

Chapter 1

Human Factors

Accessibility

Wheelchair Clearances and Reach Ranges

Protruding Objects

Accessible Routes

Accessible Ramps

Wheelchair Lifts

Accessible Signs and Telephones

Toilet Rooms and Compartments

Accessibility

Description

Public accessibility standards establish general specifications to meet the needs of a broad population of people with disabilities.

Custom accessible design targets specific needs of identifiable individuals.

Assessing Existing Conditions

Some of the things to look for when evaluating accessibility include:

- Changes in floor level and unguarded drop-off edges
- Projecting or overhead signage, lighting, and other elements
- Countertop and divider heights
- Ramp slopes, finishes, and handrails
- Wheelchair access
- Wheelchair accessible toilet rooms

Acceptable Practices

Examples of readily achievable removal of interior barriers include:

- Installing ramps
- Repositioning furnishings such as shelves, display racks, tables, vending machines, and other furniture
- Repositioning telephones
- Adding raised markings on elevator control buttons
- Installing flashing alarm lights
- Widening doors, offsetting hinges to widen doorways, installing accessible door hardware
- Eliminating turnstiles
- Adding accessible paper cup dispensers at water fountains
- Removing high-pile, low-density carpeting

In toilet rooms:

- Installing grab bars in toilet stalls
- Rearranging toilet partitions
- Insulating lavatory pipes under sinks

- Installing raised toilet seats
- Installing full-length bathroom mirrors
- Repositioning paper towel and toilet paper dispensers

REFERENCE STANDARDS

- ADA Accessibility Guidelines for Buildings and Facilities ADAAG 104 Reference Standards
- ANSI A117.1 Accessible and Usable Buildings and Facilities

Wheelchair Clearances and Reach Ranges

Description

People who use wheelchairs come in all sizes and shapes, and they have greatly varied levels of mobility disability and self-sufficiency. Wheelchairs also come in many widths and lengths, with a variety of foot support styles.

Assessing Existing Conditions

To assess wheelchair reach ranges in existing interior spaces:

- Identify and document existing conditions that could restrict access for wheelchair forward or side reach.
- ANSI A117.1 provides exceptions for existing elements located a maximum of 54 in. (1372 mm) above the floor.

Acceptable Practices

Table 1.1 ADA Wheelchair Maneuvering Clearances

Minimum Clearance	Conditions	Dimension
Minimum passage widths	Single wheelchair	32 in. (815 mm) at a point 36 in. (915 mm) continuously
	Two wheelchairs	60 in. (1525 mm)
Minimum clearances	For 180° turn	60 in. (1525 mm) diameter
	For a T-shaped turn space	Only at base of T or on one arm of T
	Knee and toe-clearances	30 in. (762 mm) wide
	For forward approaches perpendicular to wall	30 in. (762 mm) wide, 48 in. (1219 mm) long

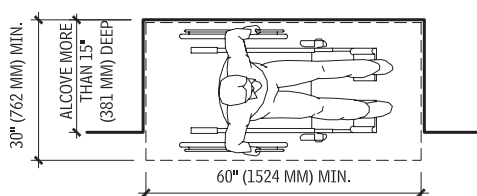


Figure 1.1 Additional maneuvering space is required to parallel park a wheelchair.
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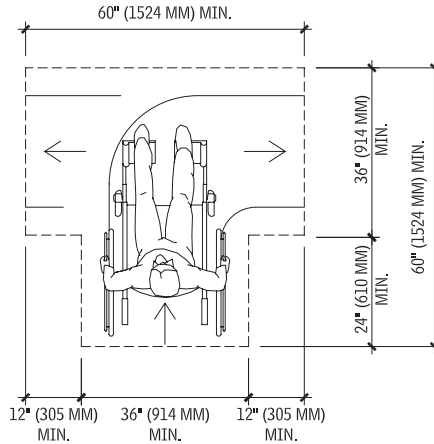


Figure 1.2 In T-shaped configurations, obstruction of part of the T may make wheelchair maneuvering impossible.

