

Universal Access in Libraries



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CONTENTS

1.	THE AMERICANS WITH DISABILITIES ACT (ADA)	1
1.1	The Law and The Building Code	1
1.2	Application to Different Categories of Facilities	1
1.2.1	New and Renovated Facilities	1
1.2.2	Temporary Facilities	2
1.2.3	Historic Properties	2
2.	UNIVERSAL DESIGN	2
2.1	Basic Concepts	3
2.2	Programming Response	4
2.2.1	Assistive Technology	4
2.2.2	Accessibility for Staff	5
2.3	Design Response	6
3.	THE ENVIRONMENT	6
3.1	Transportation	6
3.1.1	Bus Stop Access	6
3.1.2	Parking	6
3.1.3	Vans and Passenger Loading Zones	7
3.2	Site Access	7
3.2.1	General Site Requirements	7
3.2.2	Accessible Routes	8
3.2.3	Ramps	9
3.2.4	Site Hazards for Persons with Disabilities	10
4.	THE FACILITY	11
4.1	Building Entrance and Building Circulation	11
4.1.1	Building Entrance—General	11
4.1.2	Book Drop	11
4.1.3	Doors	12
4.1.4	Security Gates	13
4.1.5	Aisles and Corridors	14
4.1.6	Ramps, Elevators and Stairs	14
4.2	Service Desks	15
4.3	Stacks and Collections	17
4.4	Special Spaces	18
4.4.1	Community Rooms	18
4.4.2	Study and Tutoring Rooms	18
4.4.3	Children’s Room	19
4.5	Building Components	19
4.5.1	Floor Finishes	19
4.5.2	Signage	20
4.5.3	Fire and Life Safety Protection	20
4.5.4	Lighting	21
4.6	Public Amenities	21
4.6.1	Restrooms	21
4.6.2	Drinking Fountains	22
4.6.3	Telephones	23
5.	LIBRARY FURNITURE—GENERAL DESIGN RULES	23
5.1	Tables, Carrels and Counters	23

5.2	Chairs	24
5.3	Specialized Furniture and Equipment	24
6.	GLOSSARY OF TERMS	25
7.	FURTHER INFORMATION – UNIVERSAL DESIGN	26

1. THE AMERICANS WITH DISABILITIES ACT (ADA)

1.1 The Law and The Building Code

In July 1990, the *Americans with Disabilities Act*, or *ADA*, was signed into law. This landmark legislation has affected almost every aspect of space planning and many architectural features of every library designed in the past 14 years. The Act itself is a general mandate that all facilities used by the general public, whether public or private owners, must be “readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs”. Failure to meet this general requirement would be considered “discrimination” under the law and building owners could be subject to discrimination lawsuits.

The law also provided some concrete design standards, called the *Uniform Federal Accessibility Standards (UFAS)*, which were to be used until individual states adopted their own standards. These standards were finalized in 1991 when final guidelines for the ADA were issued by the U.S. Department of Justice. At about the same time, the State of California incorporated its own set of access regulations, closely following the federal guidelines, in the state regulatory code known as Title 24¹. Technically, California’s regulations are not exactly the same as the federal ADA guidelines, and building compliance in California is verified through a plan check process that uses the Title 24 regulations only.

Chapter 11 of the California Building Code contains the detailed design requirements with accompanying illustrations, which satisfy the requirements of Title 24. There are a number of interpretive manuals for these regulations that can be referenced^{2,3,4}, including one by the California Division of the State Architect, the plan review agency.

1.2 Application to Different Categories of Facilities

1.2.1 New and Renovated Facilities

In general, the full scope of Title 24 regulations will apply to new and renovated buildings and their related sites. In some cases, new buildings with difficult site constraints for example, some aspect of the regulations can be met only at great expense. In these cases, alternative means of *equivalent facilitation* may be used, after consultation with and approval by the governing building official.

In the case of a renovated facility, if the amount of renovation is limited, then the regulations may apply only to a portion of the building. Each such case will be unique, requiring these situations to be discussed with the building official in order to determine the required scope of “ADA

upgrades.” The interpretive manuals can assist in the initial determination of this scope. As with new buildings, if an upgrade will require high expense then it may be possible to provide *equivalent facilitation* to the satisfaction of the building official.

