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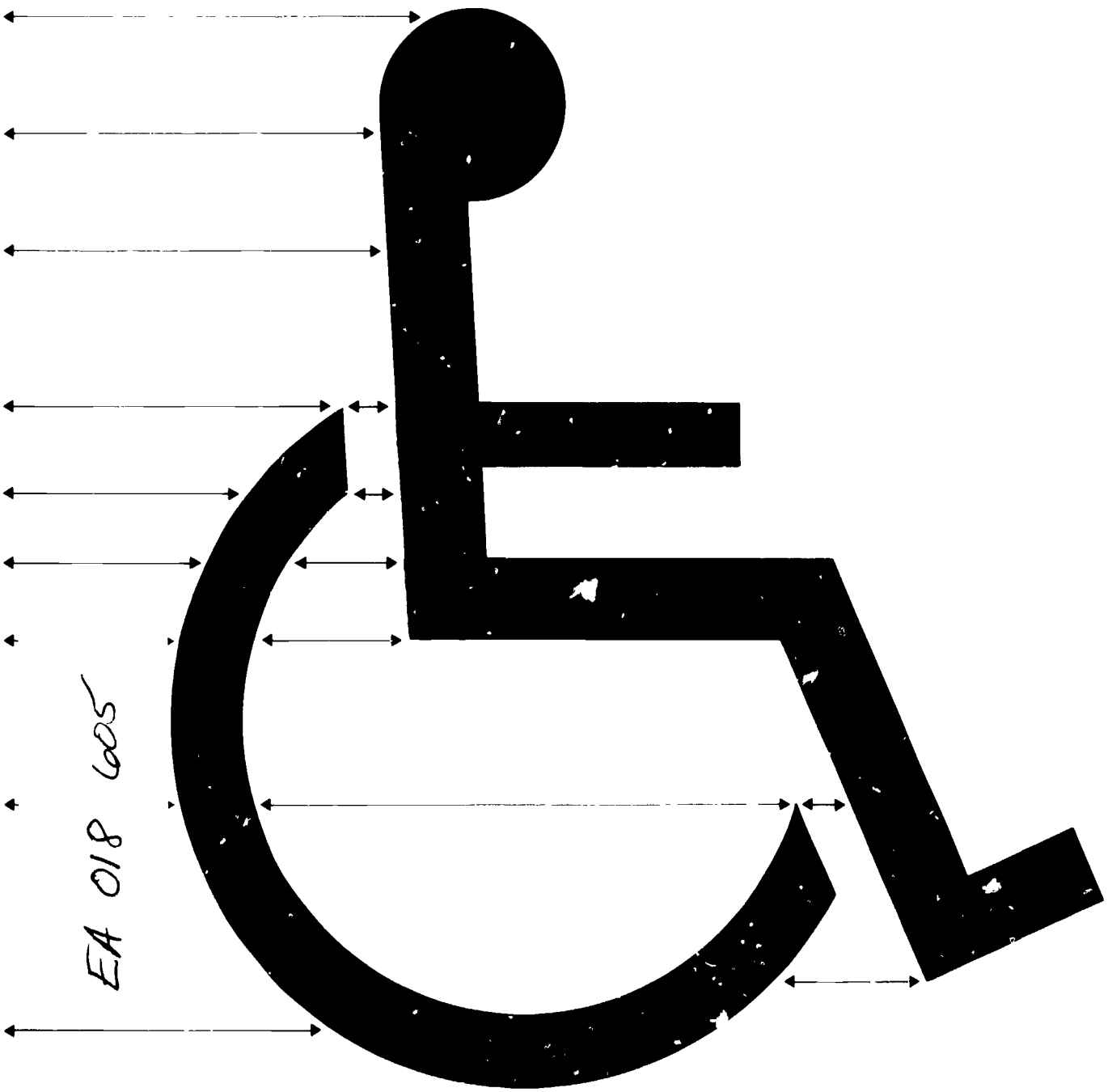
ABSTRACT

This publication provides instructions and visual diagrams both for adapting existing structures and for building new facilities to meet the special needs of the disabled. Each of the two main sections is divided into two parts: "The Site" and "The Building." The first section, "Modification of Existing Schools," covers topics of grading, walks, curbs, parking lots, ramp requirements, entrances, internal doors and doorways, stairs, handrails and balustrades, elevators, platform and chair-type lifts, washrooms, water fountains, cloakrooms, public telephones, floors and floor finishes, and wall finishes. The second section, "New Facilities: Planning for the Disabled," discusses size and location of the site, topography, landscaping, schoolgrounds, corridors, classroom and instructional areas, cafeterias, auditoriums and lecture halls, and swimming pools. The much briefer third and fourth sections, "Special Features and Equipment" and "Physical Environment," include instructions for work and storage areas, chalkboards, work tables, sand and water tables, art easels, carrels, water, window sills, lighting, and safety. Three appendixes include charts of anthropometric data, wheelchair data, and a checklist. (IW)

Ministry of Education
Ontario

The Honourable Sean Conway, Minister

Designing for the Physically Disabled



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Frank Sebo, Special Education Branch, Ministry of Education

Cover
The stylized symbol of a person in a wheelchair is the international symbol used to indicate accessibility to the disabled

Contents

Introduction

This publication replaces the document *Designing Schools for the Physically Handicapped*, originally published in 1974. It draws upon continuing provincial experience in planning and developing appropriate means of providing barrier-free schools, with the goal of adapting existing structures so that special needs do not stand in the way of universal access to publicly supported education.

Please Note:

1 Access guidelines referred to in this publication apply to all facilities unless otherwise specified.

2 Requirements for the disabled shall conform to the minimum standards set forth in the Building Code, Ontario, issued by the Ministry of Municipal Affairs and Housing, Ontario, Buildings Branch (including Ontario Regulation 583/83, Revised Ontario Regulation 549/84, and any subsequent amendments thereto).

3 All dimensions noted in this publication meet the minimum requirements.

4 Metric and imperial values may not be equivalent.

The Ministry of Education, Ontario, has an ongoing policy of improving the educational opportunities of the children, youth, and adults of this province, disabilities notwithstanding. This includes facilitating their access to as many buildings and educational areas as possible.

The growing number of disabled pupils attending secondary school through individual programming and the increasing use of schools by disabled adults and the elderly make barrier-free access to school buildings a relevant and urgent concern. Obviously, schools where all the programs offered are on the ground level present fewer difficulties to the disabled. If the building entrance is raised above the ground, ramps leading to the main entrance and to the school grounds should be provided. The provision of an elevator in multistoried schools should be seriously considered. At least one entrance should be accessible to persons using wheelchairs, while all classrooms should be accessible to wheelchairs. Where the school comprises a number of detached buildings, it should be possible to travel between them without having to negotiate steps. A consultative process involving the various participants can help to determine what additional allowances and modifications need to be made.

Implementation of the suggestions contained herein would bring the goal of equality of educational opportunity for all citizens of Ontario another step closer to realization.

Modification of Existing Schools

The Site

Grading
Grading can make a ground-level entrance accessible to individuals with physical disabilities

Walks
– Walks should be at least 1500 mm (5 ft) wide with a maximum gradient of one in twenty It is very important that the gradient of walks and driveways be less than that prescribed for ramps, since walks lack handrails and are considerably longer Walks of near maximum grade and considerable length should have level areas at intervals for purposes of rest and safety

– Walks should have a continuous common surface, not interrupted by steps or abrupt changes in level

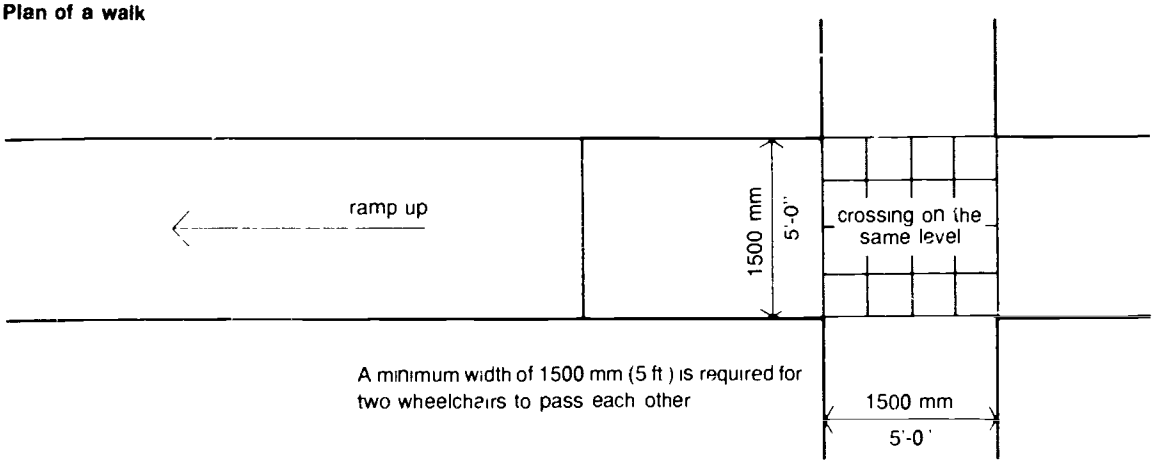
– Walks or driveways should have a non-slip surface.

– Where walks cross a curb, the curb should be cut and a ramp provided in the walk to meet the road level

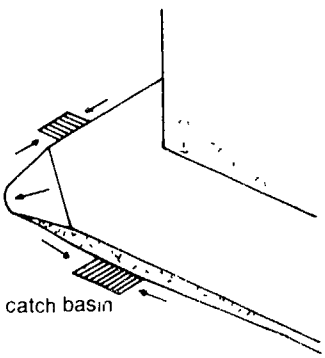
– Where a T-intersection of walks meets a curb, sloping from all three directions towards the curb cut is required

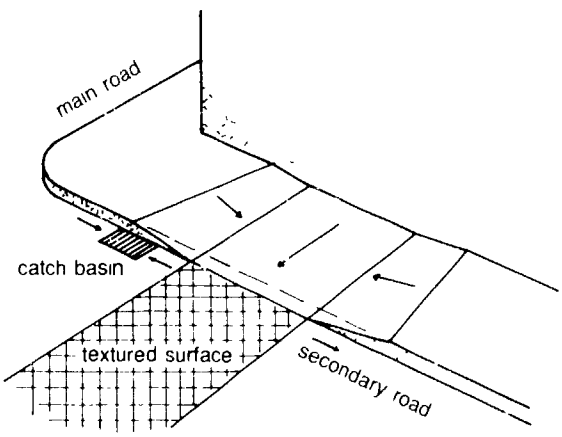
– Wherever walks cross other walks, driveways, or parking lots, they should blend to a common level. A differently textured surface material at these junctions would help orientate the visually disabled

Plan of a walk

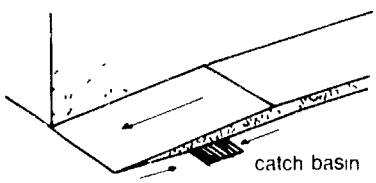


Curb cuts





different ways of cutting curbs for ramps to road level



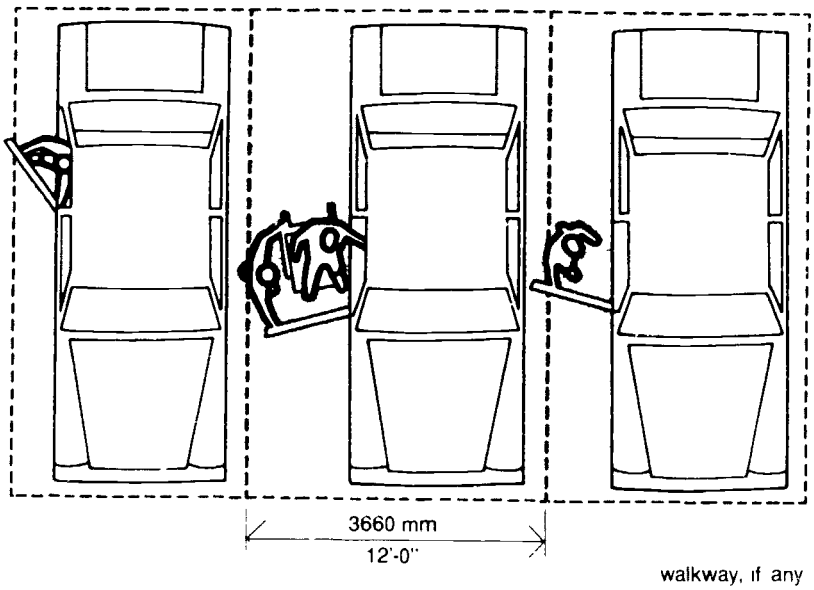
Parking

- Parking spaces that are accessible and close to the school entrance should be reserved and identified for use by persons with physical disabilities