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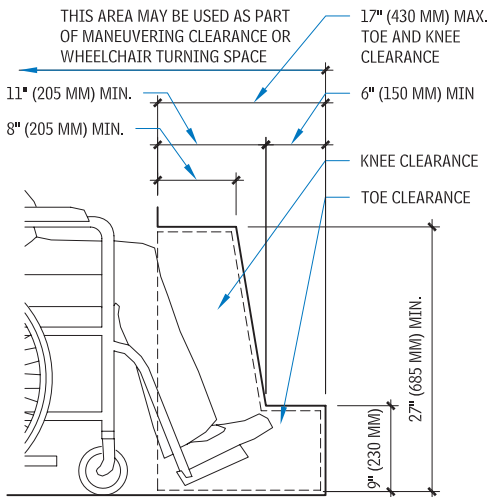


Figure 1.3 Minimum knee and toe clearances are required at specific accessible elements.

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Table 1.2 Wheelchair Reach Ranges

Reach Position	Dimension	Condition
Side reach limits	Max. 10 in. (255 mm)	To side of wheelchair
	Max. 54 in. (1372 mm) high	From floor
	Min. 9 in. (230 mm) low	From floor
Side reach limits over an obstruction	Max. 24 in. (610 mm)	To side of wheelchair
	Max. 34 in. (865 mm) high	From floor
Closet reach limits	Max. 48 in. (1219 mm) high	From floor
	Max. 21 in. (535 mm)	Center of clothes rod to side of wheelchair
Shelving accessible range	Max. 48 in. (1219 mm) Min. 15 in. (380 mm) Max. 21 in. (535 mm)	Center of shelf to side of wheelchair
Obstructed forward reach	Max. 48 in. (1219 mm)	With max. 20 in. (510 mm) counter depth
	Max. 44 in. (1118 mm)	With 20 in. to 25 in. (510–635 mm) counter depth

REFERENCE STANDARDS

- ADA Accessibility Guidelines for Buildings and Facilities, ADAAG 4.2 Space Allowances and Reach Ranges

Practices to Avoid

- Avoid locating light switches, thermostats, fire alarm pull stations, and other wall-mounted controls at the maximum permissible height when a lower height might serve wheelchair users better at no inconvenience to others.

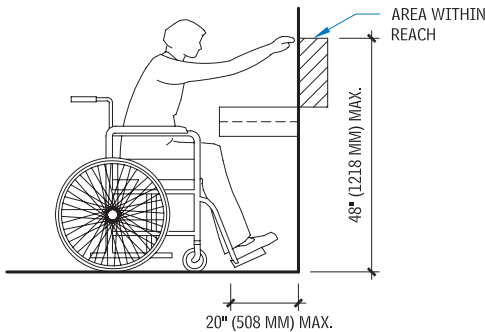


Figure 1.4 Unobstructed forward reach limits for adults are measured from a 30-in.- (760 mm-) wide wheelchair.

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Protruding Objects

Description

Someone who depends on a cane to identify conditions at foot level may not detect projections higher up.

Examples of protruding objects include:

- Wall sconces
- Fire extinguishers
- Environmental controls
- Door hardware
- Signs
- Suspended lights

Assessing Existing Conditions

Table 1.3 Obstacles for Visually Impaired Cane Users

Obstacles	Dimensions
Open spaces under staircases	Below 80 in. (2032 mm) in height
Post-mounted objects	Project into approach space more than 12 in. (305 mm) and are higher than 27 in. (685 mm) Project to either side more than 12 in. (305 mm) and are higher than 27 in. (685 mm)
Wall-mounted objects 12 in. (305 mm) or more wide	Hang 27 in. (685 mm) or less above floor Mount more than 80 in. (2030 mm) above the floor

Acceptable Practices

- Objects mounted with their leading edges at or below 27 in. (685 mm) above the finished floor may protrude any amount.
- Protruding objects must not reduce the required width of an accessible route:
 - 36 in. (915 mm) is acceptable in most cases.
 - 32-in.- (813 mm) width is permitted for maximum 24-in.- (6100 mm) length.

REFERENCE STANDARDS

- AADAG 4.4 Protruding Objects

Practices to Avoid

- Do not reduce the clear headroom of walks, halls, corridors, or passageways to less than 80 in. (2050 mm).
- Do not reduce the clear headroom of spaces adjoining an accessible route to less than 80 in. (2050 mm) without a warning barrier.

Accessible Routes

Description

The Americans with Disabilities Act (ADA) defines an accessible route as a continuous unobstructed path connecting all accessible elements and spaces of a building or facility. Interior accessible routes may include corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures.