1.2.2 Temporary Facilities

Libraries that are forced to close their facility during renovation, or due to an unforeseeable circumstance, frequently continue to provide service by moving collections and staff into a temporary facility. These temporary facilities can be either vacant buildings, such as empty retail or warehouse space, or trailers, which can be rented or purchased. The trailers are available in various sizes and are often combined to create a single larger temporary facility. These temporary locations, which are sometimes occupied for several years, are required by code to be accessible for all library collections and services. Most will require, at the very least,

- Constructing a ramp to the entrance;
- Interior ramping between connected units that may be at different levels;
- Careful arrangement of stack aisles according to minimum code requirements;
- Standard fire and life safety requirements, including audible and visible alarms and areas of rescue assistance.

“Temporaries”, as they are frequently called, are not exempt from meeting accessibility requirements, with the exception of the trailers used by the general contractor for management activities.

1.2.3 Historic Properties

Facilities that are legally designated “historic” are special cases of renovated facilities. Because of the desire to preserve the character and features of historic buildings, building regulations of all types may be waived in favor of *alternative means* of providing the equivalent accommodation or safety features. The California State Historic Building Code provides guidance in this regard and in any event the details and scope of the *alternative means* need to be discussed and approved by the governing agencies.

It is important to note that there are many types and degrees of historic designations, from local jurisdictions up to the National Register of Historic Places. More flexibility in the application of code requirements is likely for more significant historic designations.

2. UNIVERSAL DESIGN

As noted in an article on Universal Design by Barbara Knecht in the January 2004 issue of *Architectural Record*⁵, “Accessibility is a mandate; universal design is a movement.” Universal design is an approach to the design of the environment, buildings, products and communications

that equitably accommodates all types of people and takes into account as much as possible their differences. These differences include any physical impairments or difficulties speaking the dominant language.

The key concept is *equivalent facilitation*—creating a space or feature that does not treat some people differently, even when it is fully accessible and meets the letter of the law. For example, an entry that features stairs with a ramp off to one side may satisfy code but is not *universal* since it effectively segregates wheelchair users to a less commonly used and intrinsically different path to the front door. The goal is to make accessibility as invisible to every user as possible.

Universal Design is not mandated by ADA and is not a code requirement. It is, however, a desirable approach to the design of environments that is specifically inclusive and equal for all users. It is a framework for design solutions rather than a code of detailed requirements.

2.1 Basic Concepts

In 1997, the Center for Universal Design at North Carolina State University published *The Principles of Universal Design*¹ to guide designers and consumers in the evaluation of existing designs and in the design of usable products and environments. These seven principles were developed in collaboration with a consortium of universal design researchers and practitioners from across the United States. These Principles of Universal Design are as follows:

1. Equitable Use: The design is useful and marketable to people with diverse abilities. Provide the same means of use for all users: identical whenever possible; equivalent when not. Avoid segregating or stigmatizing any users. Provisions for privacy, security and safety should be equally available to all users. Make the design appealing to all users.

2. Flexibility in Use: The design accommodates a wide range of individual preferences and abilities. Provide choice in methods of use. Accommodate right- or left-handed access and use. Facilitate the user's accuracy and precision. Provide adaptability to the user's pace.

3. Simple and Intuitive Use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level. Eliminate unnecessary complexity. Be consistent with user expectations and intuition. Accommodate a wide range of literacy and language skills. Arrange information consistent with its importance. Provide effective prompting and feedback during and after task completion.

4. Perceptible Information: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities. Use different modes

¹ *The Principles of Universal Design*, Copyright © 1997 NC State University, The Center for Universal Design.

(pictorial, verbal, tactile) for redundant presentation of essential information. Provide adequate contrast between essential information and its surroundings. Maximize “legibility” of essential information. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).

5. Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated or shielded. Provide warnings of hazards and errors. Provide failsafe features. Discourage unconscious action in tasks that require vigilance.

6. Low Physical Effort: The design can be used efficiently and comfortably and with a minimum of fatigue. Allow user to maintain a neutral body position. Use reasonable operating forces. Minimize repetitive actions. Minimize sustained physical effort.