– Designated parking places for disabled persons should be 3660 mm (12 ft) wide, situated on level ground, and paved if possible

– There should be a curb cut in the walkway nearest to the designated parking spaces

Plan of designated parking place

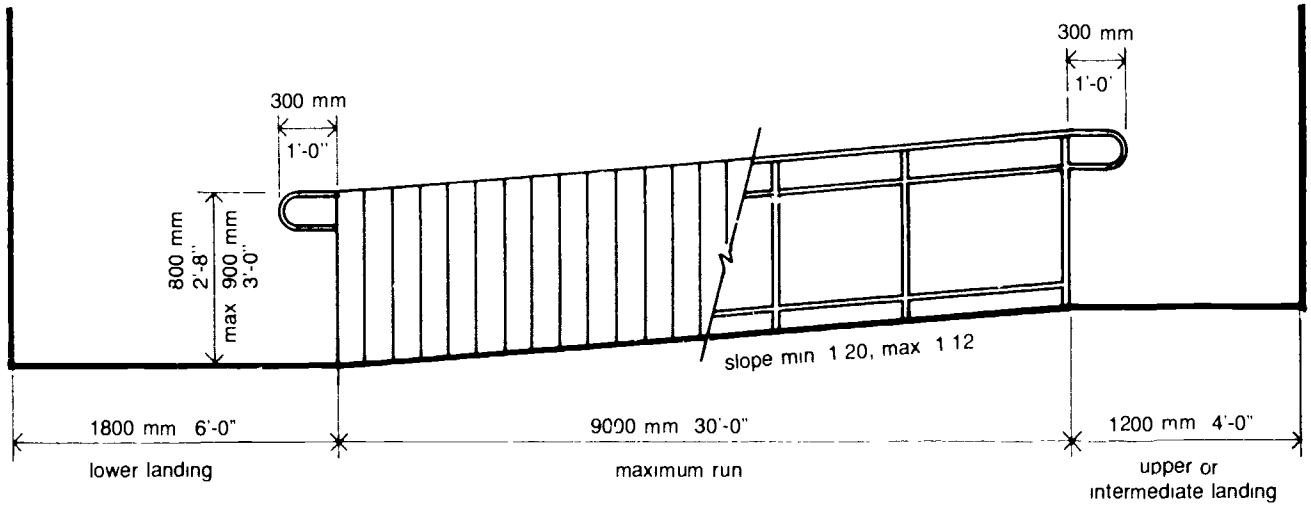


The Building

Ramp Requirements

– Where it is necessary to provide a ramp, a maximum gradient of one in fifteen is recommended However, even the steepest ramp is more easily managed by wheelchair users than a flight of steps If a ramp of the preferred gradient is impossible, one with a maximum gradient of one in twelve is better than no ramp at all, provided that steps are available for the use of non-disabled and ambulant disabled people

Ramp and platform section



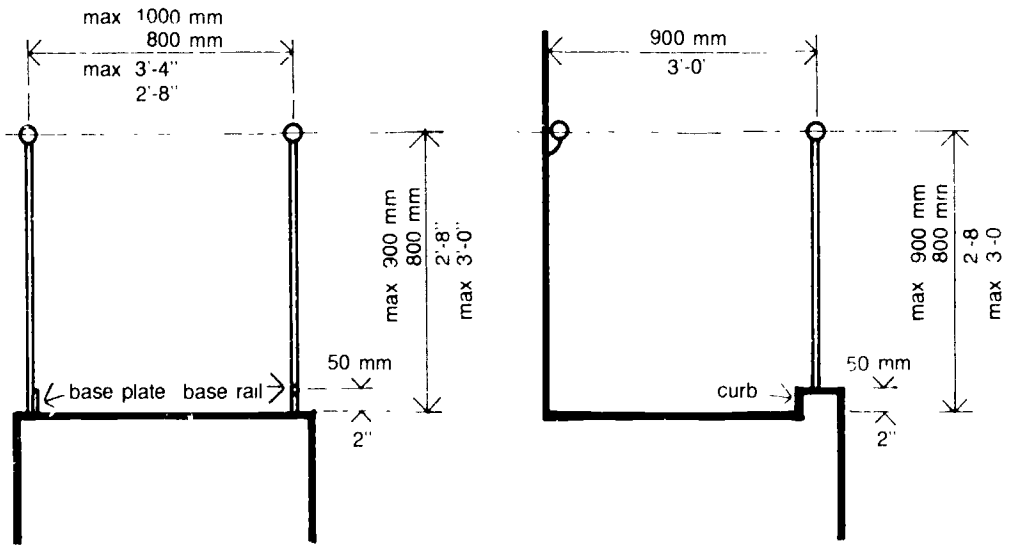
– Ramps should have a non-slip surface Various additives, such as traprock or carborundum, can be applied to concrete or bitumen surfaces

– The minimum width for ramps should be 900 mm (3 ft.).

– A ramp shall have two handrails, not less than 800 mm (2 ft 8 in) or more than 1000 mm (3 ft) apart to assist those who can walk without crutches but still need support

– Handrails should extend at least 300 mm (1 ft) beyond each end of all ramps

Ramp sections



– Ramps should have level platforms at 9000 mm (30 ft) intervals for purposes of rest and safety These platforms should be the same width as the ramp and at least 1200 mm (4 ft) long

– Each ramp should have at least 1800 mm (6 ft) of level platform at the bottom

– Ramps should have a level platform wherever they turn

– Exposed ramps should be protected from snow and ice accumulation This can be accomplished by providing a roof over the ramps or by installing controlled snow-melting devices

– A curb should be provided on the exposed side of the ramp where the gradient exceeds one in twenty Curbs should be a minimum of 50 mm (2 in) high

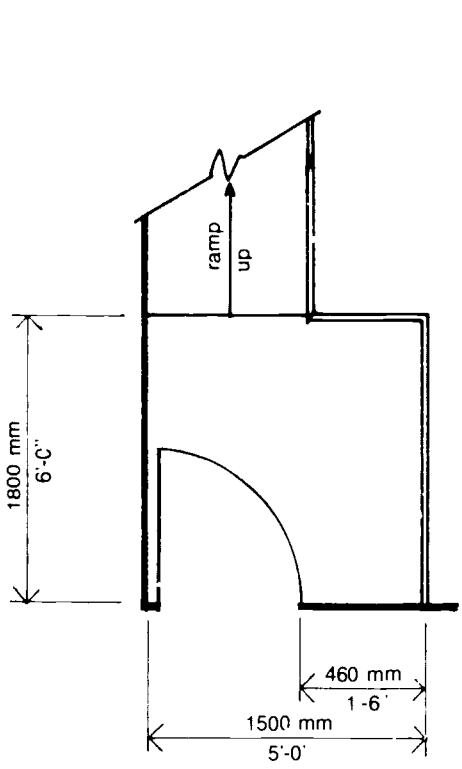
– Care should be taken to ensure that curbs provided for wheelchair users do not present a hazard for others

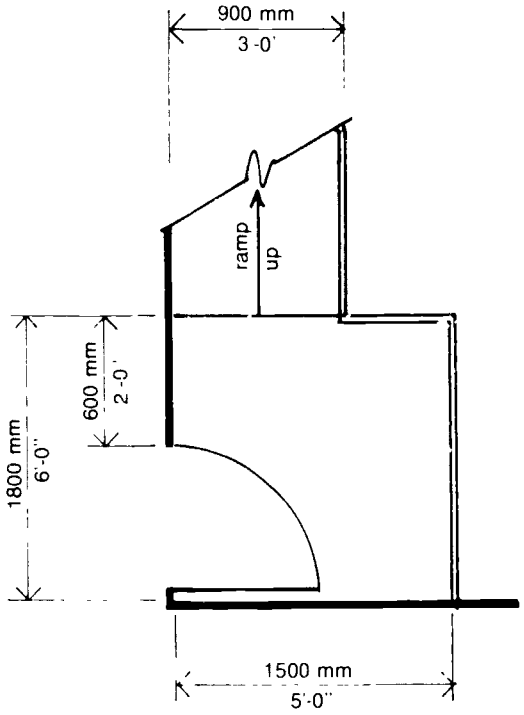
– Where a ramp is above the level of the ground floor of a building, a balustrade, parapet, or railing not less than 1070 mm (3 ft 6 in) high should be provided, and the handrail should be fixed to it at a height of 800 mm to 900 mm (2 ft 8 in to 3 ft)

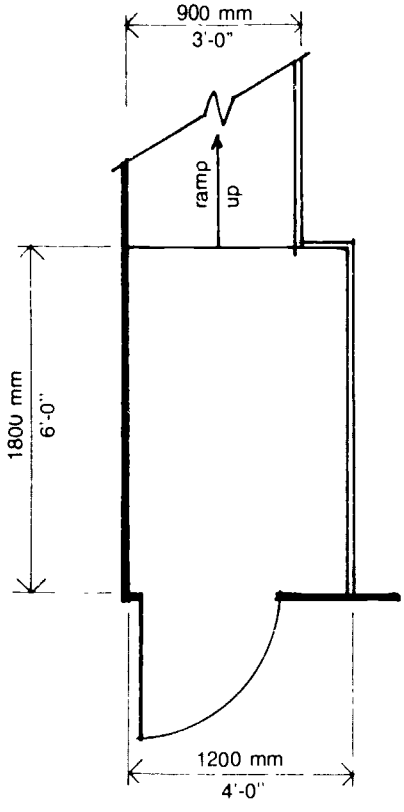
– Where a door at the top of a ramp swings towards the ramp, the level platform should be at least 1500 mm x 1500 mm (5 ft x 5 ft) If there is a frontal approach, the platform should extend at least 460 mm (1 ft 6 in) beyond the latch side of the doorway, if the approach is lateral, the platform should extend at least 600 mm (2 ft) beyond the latch side of the doorway Where a door swings outwards at intermediate landings, the platform should be at least 1500 mm (5 ft) in length

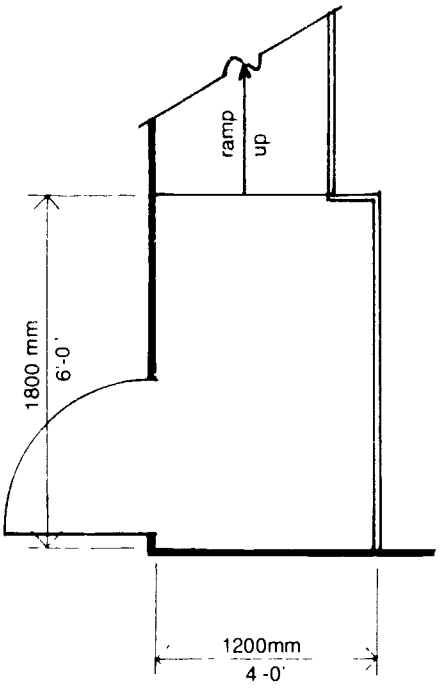
– Where a door at the top of a ramp swings inwards, away from the ramp, the level platform should be at least 1200 mm x 1500 mm (4 ft x 5 ft) Where a door swings inwards at intermediate landings, the platform should be at least 1500 mm (5 ft) in length

