with vision impairments.

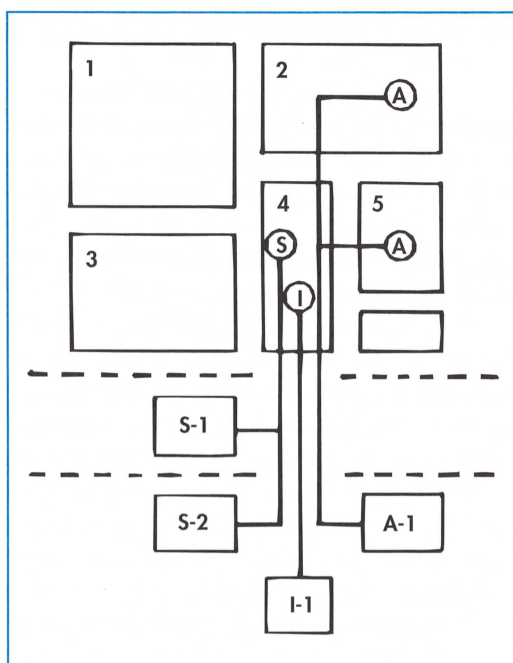
## ■ **Remote Controls**

Motorized operators and remote-control systems can assist people with severe disabilities in controlling their indoor environment and activities, and in enhancing their independence. Applications could include heating and air conditioning, doors, windows, drapes, blinds, lighting, appliances, security, communications and entertainment.

## ■ **Security Systems**

### ■ **Fire Safety**

It is particularly important to consider ways of ensuring the safety of persons with disabilities in the event of fire. Many are unable to move quickly and freely and may not be able to use normal escape routes. These problems can be compounded in highrise apartment buildings.



#### Suggested Alarm System Locations

- 1 Salon
- 2 Bedroom
- 3 Kitchen
- 4 Entrance
- 5 Bathroom
- A Alarm system
- A-1 Central alarm terminal
- S Smoke detector
- S-1 Voice communication system
- S-2 Fire alarm panel in lobby
- I Intercom
- I-1 Intercom system in lobby

The National Building Code of Canada includes general fire safety requirements for all highrise buildings. However, evacuation, and other strategies for the safety of persons with disabilities in multistorey buildings, should be fully discussed with the local authorities and their requirements reflected in the design.

Generally, where persons with disabilities are housed on floors above or below the first storey, it is recommended that:

1. An area of refuge be considered on each of the floors that do not exit directly to grade. This may be

achieved by creating a fire separation on the floor, or by creating a discrete, ventilated area of refuge, capable of accommodating a number of persons.

2. Balconies may be used as supplementary refuge areas. Such balconies may serve individual units or a group of units.
3. Smoke detectors, complying with all local regulations, should be installed in each apartment unit and be connected to a central alarm terminal.
4. An alarm, connected to the building's central fire-alarm system, should be installed in each dwelling unit. All alarms in public areas and dwelling units should have both audible and visible signals. Some people with hearing impairments may also require a vibratory signal to alert them at night.
5. For larger buildings, a direct communication link to the local fire hall or other central monitoring agency should be considered.
6. A central voice communication system should be available in buildings more than three storeys in height to provide information during an emergency.
7. The location and style of exit signs and other way-finding devices should be reviewed with the client and local fire authorities.
8. At least one elevator should be designed to satisfy the National Building Code and CSA requirements for a fire fighter's elevator. It should be equipped with a two-way voice communication system.
9. A comprehensive fire-safety plan that specifically addresses the needs of persons with disabilities, as well as other tenants, should be developed.



### ■ **Building Security**

In buildings that house people with disabilities, it is particularly important to include security systems to limit access by unauthorized persons. Various systems are available, including remote-control cameras and monitors, and card access to the building. Where such systems are included, controls and access cards that are easily usable by persons with various disabilities should be selected.

### ■ **Personal Security**

Many seniors living alone, as well as persons with disabilities, may require personal communication or emergency response systems they can use in emergencies. Such systems may be activated at call stations or by remote control and should be linked to the building's telephone or central communications system. A designated response location should be considered in buildings with a large number of occupants, and where staff are available around the clock. All signalling devices should be accessible to and usable by persons with varying disabilities.