7. Size and Space for Approach and Use: Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of user’s body size, posture or mobility. Provide a clear line of sight to important elements for any seated or standing user. Make reach to all components comfortable for any seated or standing user. Accommodate variations in hand and grip size. Provide adequate space for the use of assistive devices or personal assistance.

2.2 Programming Response

When developing a library program, and when carrying out the design of a new or renovated facility, it is required to meet the California Title 24 access standards and it is recommended that the principles of Universal Design be applied attentively throughout this process. A special section of the library program should be set aside to describe the intent of the design in this regard, to guide the design professionals and the library representatives on the project team. Universal Design requires a greater degree of attention to the issue than simply following Title 24 requirements, and if this option is chosen for the library building project, the intent and breadth of application should be clearly described.

2.2.1 Assistive Technology

Some forms of assistive technology are required by the Title-24 regulations. In addition, advances in these technologies have provided additional opportunities to make public facilities more universally accessible.

Technology for the Visually Impaired

There are many technologies available to assist patrons who are visually impaired. Enhanced image devices offer access to print and computer images through the use of either software or hardware techniques that can magnify the image four to five times. A closed circuit television (CCTV) system can use a small camera and high resolution color monitor in conjunction with a PC to provide a high resolution color image. A split screen can enable the user to transcribe information directly from the print image to the PC.

Optical character recognition (OCR) systems “read” and convert print into electronic format. Some of these are stand-alone systems such as the Kurzweil personal reading machine; others are based on a scanner, OCR card, software, adaptive technology, and a PC workstation. This technology is becoming increasingly popular and affordable.

Synthetic Speech systems use a synthesizer that does the speaking and a program to access what is on the screen, instructing the synthesizer what to say. The synthesizer can be a box attached to a PC workstation.

Mobility aids

Mobility and dexterity limitations can result from a broad range of neuromuscular and orthopedic disabilities ranging from spinal cord injury, cerebral palsy, multiple sclerosis, muscular dystrophy, post-polio paralysis, and that produce wide variations in physical abilities. Hand and arm dexterity problems can include those caused by carpal tunnel syndrome or repetitive stress syndrome. Hand dexterity problems can have greater impact than mobility limitations depending on the severity of the disability. Some individuals with hand dexterity impairment can write, type, or use a mouse; others can not.

Technology for the Hearing Impaired

Assistive listening systems are required by code in any space where audible communications are integral to the use of that space. In libraries, this requirement will apply to meeting rooms and auditoriums. These systems provide signals that can be received by anyone with special receivers or even certain hearing aids, and which filter or eliminate background noise. There are a number of technologies available, and these should be evaluated for ease of use, portability, spillover into adjacent spaces and degree of susceptibility to electrical interference.

2.2.2 Accessibility for Staff

California Title 1, which governs employment and discrimination issues, basically requires employers to provide employment opportunity for physically disabled persons and to ensure that the working environment is accessible for staff and does not inhibit their ability to carry out their tasks and responsibilities. The site and building should be just as accessible for staff as it is for

patrons, and ideally the concept of Universal Design should apply for staff as well. In addition to workstations, service desks (4.2 below), paths of travel, and equipment, staff amenities, such as the staff lounge and staff lockers, if available, must also meet accessibility requirements.

2.3 Design Response

Universal Design as applied to library facility design is a relatively recent movement, and many design professionals are not familiar with the best approaches to the many design issues involved. Guidelines should be provided to be clear about design features for such items as exterior access to the building (avoiding separate stairs and ramp systems) or service desk design (avoid the high / low approach to counter height). At a minimum, provide the seven principles listed above and work with the design team to develop and evaluate all building features with regard to these principles.

3. THE ENVIRONMENT

Almost every aspect of the design of a library facility is touched by consideration of universal design and accessibility, from transportation to the site to the detailed design of particular building features. The following sections provide information about the major aspects and point out preferred approaches in the design. For complete information, particularly about accessibility regulations that govern any design, refer to the interpretive manuals and codes listed in Section 6 below.

3.1 Transportation

3.1.1 Bus Stop Access

It is required that the path of travel from the nearest public transit stop to the front door of the library be accessible. The city or county may be obliged to upgrade sidewalks and curbs, including maximum slopes and curb cuts, to achieve an accessible route. Depending on the distance involved, this upgrade could have a significant cost impact on the project.