Plans of bottom landings

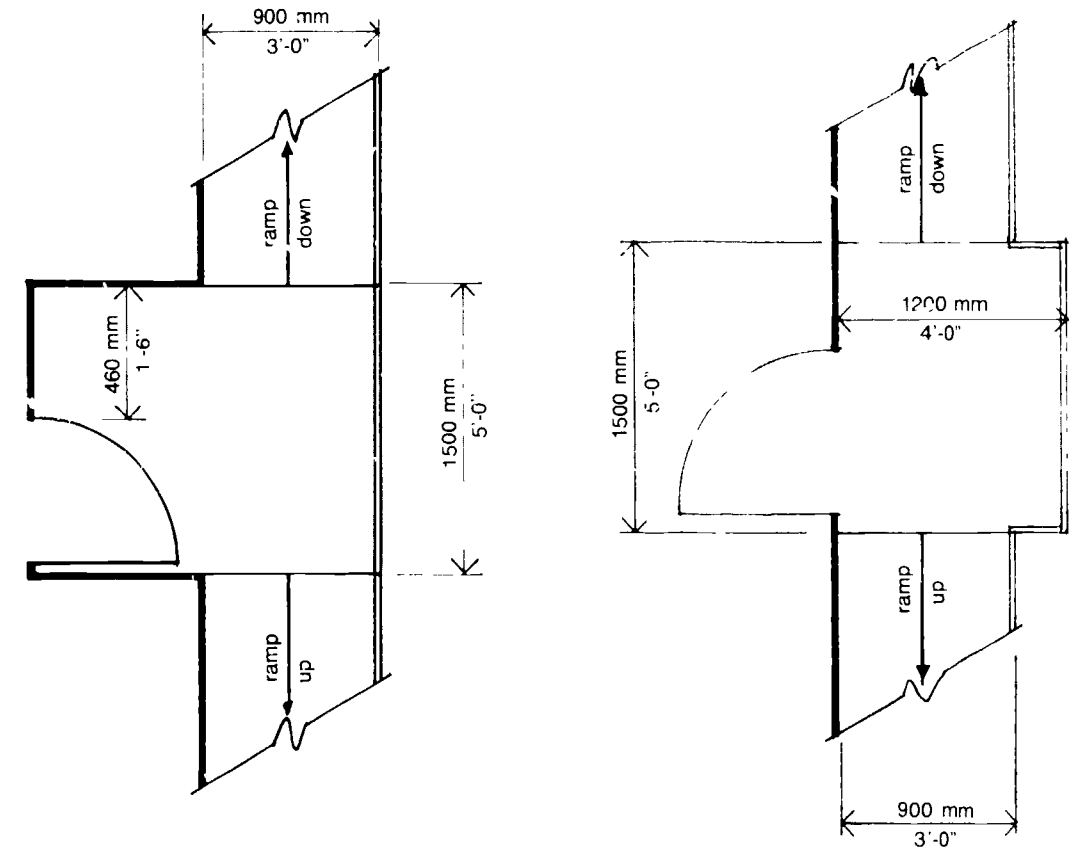


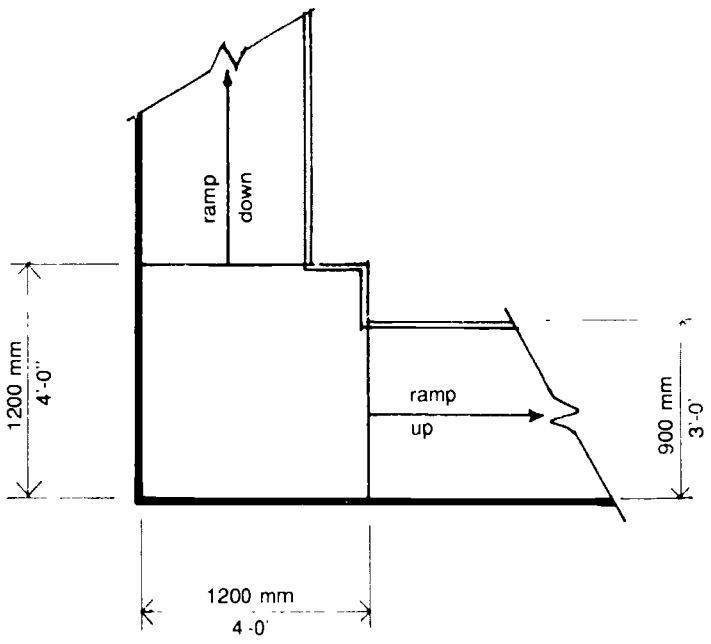




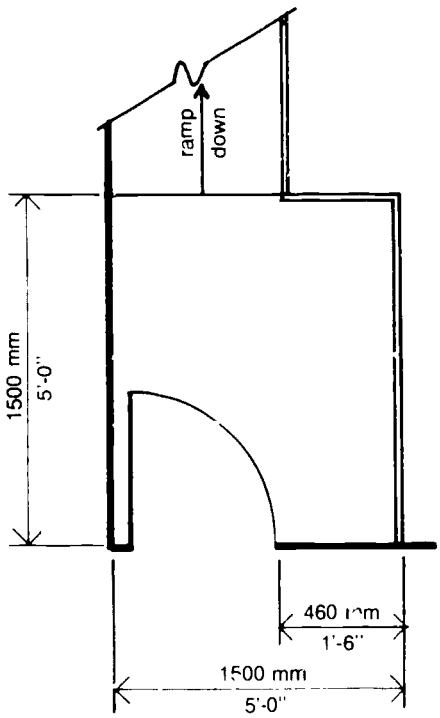


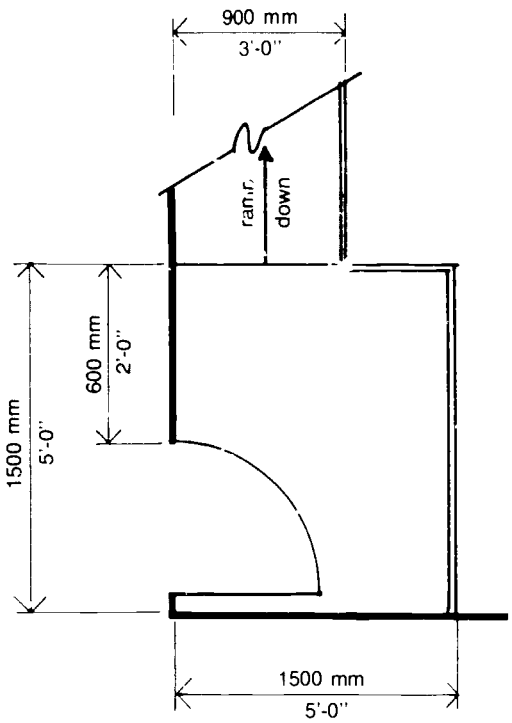
Plans of intermediate landings

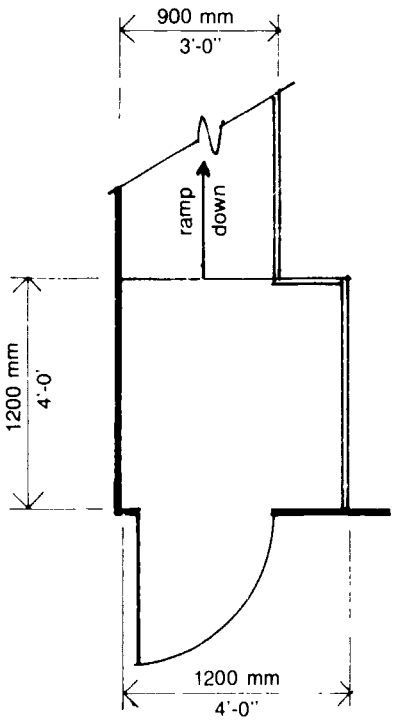


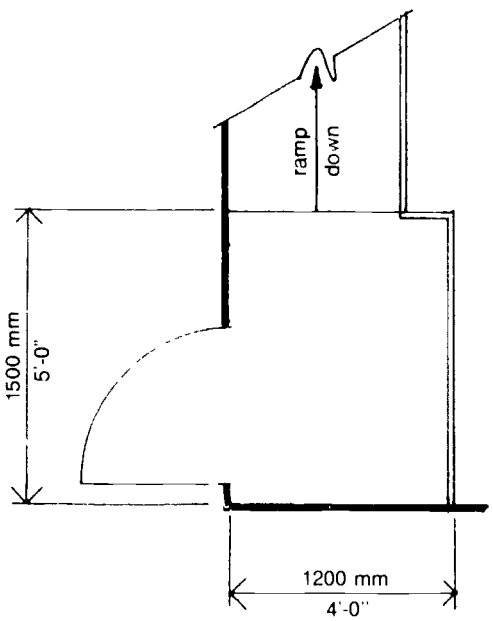


Plans of top landings









Entrances

– At least one entrance to each building should allow access to persons in wheelchairs.

– A canopy of at least 900 mm (3 ft.) may be provided over the wheelchair users' entrance

– When the main entrance is not usable by persons in wheelchairs, a sign should be installed in front of the building indicating the location of the designated entrance.

– The entrance door shall have an unobstructed opening width of 800 mm (2 ft 8 in)

– Doormats should be recessed to lie flush with the adjacent floor surface

The possibility of access for wheelchair users from transit vehicles directly onto an unloading dock should be investigated

Internal Doors and Doorways

– All doors should open with a minimum of effort and door closers should operate slowly enough to allow any disabled person sufficient time to pass through the doorway

– Doorways shall have a clear opening (free of protruding hardware) of at least 760 mm (2 ft 6 in.) when the door is open

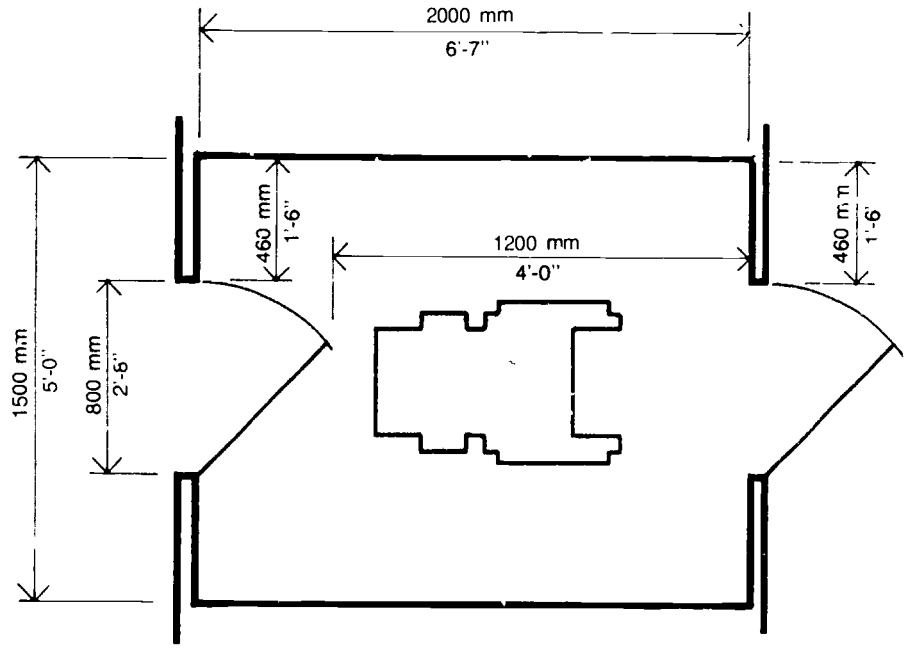
– A standard 800 mm (2 ft. 8 in) door will satisfy the minimum clearance requirement

– Doors opening into corridors should be recessed to reduce the possibility of accidents.

– Manually operated sliding doors should be installed only in situations where a side-hung door would hinder movement, e g , on closets and cabinets.