Since many domestic accidents affecting seniors and people with disabilities occur in the bathroom, a call button or other means of summoning assistance may be desirable in this location. The signalling device should be operable by someone lying on the floor. Where such a signalling device is required, a monitored answering location must be assured.

### ■ **Communication Systems**

#### ■ **Telephones, Intercom, P.A. and F.M. Systems**

All intercom and telephone systems used within the building should be suitable for use by persons with varying disabilities. Therefore, intercom speakers and two-way voice communications equipment should be mounted within

reach of a seated person and/or be operable by remote control. All buttons and controls should be easy to distinguish by persons with visual impairments. Closed-circuit television can be incorporated into intercom systems to allow residents with hearing impairments to view and communicate with people at entrance doors.

Accessible public telephones should be provided in key locations and screened for privacy and acoustical quality. Telephones should be mounted with controls no higher than 1200 mm. A shelf should be provided at a height of 840 mm to hold T.D.D.s, telephone directories, personal belongings, etc., and to provide support.

Where a public address system is provided, for example, for fire emergencies, the system should provide clearly audible transmissions to all public areas of the building, including all corridors, stairs, lounges and recreation areas.

Where large assembly or meeting areas are provided, consideration should be given to the inclusion of an F.M. loop system, or other means of enhancing the audio system, for persons with hearing impairments.

It is important to recognize that today's hearing aids are subject to electromagnetic interference, which inhibits their use in certain environments. Sources of interference include fluorescent ballasts, rheostats, solenoids, transformers, T.V.s and computers. Even runs of major service cables and wires can contribute to the problem. Therefore, the layout of wiring systems and the placement of elements that produce such emissions should be properly assessed to minimize interference for those using hearing aids.

## ■ **Signage Systems**

### ■ **Signage and Way-finding**

Signage is used for both building identification and for way-finding inside and outside the building. For persons who have difficulty reading signs, such as people with visual impairments, other methods of communicating directional or way-finding information may be necessary.

Designers should ensure that approach routes and main entrances are highly conspicuous.

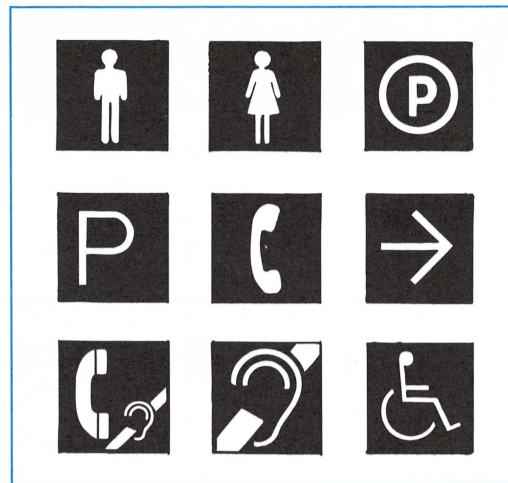
Way-finding strategies that may be useful for persons with visual impairment or cognitive limitations include highly contrasting colours and other clear visual cues and reminders to define boundaries and essential elements.

Both visual and tactile directional signage should be provided. It should be large enough to be easily read by persons from normal approach distances. Lettering and symbols should be raised so they can be read by touch. It can also be desirable to supplement important graphic or tactile information with audio-taped information or braille.

In public areas where graphics are used to complement other signage, the symbols and pictographs selected should comply with known standards and symbols.

All signage should have lettering or numbers that contrast highly with the background colour, be well-lit and mounted at eye level (i.e. between 1300 mm and 1600 mm). Where free-standing or projecting signs are used, care should be taken that these are not located in normal walking areas.

Directories and resident information in entrance areas and on post boxes should be displayed in lettering which is easily legible. Tactile cues may also be desirable.



Use high-contrast standard pictographs to enhance signage on facilities or amenities available to persons with disabilities.

Internal signage should clearly indicate directions to elevators, stairways and exits, as well as to other essential amenities and services.

At doors leading to stairways and ramps, there should be both visible and tactile information to indicate that there is a ramp or stair on the other side of the door.

Elevator signage, both inside the cab and in elevator lobbies, must conform to the requirements of the National Building Code and the CSA Elevator Code (see also page 14).