The maximum slopes, which apply in general for any accessible paths or sloping surfaces that have no conforming handrails for wheelchair users, are 1:20 (5%) for the running slope and 1:50 (2%) for the cross slope. Specifications on the design of curb cuts are provided in the accessibility reference manuals.

3.1.2 Parking

A minimum number of accessible parking spaces, typically denoted with a blue-painted curb and an International Symbol of Accessibility, are required for any building used by the public,

depending on the total number of parking spaces provided as part of the project. The minimum requirement is one accessible space for every 25 parking spaces, up to 500, with no less than one space; beyond 501 total spaces, a minimum of two percent of the total is required.

Accessible parking spaces must be at least 9' wide served by an access aisle at least 5' wide for a total of a 14' wide area. Two accessible parking spaces can share one 5' wide access aisle. One out of every eight accessible spaces must be van-accessible, which requires the designated spaces to have a larger accessible aisle of width 8'. It is important to note that a van-accessible space must be provided regardless of the number of accessible spaces required for the site. This would mean that if a library were required to have only one accessible parking space (the minimum requirement), it must be the van-accessible type.

Accessible parking must be located at the shortest route to accessible entrances and the access aisles must be part of an accessible route to the entrance of the Library. If a curb ramp is required between the access aisle (loading and unloading area) and the path to the building entrance because of a difference in elevation caused by a curb, this curb ramp may not be located in the access aisle. Finally, all accessible parking spaces and adjacent accessible aisles must meet the cross-slope requirement of a maximum 2%.

A specifically designed sign is required at the site entrance, which warns about unauthorized use of disabled accessible parking spaces. Alternatively, this sign can be located at each disabled parking space, which would be practical only for small parking lots. In addition, every parking space reserved for persons with disabilities must be identified by a prescribed sign that is either pole-mounted or wall-mounted, at a minimum height of 80" and 36" respectively.

3.1.3 Vans and Passenger Loading Zones

For passenger loading zones, there must be a minimum 20'-0" long pull-up space and a 20' x 5' access aisle adjacent and parallel to the vehicle pull-up space. The standing spaces and access aisle may not exceed a 2% slope in any direction. The International Symbol of Accessibility must be displayed at accessible passenger loading zones.

3.2 Site Access

Beyond provision of accessible parking, the entire building site must be accessible. The design of site features affecting pedestrian movement through the site is the subject of regulations and recommendations pertaining to Universal Design.

3.2.1 General Site Requirements

The general code requirements for an accessible site are as follows:

- There must be at least one accessible route within the boundary of the site to an accessible building entrance from (1) public transportation stops; (2) accessible parking spaces; (3) accessible passenger loading zones; (4) public streets and sidewalks.
- If more than one route is provided, all of these routes must be accessible.
- Site development and grading must be designed to provide access to all entrances and exterior ground floor exits. As required, the design should incorporate pedestrian ramps, curb ramps, and other design features, to create this accessibility.
- If, due to site topography or other natural features, these requirements would create an unreasonable hardship, *equivalent facilitation* (providing accessibility through other means and methods) can be provided instead.
- Site signage showing the International Symbol of Accessibility is required at every primary public entrance and at every major exterior junction along or leading to an accessible route.

The more extensive Universal Design principles would require that all paths of travel, both entering and traversing the site, are accessible. Furthermore, separation of ambulatory persons and persons in wheelchairs should be avoided. For example, using stairs and ramps to negotiate a grade change is undesirable. Rather, solutions should be sought that provide a common accessible path system.

Similarly, site stair systems or terrace-like landings that are not accessible to persons in wheelchairs violate the concept of Universal Design, even if a code-compliant ramp or accessible sloping pathway is provided. Such designs often provide intentional or unintentional socializing areas that are then not available to the person in a wheelchair.

3.2.2 Accessible Routes

There are a number of general design requirements for accessible routes through the site, which also apply to building circulation spaces. These are the following:



Fig. 1. Universal Design avoids separation of routes to the entrance.