Accessible routes are generally required between all levels in multistory buildings, including mezzanines. Accessible routes are required to all spaces and elements that are required to be accessible, with some exceptions.

Assessing Existing Conditions

- Check that walking surfaces slope less than 1:20.
- Identify any changes in floor level greater than 1/2 in. (13 mm).
- Document the condition of elevators and platform lifts.
- Document the condition of walking surfaces.

Acceptable Practices

All surfaces must be firm, stable, and slip resistant. Interior accessible routes are permitted to include:

- Walking surfaces with a slope of less than 1:20
- Changes in level greater than 1/2 in. (13 mm); these must be ramped
- Elevators
- Platform (wheelchair) lifts

REFERENCE STANDARDS

- ADAAG 4.3 Accessible Routes

Practices to Avoid

- Do not use an exterior accessible route where the general circulation path between floor levels is an interior route.
- Avoid making the accessible route a second-class means of circulation.
- Do not obscure the identity of an accessible path; provide directional signs.
- Openings in accessible path surfaces large enough to pass a 1/2-in.- (13-mm) diameter sphere are not permitted.

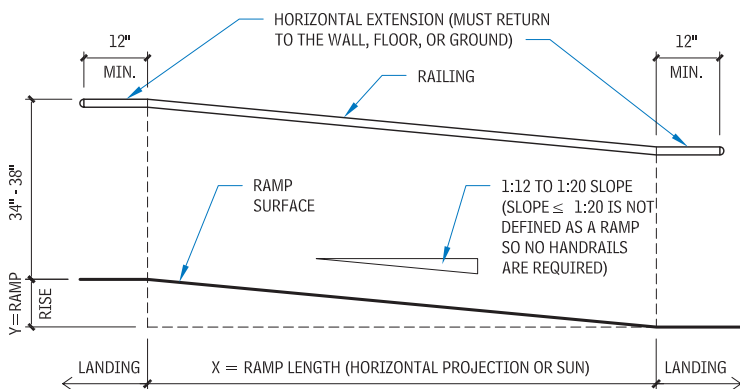
Accessible Ramps

Description

Ramps are necessary where wheelchair users need to access different levels that are not connected by elevators or wheelchair lifts. Any part of an accessible route with a slope greater than 1:20 is considered a ramp by the ADA. Some individuals who use walking aids have difficulty with ramps and prefer stairs.

Assessing Existing Conditions

- Identify any existing parts of accessible routes with a slope greater than 1:20.
- Identify slopes greater than 1:12.
- Document the condition of the ramp surface, structural support, edging, handrails, and landings.



SLOPE = Y:X, WHERE X IS A LEVEL PLANE

Figure 1.5 Components of a ramp.

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Acceptable Practices

The minimum permissible slope for an accessible ramp is 1:12; this may be difficult for wheelchair users and others to navigate. Most people, including wheelchair users, can use a ramp with a 1:16 slope. It is advisable to make the slope as gradual as possible.

Landings give ramp users a place to take a break. A landing between ramp sections should be at least 60 in. (1524 mm) long and as wide as the ramps it connects. Landings at turns should be a minimum of 60 in. in each dimension.

Handrails are required on both sides of a ramp when the rise is greater than 6 in. (152 mm).

- The top of a handrail should be 34 to 36 in. (865–965 mm) high, measured at the edge of the landing.
- ADA handrail guidelines are for adults. Where children frequently use ramps, a second set of handrails at 28 in. above the ramp is recommended.
- Handrails should be mounted 1 1/2 in. (38 mm) away from the wall.