Apartment numbers at unit entrance doors should be placed between 1370 mm and 1600 mm above the floor, at the latch side of the door. Raised numerals are preferred, so that persons with limited vision can identify them by touch.

Instructional information for operating building equipment and systems should be easy to locate and legible to persons with low vision.



### ■ *Other Technologies*

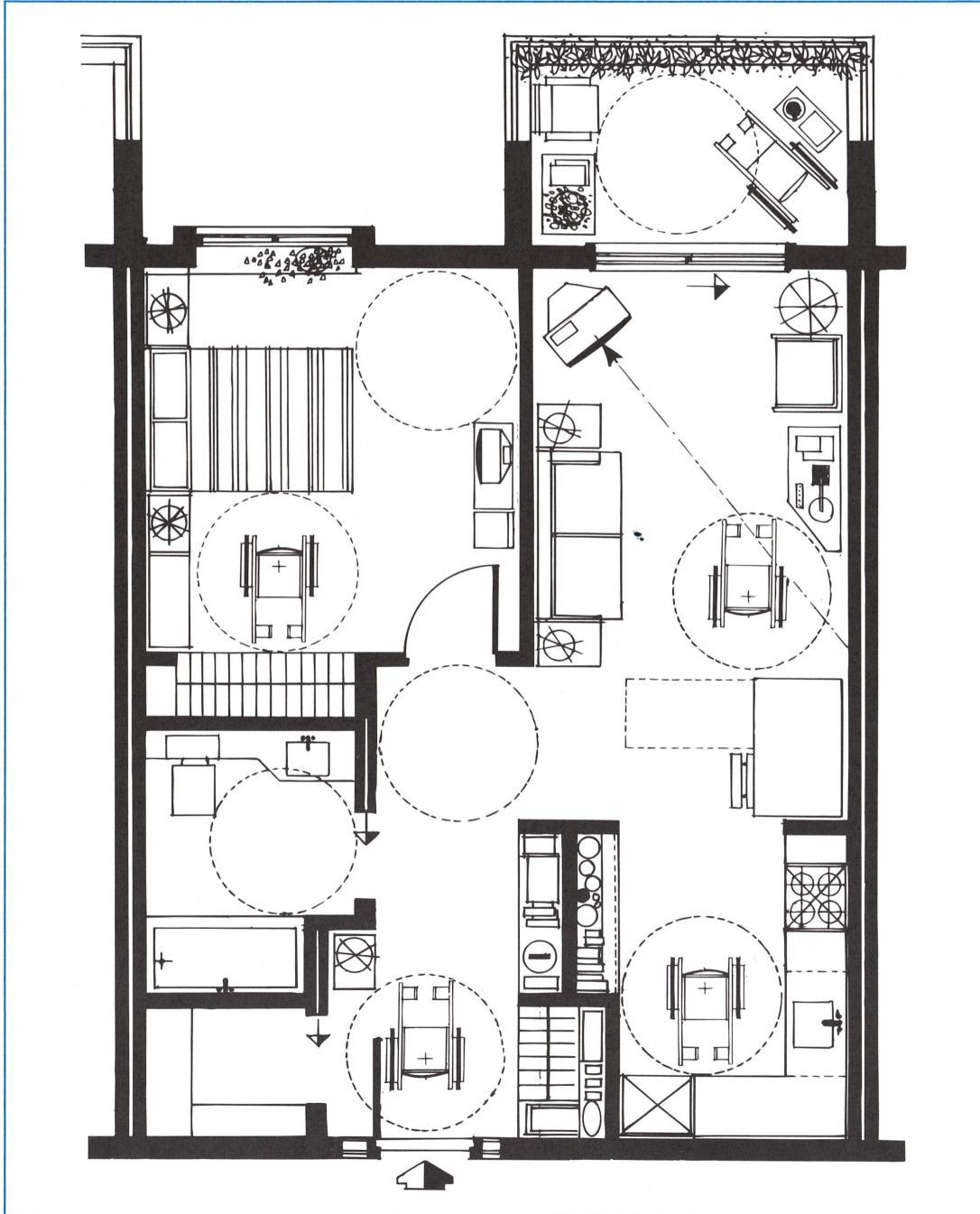
Emerging technologies, including home automation systems, will play an increasing role in enabling people with disabilities to enjoy independent lifestyles by helping them carry out daily tasks and enhancing their safety and comfort. They can also provide access to new fields of communication, entertainment and home-based employment.