- A site pathway must be a continuous common surface uninterrupted by abrupt changes in level, which are defined as any step change greater than ¼". Any change of level from ¼" to ½" must be beveled.
- Running slope may not exceed 5% and cross slope may not exceed 2% (general rule).
- The minimum width of the accessible site pathway is 48", and if there is any obstruction in the pathway such as a light pole, the required clearance at the obstruction is 36".
- No gratings are allowed, but if necessary because of special site conditions, the grid openings are a maximum ½" in the direction of traffic flow.
- Site pathways with a continuous slope must have a minimum 5' long level area every 400' to allow a person in a wheelchair to rest, and if the width of the pathway is less than 5' wide then there must be a 5'x 5' passing and turning area every 200'. This passing area is not required to be level, but must maintain a maximum 2% cross slope. Also, a T-shaped intersection of two paths can serve as the passing and turning area.
- The pathway surface must be firm, stable, and slip resistant.

3.2.3 Ramps

When the running slope exceeds 5%, the pathway is defined as a *ramp*, for which additional requirements apply. There are two types of ramps: a *curb ramp* and a *pedestrian ramp*. A curb ramp is a short ramp that cuts through a curb allowing a person in a wheelchair to make a transition from the lower surface to the surface at the top of the curb. A pedestrian ramp, distinguished from a curb ramp, is a longer ramping surface that is intended for general pedestrian traffic.

Pedestrian ramps may not have a slope greater than 1:12 (8.33%) nor a cross slope greater than 2%. The top landing of the ramp must be a minimum 5'x 5' level area and the level bottom landing must be as wide as the ramp and must extend a minimum 6' in the direction of travel. The maximum rise of any ramp is 30" before there must be a level landing. If the ramp changes direction at this intermediate landing, then the dimension of the landing must be 5'x 5'.

In addition to these requirements, a pedestrian ramp is required to have continuous handrails on both sides for the full length of the ramp, unless the ramp does not exceed 6' in length or 6" in height. Specific requirements for the design of the handrails can be found in the interpretive manuals listed at the end of this article. Finally, if there is a drop-off of more than four inches between the ramp surface and the adjacent grade, a minimum 6" wide by 2" high warning curb

must be utilized. (Note: this is distinguished from the warning curb at normal walkways, discussed in the next section, where the height of the warning curb must be 6".)

Curb ramps are distinguished from pedestrian ramps in that they are not required to have handrails, do not require level bottom landings (they can end sloping to a road surface), and have shorter required landing dimensions. The detailed designs for a variety of types of curb ramps are illustrated in the referenced interpretive manuals.

3.2.4 Site Hazards for Persons with Disabilities

There are many potential site hazards for persons in wheelchairs, and particularly for visually-impaired persons. The code effectively mitigates against these hazards, which include protruding objects, abrupt changes in elevation, sidewalk hazards and adjacency to vehicular zones.

If a site pathway or sidewalk is adjacent to landscaped areas, streets, driveways or fountains, where there is an abrupt drop-off of 4" or more, then a warning curb must be installed that is a minimum 6" high by 6" wide. If a guardrail or handrail is used in these locations, then the curb can be omitted if a guide rail is attached, centered at 2" to 4" above the pathway.

Any obstruction that overhangs the pathway, such as a light fixture or a suspended sign, must be a minimum of 80" above the walking surface. If the vertical clearance is less than 80", then a barrier must be provided to warn visually impaired persons about the hazard. Since an object can be detected by a cane up to 27" above a walking area, the barrier must provide this detection under the overhanging hazard. The zone between 27" and 80" above a walkway is considered undetectable by a visually-impaired person and must be entirely protected by the barrier in the case of any overhanging hazards.

Objects with leading edges that are between 27" and 80" above a walking area may not protrude more than 4" into the walkway. In any case, the required width of a walkway cannot be reduced by the protruding object, which requires the walkway to be widened in such an instance. When approaching an object head-on, such as a sign mounted on a post, which is less than 80" above the walkway, the object cannot be more than 12" deep before it is possible for a cane to encounter the post or other barrier below 27". Alternatively, any object mounted on a post that is less than 12" in depth may be located in the path of travel since it is expected that a visually-impaired person will detect the post or other barrier before encountering the object.