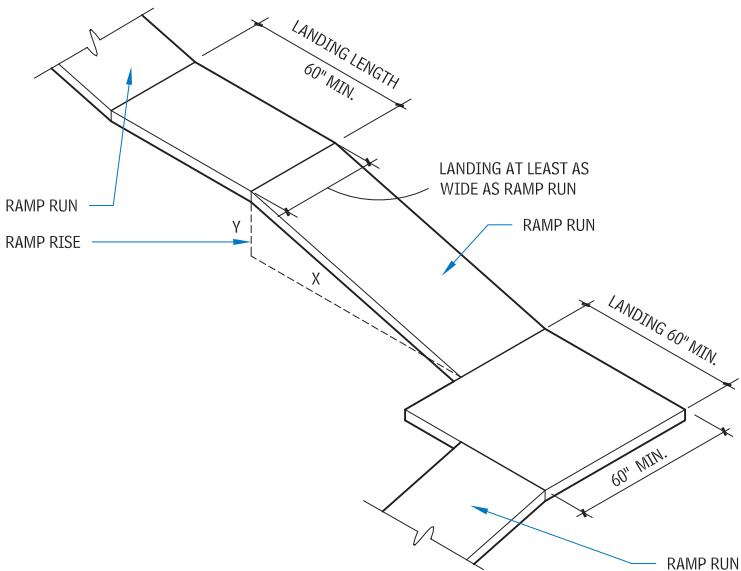


Figure 1.6 Edge protection is required at ramps and landings that drop off. Handrails are required on both sides when the rise is greater than 6 in. (152 mm).

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- Continuous handrails are to be provided at the inside rail of switch-back or dogleg ramps.
- Handrails must be returned smoothly to a wall, floor, or post.
- A walkway with a slope of less than 1:20 (e.g., 1:25) is not considered a ramp and does not require handrails.
- Handrails should have a horizontal extension of at least 12 in. (305 mm) past the end of the slope.
- Low railings must be low enough that a 4-in.-(102-mm-) diameter sphere cannot pass through.
- Balusters must be spaced so that a 4-in.-(102-mm-) diameter sphere cannot pass between them.
- A curb at a ramp edge must be a minimum of 4 in. (102 mm) high.

REFERENCE STANDARDS

- AADAG 4.8 Ramps

Practices to Avoid

- Do not use a ramp with a 1:12 slope when a 1:16 slope is readily achievable. Many people cannot manage a slope of 1:12 for 30 ft.
- When two sets of handrails are provided, one for adults and one for children, do not place them closer than 9 in. vertically, to avoid trapping hands.
- Where it is not necessary, do not extend ramp runs to the maximum allowed without a landing to take a break.

Wheelchair Lifts

Description

Inclined and vertical platform lifts are available for short-distance vertical transportation of people with disabilities. Wheelchair lifts are suitable for retrofits.

Assessing Existing Conditions

Document the location and condition of any existing lifts. If an existing space is being considered for a wheelchair lift, identify and document possible locations and related structural conditions.

Acceptable Practices

Vertical wheelchair lift requirements include:

- 42-in. (1066-mm) door for top and bottom landings with mechanical/electrical interlock and solid construction
- 42-in. (1066-mm) platform sides, with solid construction
- Grab bars
- Enclosure or telescoping toe guard
- Maximum travel 12 ft. (3.7 m)

Inclined wheelchair lift requirements include:

- 42-in. (1066-mm) self-closing door for lower landing, with mechanical/electrical interlock and solid construction.
- 42-in (1066-mm) platform side guard not used as an exit, with solid construction. A 6-in. (152-mm) guard is permitted in lieu of a side guard.
- Maximum travel: three floors.
- Key operation, with push-button attendant operation.

REFERENCE STANDARDS

- AADAG 4.2 Space Allowance and Reach Ranges
- AADAG 4.5 Ground and Floor Surfaces
- AADAG 4.11 Platform Lifts (Wheelchair Lifts)
- AADAG 4.27 Controls and Operating Mechanisms
- ASME A17.1 Safety Code for Elevators and Escalators, Section 2000.1 Wheelchair Lift Requirements
- ASME/ANSI Standard A18 Platform Lift and Stair Chair Lift Safety Standard

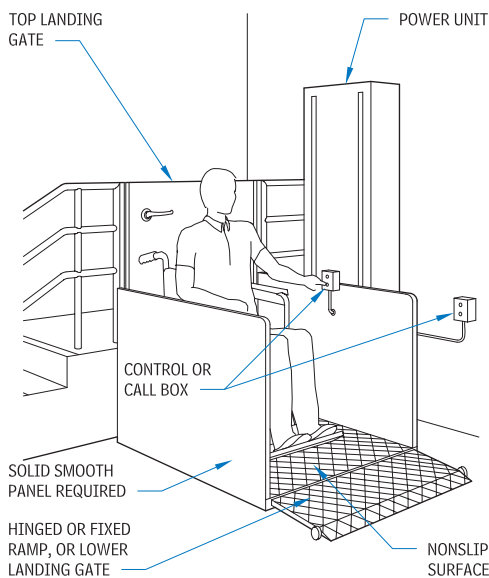


Figure 1.7 A wheelchair lift rises vertically to accommodate moderate changes in height.