Note: Two-leaf doors are not suitable for persons who are physically disabled unless they operate by a single effort, or unless one of the halves is at least 800 mm (2 ft 8 in) wide

Plan of vestibule



Stairs

– The ratio of rise to run dimensions of stairs should conform to the Building Code, Ontario, and must be the same for all steps in any one staircase

– Open riser staircases must be avoided

– Steps with projecting noses greater than 30 mm (1 3/16 in) are not recommended

– Single or double steps should never be used

– Steps less than 110 mm (4 in) high are hazardous

– Steps exposed to the weather should have risers of not more than 170 mm (6½ in) and treads of not less than 280 mm (11 in)

– For general purposes and to allow for the ambulant disabled, the stair riser on internal staircases should not exceed 190 mm (7½ in) The tread should not be less than 260 mm (10 in)

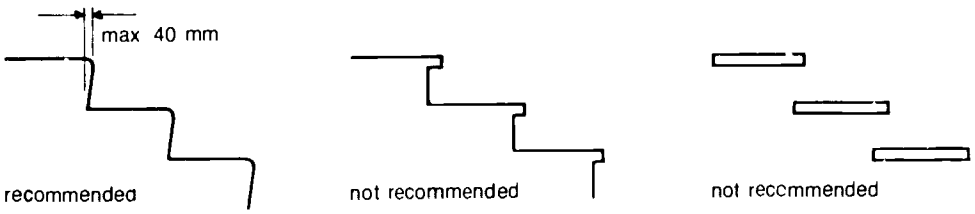
– The maximum rise of any flight of stairs should not exceed 2400 mm (8 ft) A much reduced height is preferable, however, as it provides the disabled person with more frequent stopping and resting places

– No door should open directly onto the top of a staircase or swing so as to obstruct the top or bottom step

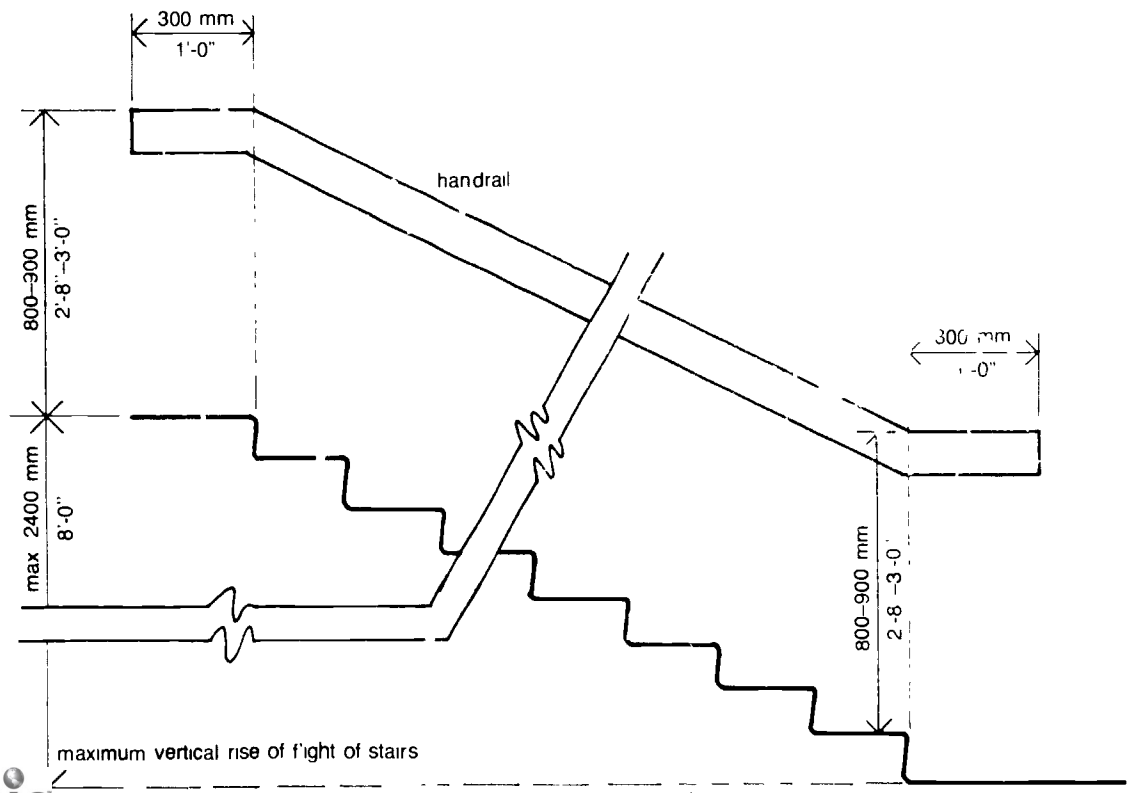
– Surfaces must be non-slip If carpeting is used, it must be securely fixed

Note: Terrazzo stairs can be made non-slip by using aluminium oxide abrasive as a finish, stairs of wood or steel may be covered with premoulded treads or carpet material

Risers



Stair section



Handrails and Balustrades

– A handrail should be provided on both sides of all staircases

– Handrails should be continuous and should not be broken at half landings or where windows are situated beside staircases

– Handrails should extend at least 300 mm (1 ft.) beyond ramps and stairs

Note Care should be taken that the extension of the handrails is not in itself a hazard. The extension may be made on the continuing wall

– The recommended height for handrails is 800 mm (2 ft 8 in.) to 900 mm (3 ft.), to accommodate both children and adults

– Handrails should be easy to grip and should not exceed 37 mm (1½ in) in diameter for children and 44 mm (1¾ in) for adults.

– There should be at least 40 mm (1½ in) of free space between the handrail and the wall

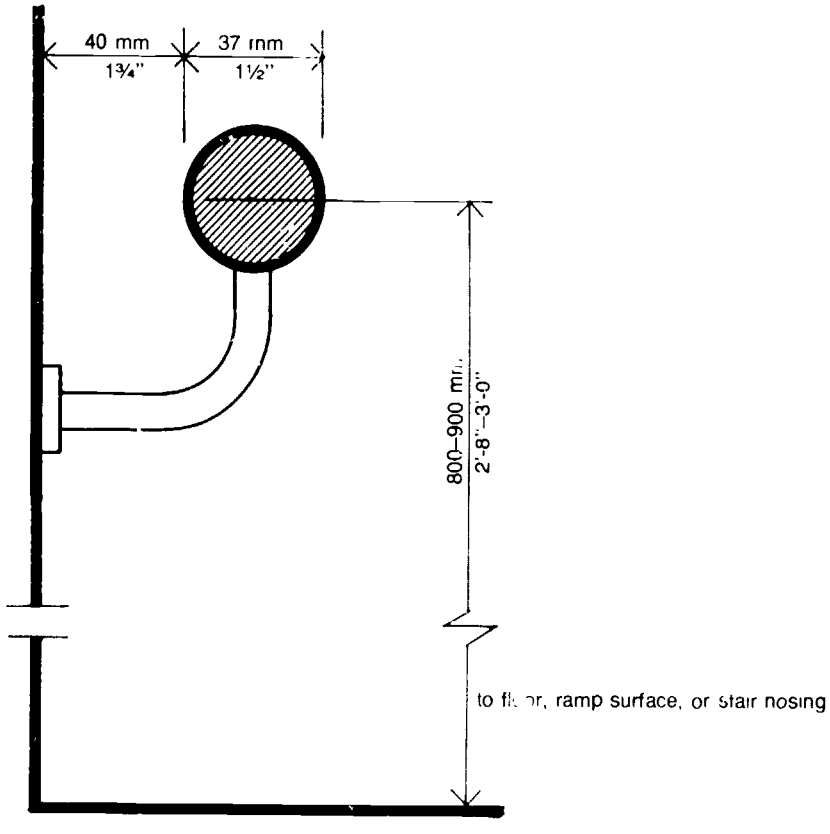
– Handrails and balustrades must be securely fixed

– Brackets should be fixed to the underside of rails.

– Rough-textured finishes on wall surfaces behind handrails should be avoided.

– A handrail should be provided on at least one side of all public corridors to assist those who can walk without crutches but require some support. In corridors with lockers ranged along both walls it will not be possible to provide a handrail

Handrail section



Elevators

In buildings utilised by individuals who are disabled, elevators are the most efficient means of vertical transportation

– An elevator should be provided in buildings of more than one story

– For large wheelchairs the area inside the elevator should not be less than 2 33 m^2 (25 sq. ft)

– Push buttons should be low enough so that they can be reached easily by a person in a wheelchair A prominent "hold" button is also important. The elevator should be equipped with a telephone or two-way communication system that can be easily reached from a wheelchair. Where access to the elevator is by key, a single control should be used

– Handrails should be provided on three walls of the elevator, or on two if there is a rear door.

– The elevator should be automatically self-levelling and should stop precisely at floor level.

– The elevator waiting area should have an unobstructed space not less than 1910 mm (6 ft. 3 in.) deep in front of the elevator door.

– Mats or gratings should not be placed immediately in front of elevator doors

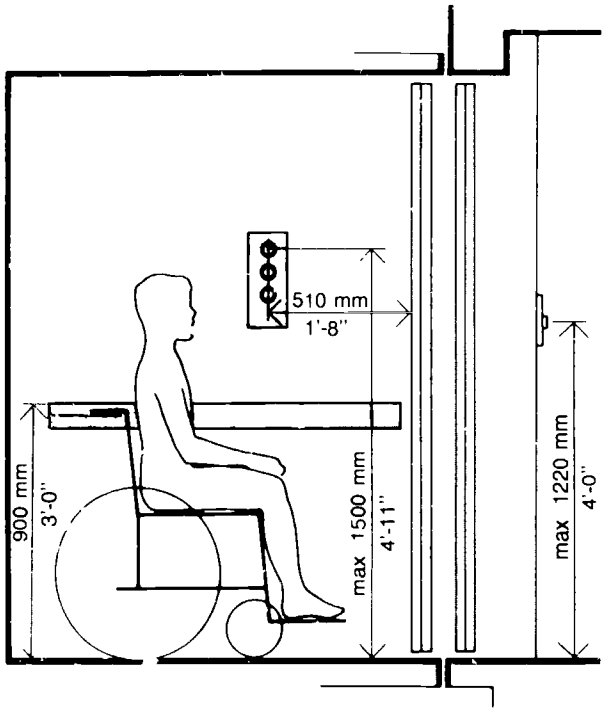
– A durable material is recommended for the elevator cab's walls to prevent damage by wheelchairs.

– Elevator doors should have a minimum clear opening of 800 mm (2 ft 8 in)

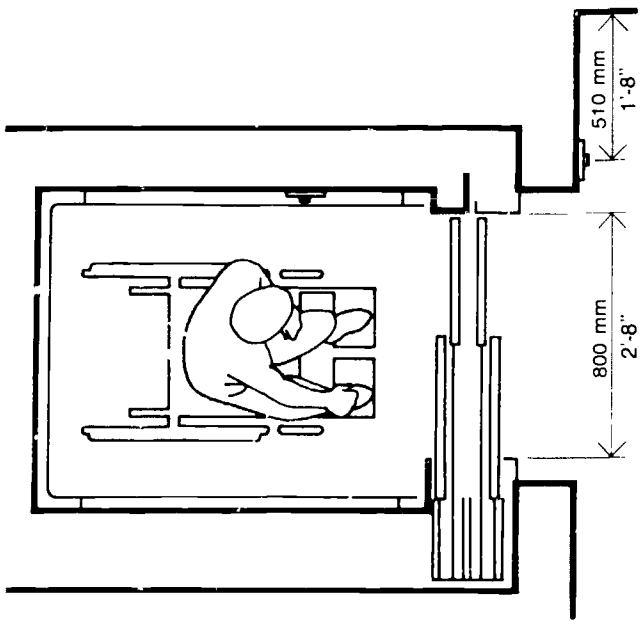
– Automatic elevators should have delayed-action doors

Note Braille numbers to assist the visually impaired are now available for elevator direction panels.

Elevator section



Plan of elevator



Platform and Chair-Type Lifts
Where the installation of an elevator is impractical, other means of vertical transportation such as wheelchair carriers or stairlifts should be considered Where provided, such devices shall conform to the Safety Code for Elevating Devices for the Handicapped (CAN3-B355-M81 and any subsequent amendments thereto)

Washrooms
In washrooms sufficient space should be provided for the passage of wheelchairs

– There should be at least one toilet compartment 1500 mm (5 ft.) wide and at least 1500 mm deep (5 ft.) in each of the main washrooms. Existing toilets can be converted to meet the needs of the disabled by removing the common partition and combining two standard compartments The door (where doors are used) should be 800 mm (2 ft 8 in.) wide and must swing outwards, preferably against a side wall. The door lock should be operable from the outside in case of emergency.