Detectable warnings are required at the edge of any hazardous vehicular areas, if the walking surface is not separated by curbs, railings or other elements. The detectable warning must extend the full length of the boundary between the vehicular way area and the walking area. The design

of the detectable warning is specified in detail by the code, and basically consists of an 18”-wide yellow mat with small raised, truncated “domes.”

4. THE FACILITY

4.1 Building Entrance and Building Circulation

4.1.1 Building Entrance—General

In new buildings or renovated buildings that must comply throughout with accessibility standards, all entrances and exits, including exit-only doors (those without entry hardware), are required by code to be accessible to persons with disabilities. Exit-only doors become exempt if the building has a fire sprinkler system installed throughout, if the exit provides an “Area for Evacuation Assistance” (see section 4.5.3 below), or if it is not a required exit, is more than 24” above or below adjacent grade, and has warning signage that it is not an accessible exit.

In a renovated building that does not require a full accessibility upgrade, only one entrance and path of travel to the area of alteration is required to be made accessible.

Any doormats must be recessed and anchored to prevent interference with wheelchair traffic.

At every primary entrance to the building, a sign must be posted displaying the international symbol of accessibility.

4.1.2 Book Drop

According to the principles of Universal Design, there should be one accessible book drop per location, rather than providing two book drops, one of which serves ambulatory patrons and one which serves patrons in a wheelchair. If only one book drop for each type of media is provided, the design will be constrained by maximum height of handle, the reach range for the person in a wheelchair, and the space required in front of the book drop to accommodate the wheelchair.

The maximum reach height of the handle, if a wheelchair approaches from the side, parallel to the wall, is 54” above the floor. To allow a forward approach to the book drop, the maximum height is 48” above the floor to allow reaching capability from the wheelchair. The required clear space in front of the book drop is 48” x 48” if



Fig. 2. The book drop must be low enough for a side reach—no higher than 54” (48” recommended).

capability for both parallel and forward approaches is desired. Otherwise, the clear space is 48" x 30", with the 48" dimension in the direction of travel of the wheelchair. If the book drop is in an alcove deeper than 15", the parallel approach dimension changes to 60" x 30" and the forward approach dimension changes to 48" x 36", which means that for both parallel and forward approaches in an alcove greater than 15" deep the required clear space is 60" x 48", with the 60" dimension along the wall.

4.1.3 Doors

All aspects of the design of exterior entrance doors and interior doors are strongly regulated to ensure reasonable equivalent ease of use by a patron with physical disabilities. In addition to requiring minimum door widths to allow ease of passage of a patron in a wheelchair, the maximum force required to open a door is specified at 5 pounds of pressure. The only exception is for fire exit doors, which are allowed to have a maximum of 15 pounds of pressure in order to ensure adequate fire separation.

This limit effectively governs the design of door hardware, which must be capable of meeting the requirement even for normally heavy steel or solid wood doors. While this poses no problem for most interior doors, the normal pressure differentials around a building make it virtually impossible to meet the 5 lb. pressure requirement for exterior doors. Therefore, the only type of accessible exterior door that is practical is an automatically opening door.

There are a number of types of automatic doors, including push-button activated type, a mat-activated type, a motion-sensor activated type, and power-assist type that is activated by a gentle pull of the door handle. Also popular are "storefront" bi-parting doors, which generally provide wide clearances when open and are good choices for high traffic facilities. The bi-parting doors can also be pushed open in case of emergency.

Universal Design will require that all patrons enter the library through the same doors as patrons in wheelchairs. For cost reasons, the bi-parting automatic doors may be the preferred option for main entrances. Note that revolving doors, which were designed to prevent large drafts of air in tall buildings, are not usable by persons in wheelchairs, and therefore are not acceptable if Universal Design is the design criteria.



Fig. 3 Accessible entrance doors have many design options, including power assist push-button activation.

The doors themselves must be at least 3'-0" in size, and when in the open position (at 90 degrees) cannot block the door opening so that there is less than 32" of clear width. All accessible swinging doors are required to have a 10-inch high smooth "panel" on the push side that allows the door to be opened by a wheelchair footrest. For narrow stile doors, care should be taken that the footrest cannot be snagged on the frame, which means that the 10-inch panel must be flush with the door stile.