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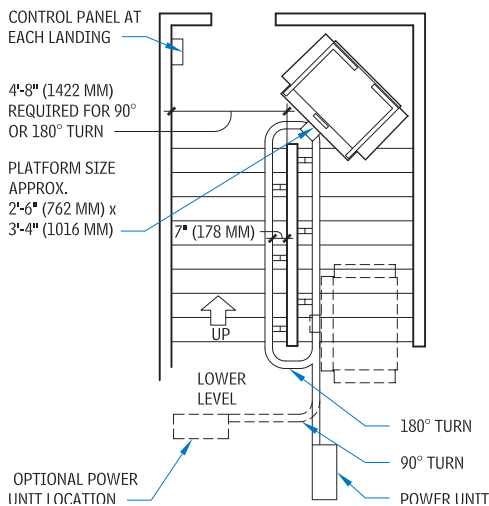


Figure 1.8 A stair lift or platform runs along a special support railing that can accommodate turns.

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Accessible Signs and Telephones

Description

Signs provided as permanent designations of rooms and spaces must be tactile, with raised characters and Braille. Wheelchair-accessible telephones are required where public telephones are provided.

Acceptable Practices

TACTILE SIGNS

- Characters must be between 48 and 60 in. (1219–1524 mm) above the floor.
- Door-mounted signs are allowed on the push side of doors with closers and without hold-open devices.
- Signs on the pull side of doors require an 18-in. by 18-in. (457- x 457-mm) safe zone beyond the arc of any door swing.

TELEPHONES

- All wheelchair-accessible phones, plus 25 percent of additional phones, must provide volume control.
- Provide a shelf and outlet for a portable text telephone (TTY) system at banks of phones without TTYS.

REFERENCE STANDARDS

- ADAAG requirements

Toilet Rooms and Compartments

Description

Standard accessibility dimensions are intended for use by adults; Americans with Disabilities Act Accessibility Guidelines (ADAAG) provide alternative dimensions for children. Accessible unisex toilets are required in certain assembly and mercantile occupancies.

Assessing Existing Conditions

When evaluating existing toilet facilities:

- Identify existing accessible toilet rooms and compartments.
- Check wheelchair turn clearances for toilet rooms and compartments, maximum sink depth and knee space, and placement and types of faucets and mirrors.
- Check accessible toilet door swing, size, direction, clearances of approach spaces, and hardware.

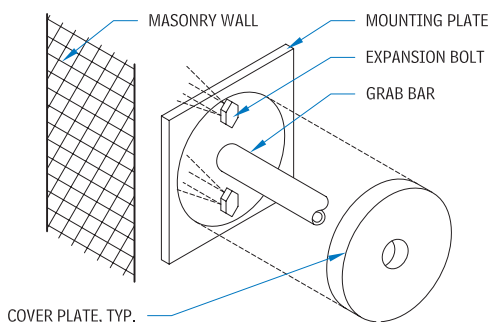
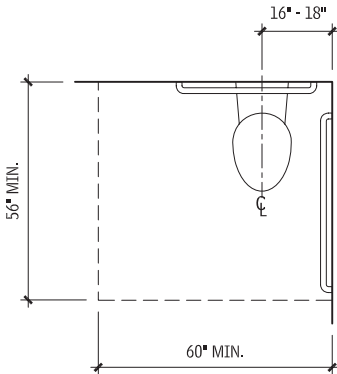


Figure 1.9 Check stainless-steel or chrome-plated brass grab bars for heavy-duty installation and correct length and positioning.

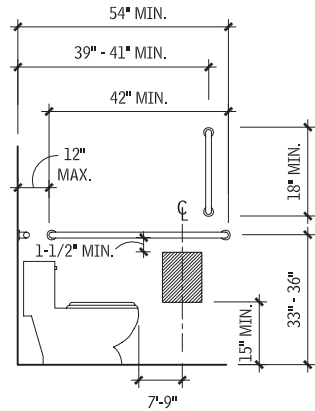
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PLAN CLEARANCE

Figure 1.10 The water closet center should be 18 in. (457 mm) from one side wall.