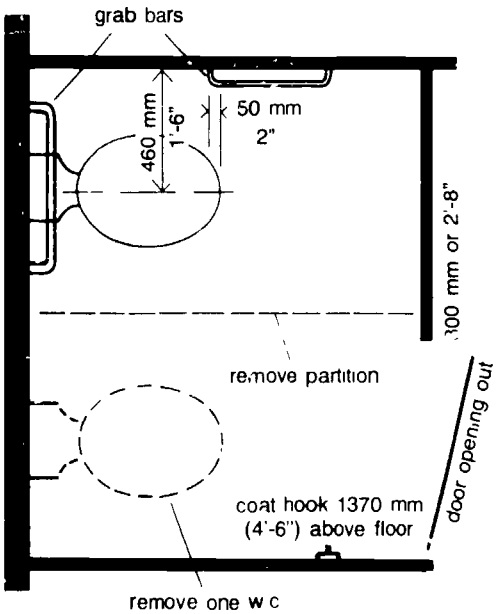
– The toilet fixture should be located 450 mm (1 ft 6 in.) from the side wall, measuring from the centre of the fixture. Tank-type toilets should be avoided if possible.

– The compartment should include grab bars Fixed securely on the side and back walls the bars should be at least 610 mm (2 ft) long and 32 mm to 40 mm (1¼ in to 1½ in) in diameter with a minimum space of 40 mm (1½ in) between the bar and the wall The bar on the rear wall should be placed horizontally on the centre line of the toilet and fixed approximately 280 mm (11 in) above the toilet seat (slightly lower for children, depending on age group). The bar on the side wall should be installed at a 50° angle to the floor. A coat hook should be installed about 1370 mm (4 ft 6 in) above the floor on the side wall.

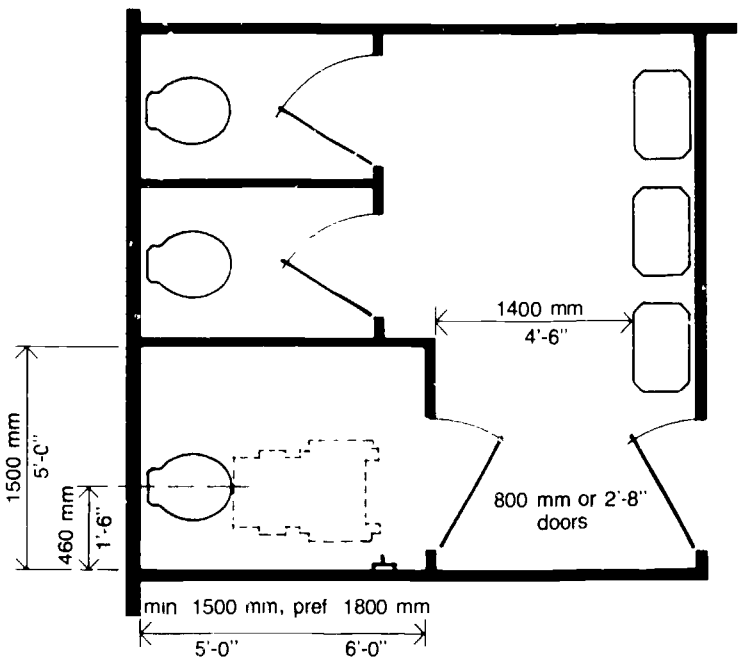
– A wall-mounted toilet with a narrow understructure that recedes sharply is most desirable

– The floor should be level throughout the washroom

Plan of toilet compartment



Plan of washroom



Urinals

– Urinals may be wall-hung or floor-mounted A stepped platform is an unnecessary hazard

– Grab bars may be required, depending on the types of disabled persons using the facility

Wash Basins

– In washrooms with only a circular, floor-mounted, foot-operated washing facility, a separate wall-mounted wash basin will be required

– Wash basins should be wall-mounted without legs or pedestal, to permit easy approach by persons using wheelchairs.

– Wash basins should have a clearance of 660 mm (2 ft 2 in.) under the apron and bowl to a point at least 260 mm (10 in.) from the front of the fixture.

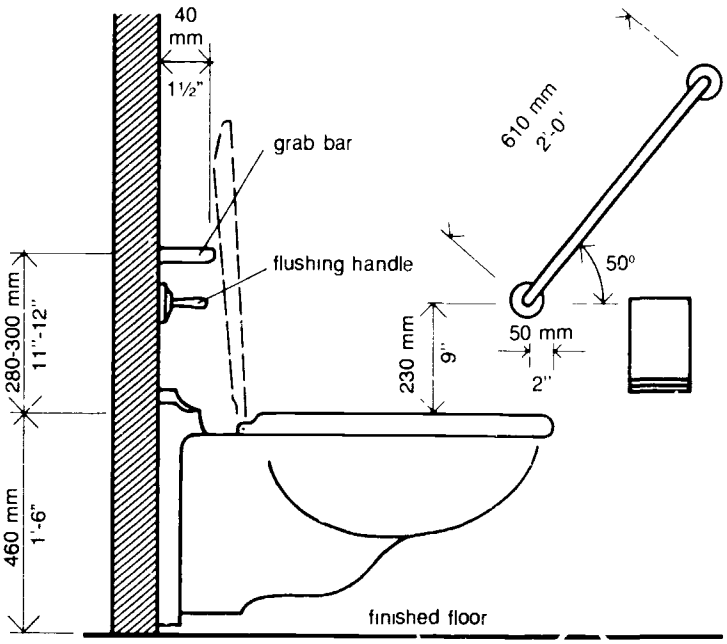
– Basin heights should vary to accommodate different types and ages of disabled persons

– Single-lever faucet handles are preferable.

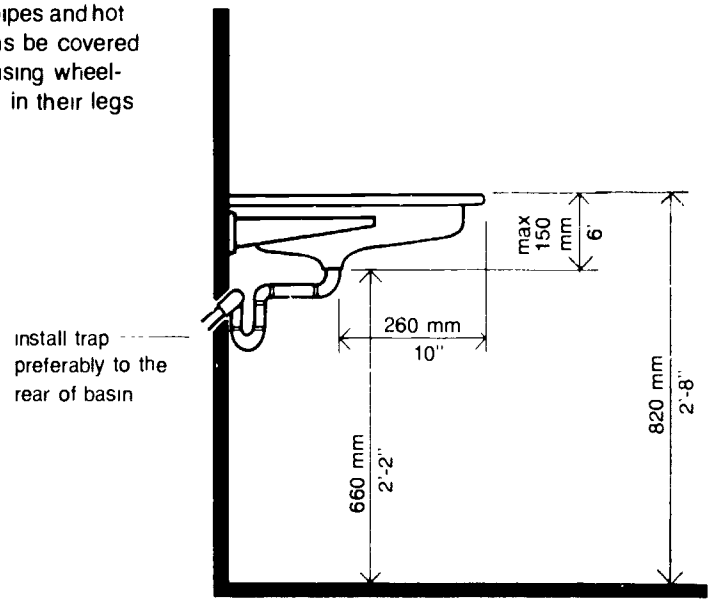
– Spring-loaded or pressure-operated faucets should be avoided.

Note: It is important that drain pipes and hot water pipes under wash basins be covered or insulated so that persons using wheelchairs who have no sensation in their legs will not burn themselves.

Toilet elevation



Basin installation



Accessories

– A mirror centred at a height of 1100 mm (3 ft 9 in) above the floor should be provided for wheelchair users

– Washrooms should have at least one towel dispenser or electric hand dryer, disposal unit, and soap dispenser within reach of wheelchair users

Change Areas

A change area with a change table and an adequate exhaust system may be desirable to meet the needs of some physically disabled.

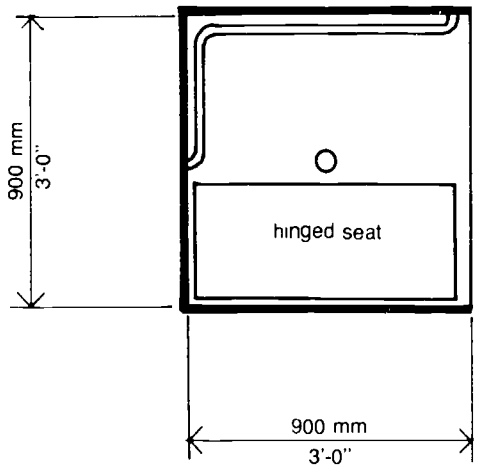
Showers

– A shower area for the disabled should be at least 900 mm x 900 mm (3 ft. x 3 ft) in size. It should be equipped with grab bars for both sitting and standing persons and the seat should be hinged.

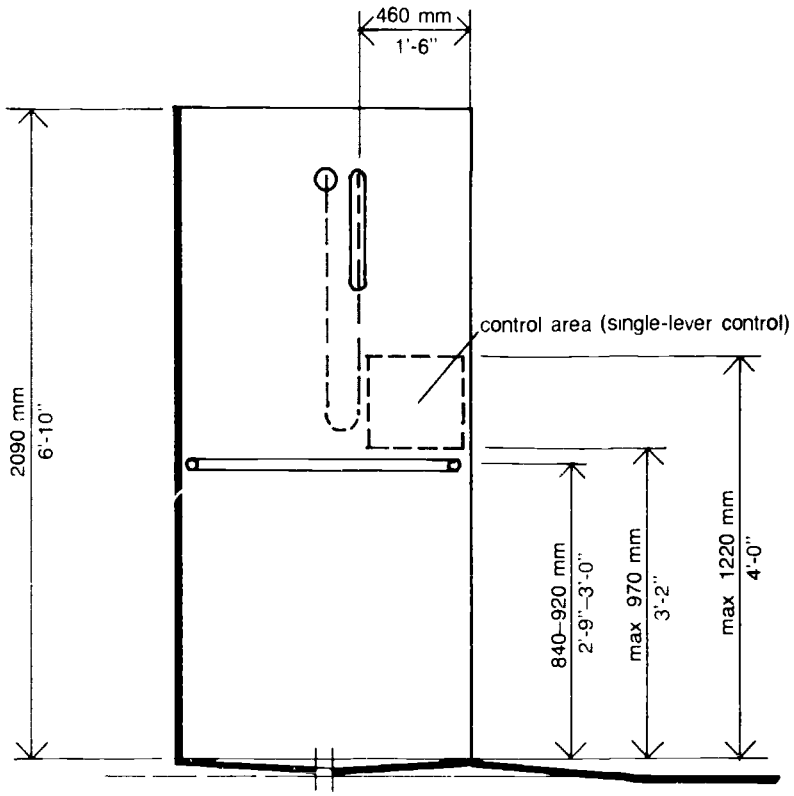
– The single-lever control should be pressure-balanced to ensure a constant water flow rate and a fixed, preset temperature.

– The shower head should be hand-held with a flexible hose at least 1800 mm (6 ft) in length

Plan of shower compartment



Shower compartment section



Water Fountains

– Water fountains should be provided with up-front spouts and with dual hand and foot controls.

– The recommended height for water fountains for elementary schools is 660 mm (2 ft 2 in) above floor level; for secondary schools, 760 mm (2 ft 6 in.). If replacement is required, a bi-level fountain is recommended

– Fully recessed water fountains are not accessible to wheelchair users

Lockers

In most schools, standard lockers are quite satisfactory for the use of all students.

Cloakrooms

The width should permit easy turning of a wheelchair. Minor modifications may be made to meet the particular needs of the individual student.

Public Telephones

Standard telephone booths are generally convenient for ambulant disabled people, but are inaccessible to persons using wheelchairs. Where public telephones are not already in booths, provision should be made for individuals in wheelchairs.