In developing new housing or adapting existing housing for people with disabilities, consideration should be given to how these technologies could benefit the intended occupants. In some cases, it may be appropriate to install technological aids, devices and controls during construction. In other cases, dwellings could be prewired to facilitate the future installation of home automation systems based on protocols such as CEBus or Echelon.

# Appendix A

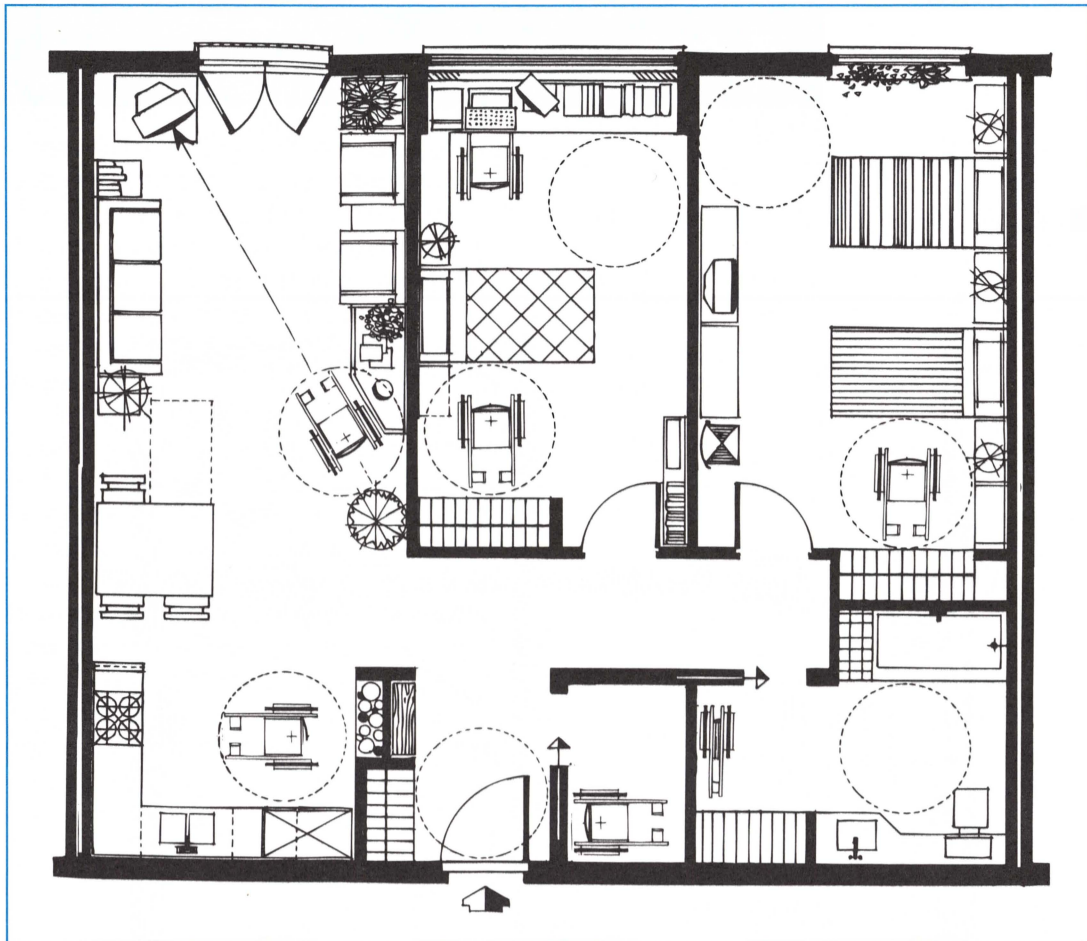
## ■ Unit Designs

### ■ Unit Designs



Typical one-bedroom accessible layout. Note: many variations are possible.





Fully accessible two-bedroom layout. Actual configurations and furniture layouts may vary considerably from project to project.

# Appendix B

## ■ CMHC Resource Information

## ■ Other Sources of Resource Information

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