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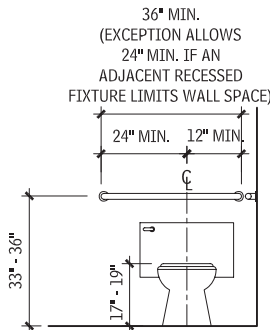
SIDE WALL ELEVATION

Figure 1.11 Check grab bar and accessory locations.

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Check accessible lavatories for:

- Minimum 29-in. (735-mm) to maximum 34-in. (865-mm) top surface height
- Minimum 17-in. to maximum 25-in. (430–635-mm) knee and toe clearances.



REAR WALL ELEVATION

Figure 1.12 Check water closets for obstruction by lavatory or other fixtures.

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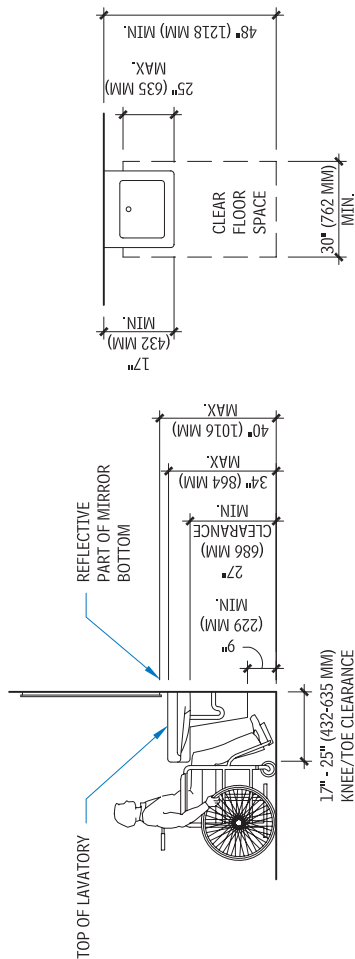


Figure 1.13 Insulate or protect waste and water supply pipes to avoid contact with legs.
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Acceptable Practices

Confirm accessible toilet room maneuvering clearances for actual water closet and lavatory dimensions.

- Accessible toilet rooms must be identified by signs.
- Doors must be 36 in. (915 mm) wide, with closers and latches.

Unisex toilet rooms are permitted in alterations in certain conditions. They must:

- Be located near existing inaccessible facilities.
- Be located within 500 ft (152 m) and within one floor of separate-sex facilities.
- Have doors securable from within the room.

Wheelchair-accessible compartments require a toe clearance 9 in. (230 mm) high and 6-in. (152 mm) deep at the front and at least one side.

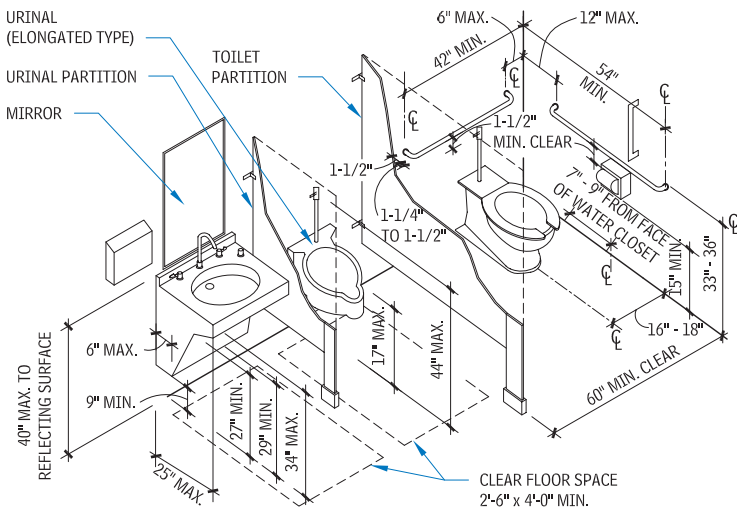
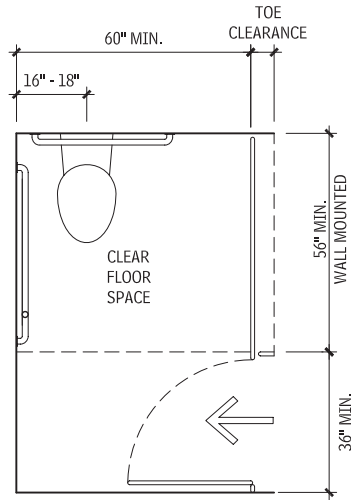


Figure 1.14 Properly located fixtures and accessories include toilet paper dispensers that allow continuous paper flow.