Floors and Floor Finishes

For persons who are physically disabled, floor surfaces can present a serious problem

– Floors on a given storey should be at the same level throughout the building or be connected by a ramp. (See ramp specifications)

– All floor surfaces should be of the non-slip variety Slippery surfaces are particularly hazardous to the ambulant disabled, especially those with crutches

– Floors that look slippery (although they may have non-slip characteristics) should also be avoided

– Floors should be durable but resilient, they should also be attractive and easy to clean

– In washrooms, lobby areas, and other areas where water is used, waterproof floor materials are most practical If wax has to be applied, it should be used sparingly. Floor drains are helpful in washrooms, so that floors can be cleaned more easily and water damage minimized in case of overflow

Wall Finishes

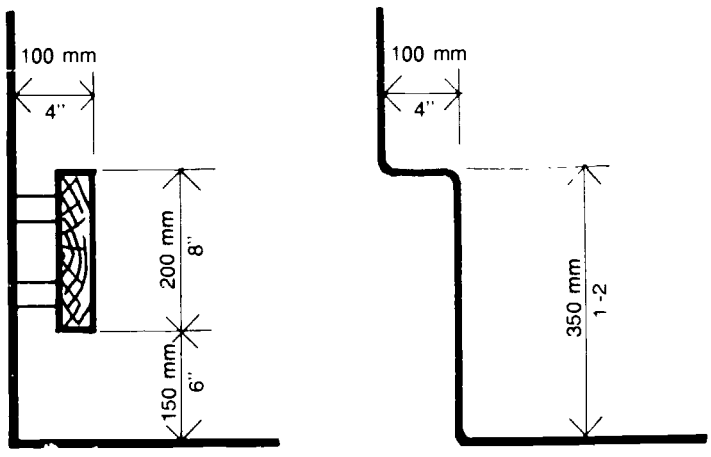
– Different wall finishes may be provided above and below dado level, so that the lower area, which is liable to rough treatment from wheelchairs, may be renewed independently of the rest of the wall

– Wall finishes should allow for easy cleaning and maintenance Materials should be resistant to marks and be easy to repair when damaged.

– Colours for interior walls should be considered very carefully Strong colours may be useful when used with discretion; they may emphasize obstructions or hazards such as ramps, radiators, or exposed beams

Note: In areas where wheelchairs are commonly in use, a buffer baseboard should project 100 mm (4 in) from the wall with a minimum height of 160 mm (6 in.) above floor level. This buffer baseboard protects the hands from being scraped between the wall and the wheel of the chair

Buffer-baseboard sections



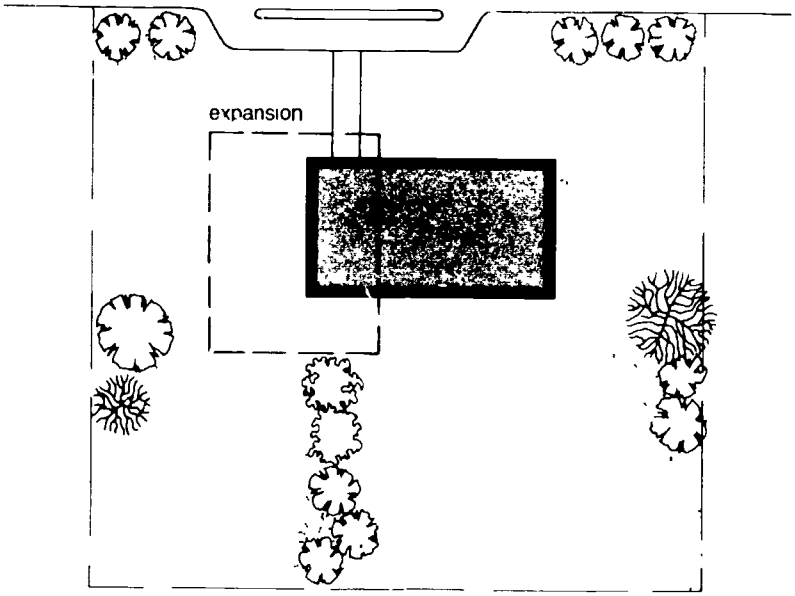
New Facilities: Planning for the Disabled

The Site

Size and Location

The size and location of a new site will depend upon the activities planned, but future expansion must be kept in mind Planning should take into account such matters as parking, service areas, recreation, transportation requirements, and the number of physically disabled pupils to be served

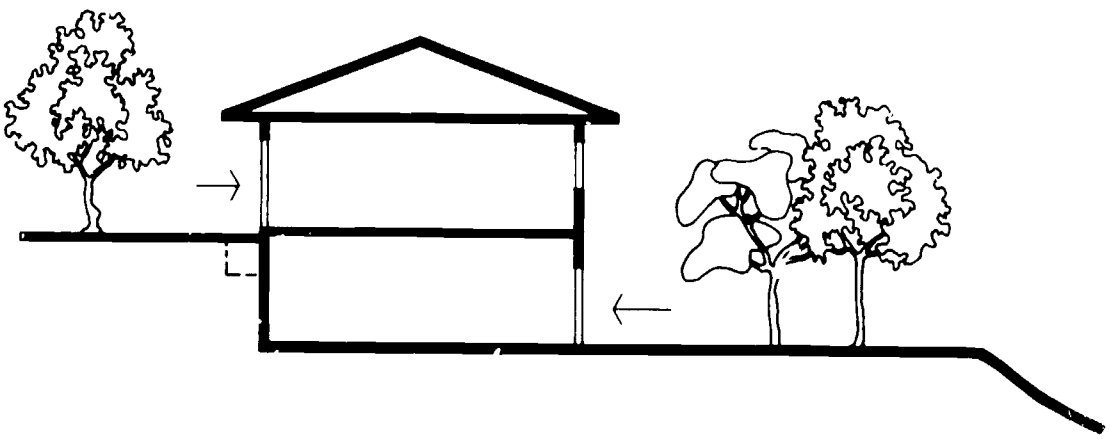
Provision for expansion



Topography

A level site presents fewer planning problems, but a sloping site combined with level areas can have grade-level entrances at each floor if the building is of more than one storey Small hills, either natural or artificial, can provide areas for recreation and outdoor training

Grade-level entrance at each floor



Landscaping
The presence of trees and other plants on the site creates a pleasing environment for recreation, instruction, and relaxation An area set aside where children can grow flowers and vegetables is useful

Schoolgrounds
Recreation is essential for physical, as well as mental, social, and emotional development. The recreation environment should present a series of challenges to be mastered gradually by the physically disabled pupils. The needs and interests of the pupils should be met through both indoor and outdoor activities.

The schoolground should be planned by a team composed of architects, physiotherapists, recreational staff, and educators. It should be protected and well supervised

Depending on the activities involved, the various areas should have a variety of surfaces that harmonize with the location and the equipment used. Soft surfaces like grass or shredded wood may be used for some types of ball games, and to cushion falls under climbing equipment and swings. Hard but resilient surfaces should be used for walking and for equipment that can be pulled or pushed. Ramps and paths leading directly from the classroom areas should be provided with a hard surface for wheelchair users

Decorative fish ponds and fountains must have special protection to prevent accidental entry by persons in wheelchairs.

Schoolgrounds play an important role in creating an awareness of nature. Seating, including benches, logs, chairs, boxes, etc , can be provided for storytelling, drama, singing, and outdoor classes.

Paths and areas for circulation should be clearly defined.

A small artificial hill adds to the variety of physical activities.

Outdoor Equipment
It is very important to recognize each individual's disabilities and to select the equipment most suitable for his or her use

The equipment should challenge and stimulate the children to action involving the usable parts of their bodies It is of great importance that the equipment be constructed of durable materials the children must feel secure while using it.

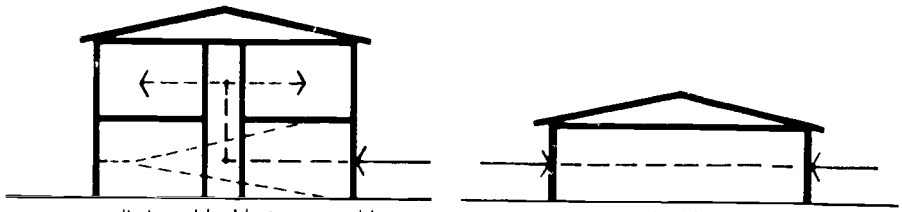
Sand and water are sources of great enjoyment to younger pupils. A raised portable waterplay tub and a portable sandbox that can be wheeled about and used for indoor or outdoor play can be situated on the hard-surfaced area

Storage space for outdoor equipment is necessary. All equipment and installations must meet the highest possible safety standards to protect the users Equipment should also have a visual appeal. Primary colours add freshness to the area and contrast well with the buildings and the green of the grass, trees, and shrubs

The Building

One of the major problems in planning for the disabled is presented by movement within the building For that reason, a single-level building is preferable Where the site is limited, a multistoried building serviced by an elevator and/or ramps is quite satisfactory

Circulation



multistoried building serviced by elevator and/or ramps

one-storey building

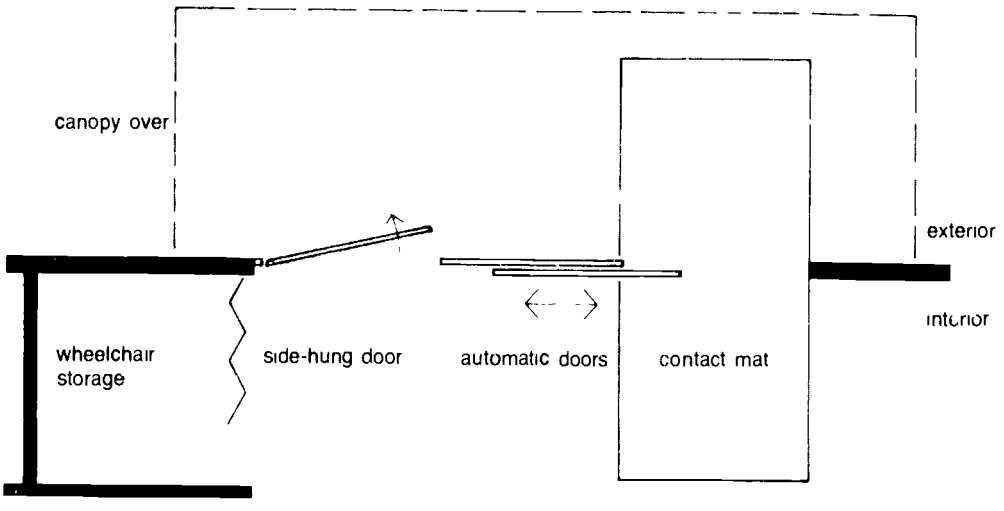
Entrances

– One entrance to the school can be covered and provided with ample space for loading and unloading buses, taxis, and cars. Mechanically-assisted door openers at this entrance are desirable.

– A wheelchair storage area should be located immediately next to this entrance A folding door will keep the area neat when not in use

– The most suitable automatic door for disabled people is a sliding door operated by a contact mat. Doors are held open for as long as the area to either side is occupied. Mats must be sensitive to pressure exerted unevenly, as by crutch users Doors operated by electric eyes and switches may also be used. Where automatic doors are installed, there should also be a side-hung door in case of power failure. Revolving doors should not be used.

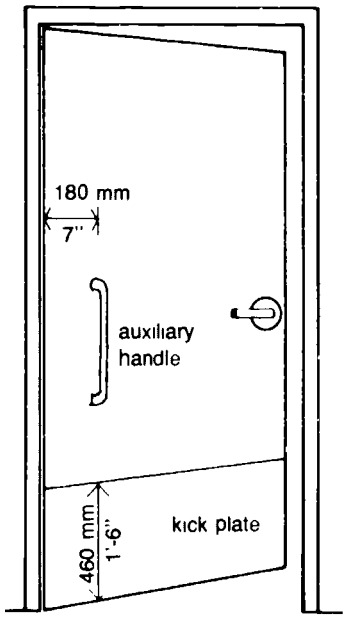
Plan of entrance



Internal Doors

– An auxiliary handle may be located on the push side 180 mm (7 in.) from the hinged edge of the door, so that the door may be closed by a person in a wheelchair Lever-type door handles are preferable to knobs, so that the doors can be opened easily by those whose grip is impaired

Internal door



– It is advisable to protect doors against wheelchair damage.

– A kick plate should be provided to a minimum height of 460 mm (1 ft 6 in) above the floor level.

– Doors faced on both sides with durable material are recommended

– Glass in fully glazed doors should be shatterproof.