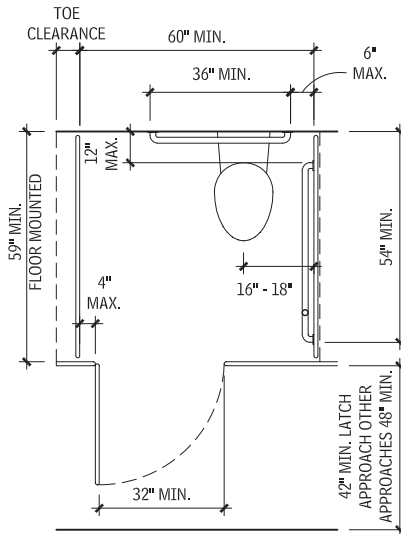
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**END OF ROW
WHEELCHAIR-ACCESSIBLE**

Figure 1.15 End-of-row wheelchair-accessible compartments must be at least 60 in. (1524 mm) wide with a minimum 56-in. (1422-mm) clear depth beyond the 36 in. (915 mm) required for door swing.

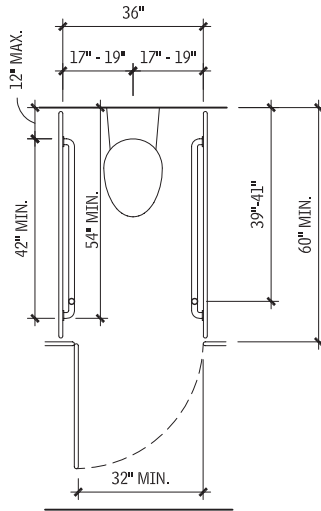
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MIDROW

Figure 1.16 Midrow short and wide stalls are sometimes provided for people who can leave their wheelchairs, stand, and walk a few steps.

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AMBULATORY-ACCESSIBLE

Figure 1.17 Ambulatory-accessible compartments are provided for people who can walk but require grab bars for stability.

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REFERENCE STANDARDS

- ADAAG requirements

Practices to Avoid

- Doors that swing into the required clear floor space at any fixture except in single-user rooms

Resources

ALSO IN THIS BOOK:

- Chapter 5 Stairs: handrails and guardrails
- Chapter 6 Building Codes: egress, corridors and aisles
- Chapter 11 Finish Carpentry: shelving, closets, cabinets
- Chapter 12 Countertops: installation
- Chapter 14 Doors: door criteria, special door types, locksets
- Chapter 21 Carpets: carpet standards, installation
- Chapter 22 Wall Surface Materials: toilet compartments and accessories

OTHER RESOURCES:

- Americans with Disabilities Act Accessibility Guidelines (ADAAG), Title III.
- Ankrum Associates. *Office Ergonomics Training*. www.office-ergo.com.
- Bobrick. *Barrier-Free Washroom Planning Guide*. www.bobrick.com/Bobrick/BarrierFreeGuide/82455.pdf.
- Bradtmiller, Bruce. *Anthropometry for Persons with Disabilities: Needs for the 21st Century*. U.S. Access Board, 1997.
- Human ErgoSystems Inc. *Human Ergonomics*, Ergonomic resources. www.humanics-es.com.
- Human Factors and Ergonomics Society (HFES). www.hfes.org.
- International Code Council (ICC). www.iccsafe.org publications:
 - International Building Code (IBC)
 - International Existing Building Code
 - 2009 International Plumbing Code
- McGowan, MaryRose, and Kelsey Kruse. *Interior Graphic Standards*. Hoboken, NJ: John Wiley & Sons, 2003.
- National Fire Protection Association. NFPA 72 National Fire Alarm Code.
- Panero, Julius, and Martin Zelnik. *Human Dimension & Interior Space: A Sourcebook of Design Reference Standards*. New York: Whitney Library of Design, 1979.
- United Nations Enable. *Accessibility for the Disabled: A Design Manual for a Barrier Free Environment, V. Implementation Checklists: Anthropometrics*.
- WBDG Accessible Committee. *Accessible*. Whole Building Design Guide. Updated 09/23/2008. www.wbdg.org/design/accessible.php.