– Vision panels, where provided in a corridor door, should be not less than 76 mm (3 in) in width and located on the latch side of the door. The bottom of any vision panel in a corridor door should not be more than 900 mm (3 ft.) above the finished floor level

Corridors

– For those who are physically disabled, corridors should ideally have a minimum width of 2440 mm (8 ft), increasing to 3660 mm (12 ft.), depending on the size of the building and the amount of traffic This should permit a free flow of traffic for persons using wheelchairs, crutches, and walkers

– At least one wall in every public corridor should be equipped with a handrail.

– External corners should be protected from wheelchair damage by metal corner guards from the floor to a height of about 1070 mm (3 ft. 6 in.).

Classroom and Instructional Areas

In order to allow the maximum participation of the disabled in school programs, special allowances and modifications to classroom and other instructional areas are required

– There should ideally be no .hreshold at any door opening into a classroom In every case the permissible maximum height of a threshold is 16 mm (⅝ in.).

– A clear knee space is required under a portion of any assigned work counter

– The lighting and audio conditions at any "station" will require particular attention for students with multiple disabilities

– An electrical outlet easily reachable from a wheelchair is necessary for students using audio-visual equipment, e g , cassettes or filmstrips

– Wider aisles may be necessary for manoeuvrability within some furniture arrangements.

– Portable book storage bins should be provided for students using wheelchairs

– In the general purpose room or auditorium wheelchair users should have access to the stage

– In the gymnasium basketball backboards can be adjustable for use by the disabled.

The use and handling of power tools and machines by the disabled in shop areas requires particular attention

Cafeterias
Cafeterias should be designed in such a way as to allow the passage of wheelchairs through the food service lanes and between tables. Food display racks and cutlery should be visible and within easy reach of persons in wheelchairs

Auditoriums/Lecture Halls
– It may be difficult to provide a level area for wheelchair users in an auditorium or lecture hall. The aisle is often the only level area. The minimum clear width of an aisle should be 1100 mm (3 ft 7in.), with the following exceptions: when serving 60 seats or less, it may be reduced to 750 mm (2 ft 6 in.) and when serving seats on one side only, to 900 mm (3 ft.).

– A cross aisle for wheelchair users may also present problems. The cross aisle should be at least the width of the widest aisle plus 50 per cent of the total required width of the remaining aisles that it serves

If the design of an existing auditorium or lecture hall permits, seats may be removed to create a space for wheelchairs.

Swimming Pools
If the construction of a new pool is being planned, the guidelines below should be followed in order to allow physically disabled persons to enjoy the benefits of water activities along with other users.

– The most suitable depth for very young children is 610 mm (2 ft.)

– The most suitable depth for older students is 1200 mm (4 ft.)

– A section of handrail at the water line of the pool can provide independent support for the disabled.

– A ramp with a handrail leading to the pool is essential.

– A special lifting device enabling the physically disabled to enter and leave the pool can be economically installed in existing pools.

If the pool is located in close proximity to the gymnasium or general purpose room, it should be possible to use the same showers and change rooms

Note: Swimming pools are not funded by the Ontario Ministry of Education The construction of such a facility is often a joint venture of the school board and the local municipality

Work and Storage Areas
The height of work surfaces for the physically disabled should be adjustable to the user's size.

– Personal bookshelves and storage cabinets should be at a lower level so that they are accessible to persons in wheelchairs They should be no less than 305 mm (1 ft.) oove the floor.

Chalkboards
Chalkboards with a railing may help to provide support for some students. For students who have difficulty using a wall chalkboard, various types of portable chalkboards may be used A lowered portion of chalkboard and rail at some point in a classroom is desirable.

Work Tables
A group work table is useful. Circular, rectangular, or multisided tables can be used for socializing activities. A group table can also be formed hy putting several smaller tables of similar shape together.

– Some tables may have a cut-out section, allowing the child with weak musculature a convenient resting place for his or her arms while working. The cut-out encircles the child's waist, thus decreasing the possibility of objects falling from the table. The dimensions of the cut-outs should vary from 300 mm to 460 mm (1 ft to 1 ft 6 in.). The height of the tables should be adjustable. Heavy tables are more easily moved on individually locking casters.

Sand and Water Tables
The tables for sand and water play have features similar to the work tables They should be accessible to children in wheelchairs, children who use conventional chairs, and children who work from a standing position. The table is more useful if designed for more than one child. It should be wide enough and long enough to give each child the freedom to work independently. The table has to be deep enough to contain a sufficient amount of sand or water and to prevent spillage. A table designed for kneeling children may also be appropriate. Sand tables should be lined with a durable and waterproof material and be equipped with locking casters.

Plan of table with cut-out section

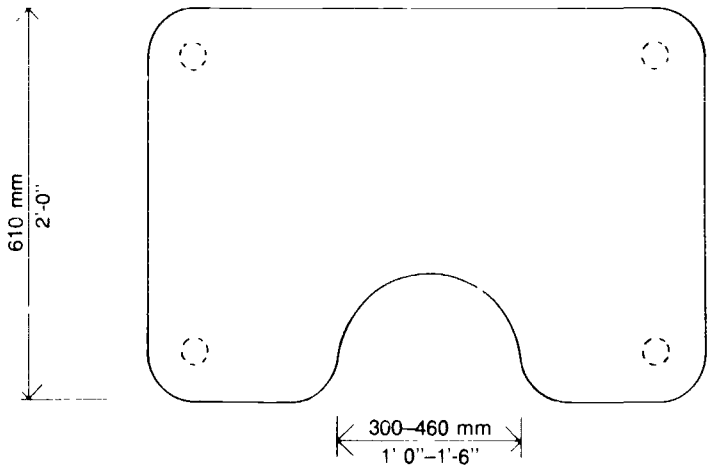
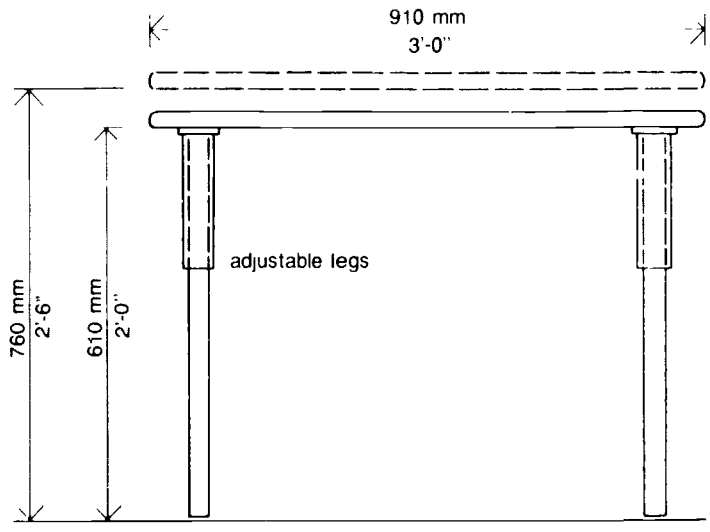


Table with cut-out section elevation



Art Easels
Conventional easels are usually unsuitable for the disabled as their bases are too narrow and the angle of the painting surface is fixed. For disabled children an easel has to be much more flexible Movement on the vertical axis has to be adjustable to make the surface available for young children painting in a standing position or sitting in their wheelchairs.

– The best range for rotation is from the vertical to 45°. The paint trays should be adjustable to any height convenient to the

working child and should be attached across the front of the easel It is important that the painting surface have clamps so that the paper can be firmly attached

Carrels
Where carrels are already in place, such as in a library or in areas where video terminals are in use, it may be necessary to increase the height of the work surface so that the arms of the wheelchairs can easily fit beneath it.

Water
Running water is a desirable feature in all classrooms. The sink should project into the room to be accessible and should have knee space underneath to permit students in wheelchairs to use the taps independently.

– Counters surrounding the sink should be 610 mm to 760 mm (2 ft to 2 ft 6 in.) in height and covered with plastic laminate

Window Sills
Extra-wide window sills, finished with a durable surface, can provide additional teaching space for scientific experiments, plant growing, aquaria, etc. Be careful to ensure that items placed on the sill do not interfere with any space heating system

Lighting
The usual lighting for schools, in sufficient quantity and of good quality, is required. The illumination should not cause glare or shadow. Students with impaired vision require additional lighting

Details of the recommended levels of illumination are to be found in the ministry publication *Lighting for Education*, 1982

Safety
Every effort should be made to eliminate hazards for those persons with physical disabilities.

– Access panels or manholes in floors or walk areas can be hazardous. They should be exactly level with the floor surface and should be well protected when opened

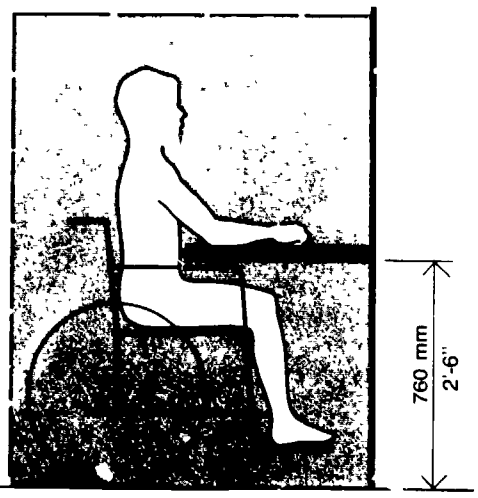
– Door closers, signs and fixtures that protrude into corridors or traffic ways should be avoided or mounted at least 1980 mm (6 ft 6 in.) above the floor

– In areas where there is fixed furniture and particularly in laboratories or shop areas, where fires are most likely to occur, special consideration must be given to the rapid evacuation of persons who are physically disabled.

– No opening part of an upper-storey window should be less than 840 mm (2 ft. 9 in.) above floor level. The hazard of an in-swinging window can be lessened by the provision of a deep sill or shelf.

– The location of electrical outlets for powered equipment, such as typewriters, requires careful consideration. Wall outlets above counters are suitable for use by persons in wheelchairs. Floor outlets with flush protective caps, overhead outlets, and/or baseboard strip outlets can provide a flexibility of arrangement

Carrel section



Appendix A: Anthropometric Data

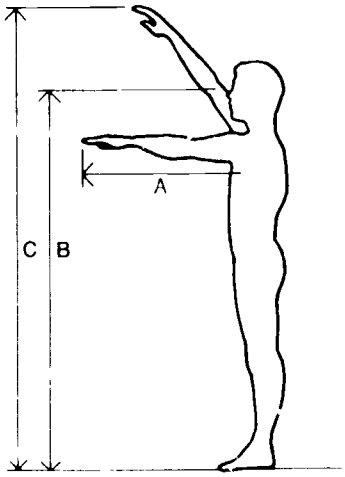
The dimensions given in the building standards codes are for adults of average stature (e.g , National Building Code of Canada). The following charts provide the anthropometric data needed when designing for the disabled, both children and adults

Men Standing

		mm	in
A	Forward reach	480-560	19-22
B	Eye level	1650	65
C	Vertical reach	2110	83

Women Standing

		mm	in
A	Forward reach	430-560	17-20
B	Eye level	1520	60
C	Vertical reach	1960	77

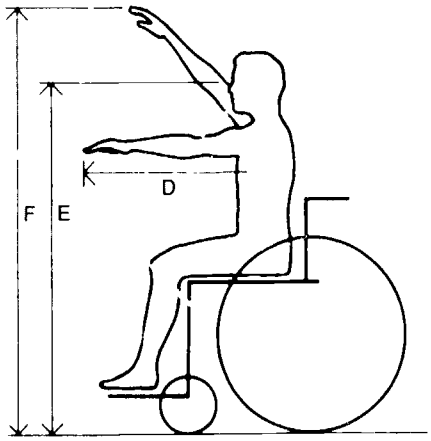


Men Sitting

		mm	in
D	Forward reach	460-560	18-22
E	Eye level	1270	50
F	Vertical reach	1730	68

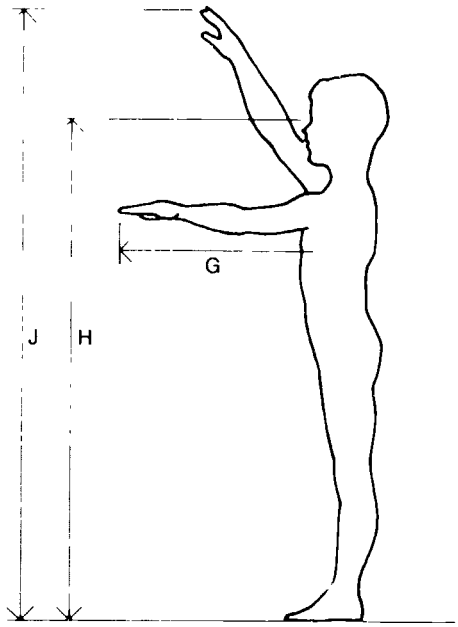
Women Sitting

		mm	in
D	Forward reach	380-480	15-19
E	Eye level	1170	46
F	Vertical reach	1580	62



Boys Standing (Ages 4-18)

Age	G Forward reach		H Eye level		J Vertical reach	
	mm	in	mm	in	mm	in
4	430	17	1020	40	1120	44
6	480	19	1150	45	1270	50
8	560	22	1250	49	1400	55
10	610	24	1350	53	1530	60
12	660	26	1420	56	1650	65
14	710	28	1550	61	1810	71
16	760	30	1650	65	1960	77
18	810	32	1700	67	2000	79

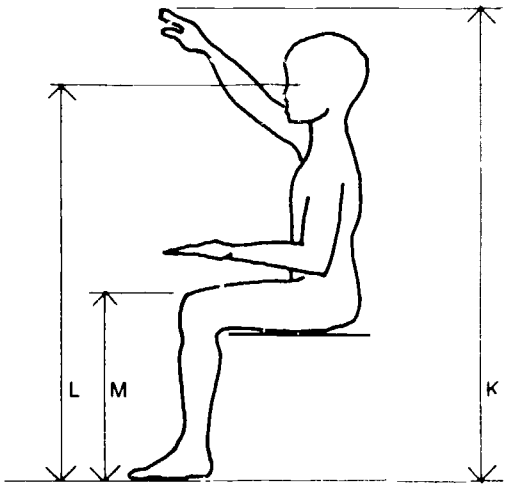


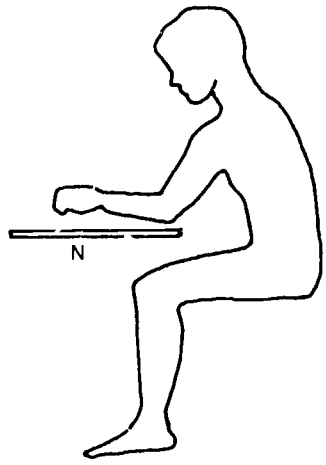
Girls Standing (Ages 4-18)

Age	G Forward reach		H Eye level		J Vertical reach	
	mm	in	mm	in	mm	in
4	410	16	1020	40	1120	44
6	480	19	1150	45	1270	50
8	530	21	1250	49	1400	55
10	610	24	1350	53	1530	60
12	660	26	1450	57	1680	66
14	690	27	1530	60	1780	70
16	710	28	1550	61	1830	72
18	710	28	1550	61	1830	72

Boys Sitting (Ages 4-18)

Age	K Sitting vertical reach		L Sitting eye height		M Sole to top of knee		N Sitting horizontal reach	
	mm	in	mm	in	mm	in.	mm	in
4	920	36	740	29	310	12	350	14
6	1040	41	840	33	360	14	410	16
8	1150	45	920	36	410	16	430	17
10	1250	49	990	39	430	17	480	19
12	1350	53	1070	42	470	19	510	20
14	1450	57	1170	46	510	20	560	22
16	1550	61	1220	48	560	22	590	23
18	1600	63	1270	50	590	23	630	24





Girls Sitting (Ages 4-18)

Age	K Sitting vertical reach		L Sitting eye height		M Sole to top of knee		N Sitting horizontal reach	
	mm	in	mm	in.	mm	in.	mm	in
4	920	36	740	29	310	12	360	14
6	1020	40	840	33	360	14	380	15
8	1150	45	920	36	410	16	430	17
10	1250	49	990	39	430	17	480	19
12	1350	53	1070	42	480	19	510	20
14	1420	56	1140	45	510	20	530	21
16	1450	57	1170	46	530	21	560	22
18	1450	57	1170	46	530	21	560	22

Appendix B: Wheelchair Data

Standard Wheelchair Dimensions

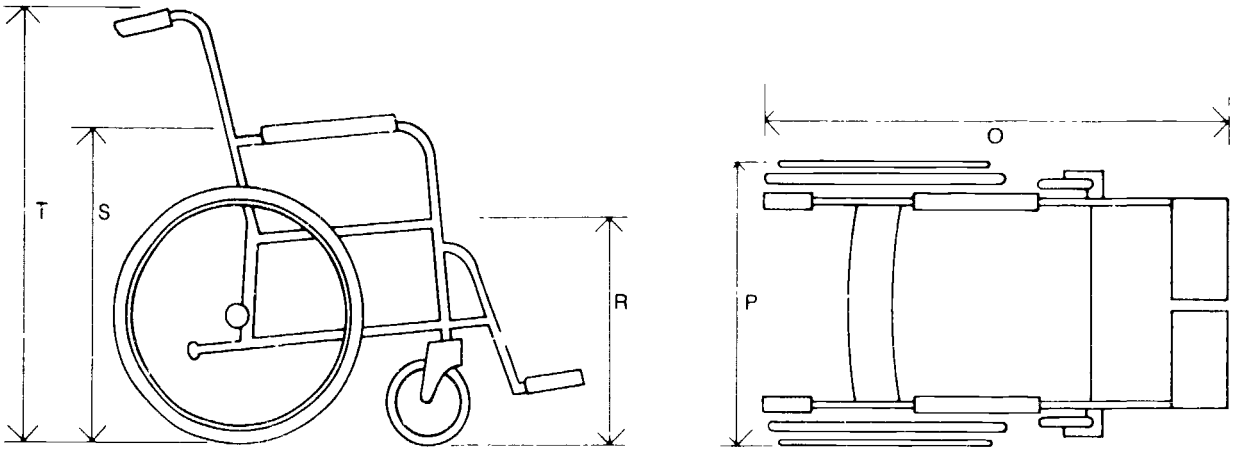
Adult Size

		mm	in
O	Length	990-1060	39-42
P	Width when open	610-710	24-28
	Width when collapsed	230-310	9-12
R	Height of seat from floor	480-530	19-21
S	Height of armrest from floor	710-760	28-30
T	Height of rear pusher handles from floor	890-910	35-37

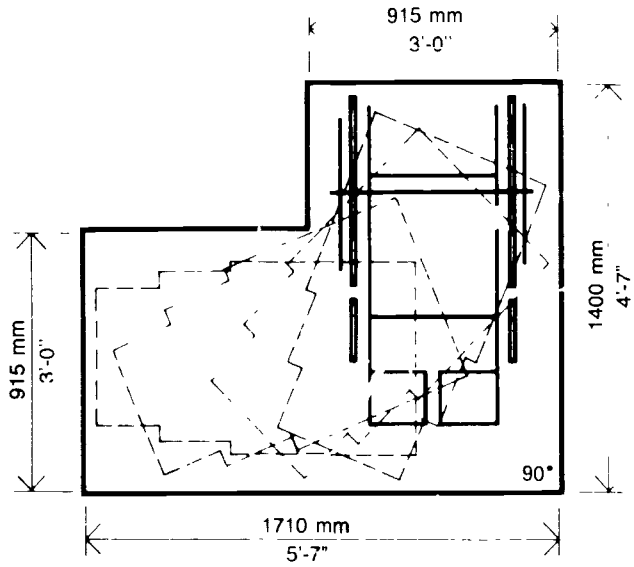
Junior Size

		mm	in
O	Length	740	29
P	Width when open	480	19
T	Height of rear pusher handles from floor	840	33

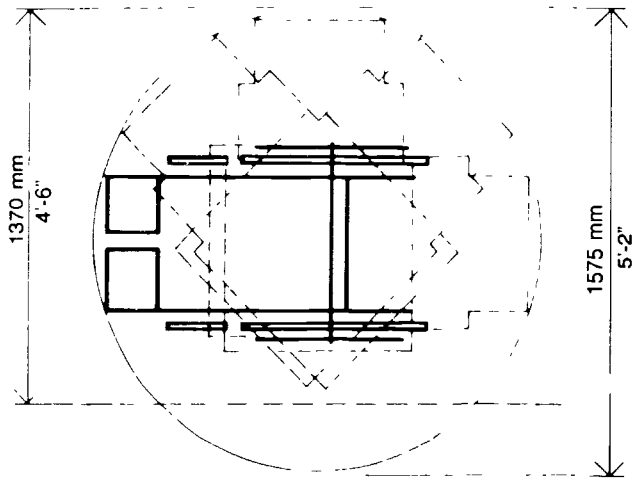
Standard wheelchair dimensions



Wheelchair movement



minimum space needed for 90° turn



minimum space needed for 180° turn with one wheel as fixed pivoting point

Appendix C: Quick Checklist

Walks

☐ Are they a minimum of 1530 mm (5 ft) wide?

☐ Are they surfaced with a non-slip material?

☐ Do they have a maximum grade of 1 20?

☐ Do they have resting places?

Parking

☐ Will parking be required?

☐ Is it convenient?

☐ Is it paved?

☐ Is the parking space at least 3660 mm (12 ft) wide?

Ramps

☐ Do they have a gradient of 1:15? 1 12?

☐ Do they have a minimum width of 920 mm (3 ft.)?

☐ Do they have curbs and handrails?

Entrance

☐ Is the access point for the disabled signposted?

☐ Is there easy access to the building through at least one entrance?

☐ Is there an unloading dock? Is it possible for the disabled to use it to gain access to the building?

Doors

☐ Does the entrance door have a clear opening of at least 800 mm (2 ft. 8 in.)?

☐ Does the entrance door have delayed-action closers?

☐ Are doormats recessed flush with the floor?

☐ Do internal doors have a clear opening of at least 760 mm (2 ft 6in) free of protruding hardware?

Stairs

☐ Do they have open risers or projecting noses?

☐ Do they have a non-slip surface?

Handrails

☐ Are they continuous?

☐ Do they come to an abrupt end?

☐ Are the wall surfaces behind the handrails smooth-textured?

Elevator

☐ Is there one?

☐ Can the controls be easily reached from a wheelchair?

☐ Is it automatically self-levelling?

Main Washrooms

☐ Is there a toilet compartment at least 1530 mm (5 ft) wide and 1530 mm (5 ft) deep?

☐ Does the door swing outwards?

☐ Does the compartment include grab bars?

☐ Is the toilet wall-mounted?

☐ Is there a wall-mounted wash basin?

☐ Does it have single-lever faucets?

☐ Are exposed hot pipes covered or insulated?

Showers

☐ Is there one?

☐ Can it be used both sitting and standing?

☐ Does it have grab bars of appropriate size and type at specified heights and angles?

☐ Is the water temperature regulated?

Water Fountains

☐ Are they two-level?

☐ Are they fully recessed?

☐ Are they easy to operate?

Hazards

Have the following been avoided or modified?

☐ catch basins

☐ manhole covers

☐ loose carpets

☐ changes of level

☐ slippery floors

☐ protruding objects

☐ rough-textured surfaces

Alarms and Signals

☐ Are both visible and audible alarm signals and messages provided?

☐ Are exit doors accessible to the disabled?

Further Reading

Kushner, Carol, Falta, Patricia Ladia, and Aitkens, Andrew *Making Your Home Accessible: A Disabled Consumer's Guide* Ottawa Canadian Housing Design Council, Consumer and Corporate Affairs Canada, 1983

Ontario Ministry of Education *Lighting for Education* Toronto Ministry of Education, Ontario, 1982

Ontario. Ministry of Labour "Barrier-Free Design Kit". Toronto Ministry of Labour, Ontario, 1982.

United Kingdom. Department of Education and Science. *Access for the Physically Disabled to Educational Buildings* Department of Education and Science Design Note 18. London. Her Majesty's Stationery Office, 1979