Door lever handles and manual locking devices must be no lower than 30" and no higher than 44" above the floor to allow a person in a wheelchair to reach them from a forward approach position. If a door has an automatic closer, it must be set so that it takes at least 3 seconds to close from an open position of 70 degrees to within 3" of the latch in order to allow persons in wheelchairs adequate time to clear the doorway.

When passing through a vestibule, the two doors on opposite sides of the room must be a minimum of 48" apart when in the open position. This rule applies to any two doors encountered in sequence.

Door thresholds cannot be any higher than ½", and when between ¼" and ½" there must be a beveled edge to the threshold at a slope of 1:2.

Code requires that there be a level clear space on both sides of any door. The level area in the direction of the door swing must be a minimum of 60" in length. The level area opposite the direction of the door swing is a minimum of 44" to 48" in length, depending on the direction of approach and the existence of a door latch and automatic closing device. It is also important to note that there is a required "strike side" clearance adjacent to the door, which is 12" minimum on the push side of the door, 18" minimum on the pull side of interior doors and 24" on the pull side of exterior doors. Refer to the interpretive manuals listed at the end of this article for illustrations and detailed description of these different situations.

4.1.4 Security Gates

Book detection systems are designed to be accessible and are not provided with any kind of gate system. If security gates are used to prevent exiting in case of alarm, they must comply with the same requirements as doors. Turnstiles are not accessible. If they are used, a separate, accessible gate must be provided adjacent to the turnstiles. However, if Universal Design is the design criteria, turnstiles may not be used.

Many libraries rely on the book detection system only, backed up by security or library staff in case of alarm, in order to provide a simple, universally accessible system of control.

4.1.5 Aisles and Corridors

All aisles serving one side only must be a minimum of 36” in width, while all aisles serving both sides must be a minimum of 44” in width. The significant exception to the double-side requirement is library bookstacks, which is now specifically spelled out in the code. See section 4.3 below for specific information on stack and bookshelf aisle requirements.

Most corridor widths are determined by general fire exiting requirements. However, accessibility code requirements may set certain minimum dimensions. Corridors on an accessible route, and *all* corridors in the case of Universal Design, that are greater than 200’ in length must be a minimum of 60” wide, or have a minimum 60” x 60” wheelchair turning area or an intervening cross or tee corridor at a central location. Irrespective of the code requirement, a minimum of 60” width is recommended for all corridors since this allows two wheelchairs to pass in opposite directions. This would also satisfy the basic principles of Universal Design.

See the interpretive manuals for details about minimum widths at turns in corridors or at obstructions. Note that the code requirements regarding protruding objects, as discussed in section 3.2.4 above, apply to interior aisles and corridors.

4.1.6 Ramps, Elevators and Stairs

The code requirements for exterior site ramps as described in section 3.2.3 above apply to internal ramps as well. From a practical perspective, ramps take up much valuable floor space and unless such a feature is desired for architectural reasons and is usable by all library patrons, they are generally avoided. This usually mitigates against relatively small floor elevation changes and encourages a continuous and uniform floor level. High spaces, when designed into the building, are usually served by an elevator system.

Although the general building code does not require elevators in all multistory buildings, practically speaking, all multistory libraries will be required to install elevators. When elevators are installed, *all* of them must be accessible, including staff and freight elevators. It is not permitted to designate one elevator only as accessible. Elevators must serve all levels of the building, including any small mezzanine levels, and must be located near a major path of travel.

If central stairs are provided near the entry to the library, the principles of Universal Design suggest that the primary passenger elevator system be located within reasonable distance of the stair, in order to provide an equivalent ease of vertical circulation within the library. It should be noted that according to the code, any stairway located more than 200 feet from the primary passenger elevator system cannot be used for vertical circulation of patrons or staff, and must be limited to fire exit use only.

If the building has only one elevator, it is not permitted to limit public access to this elevator and to use it to provide wheelchair access to upper floors through a request to a staffperson. There must be at least one public elevator in the building.

The elevator cab must be designed for the turning of a wheelchair (enter the cab, maneuver within reach of controls and exit from the cab). This requirement sets certain minimum sizes for the platform of the elevator cab, depending on how the elevator door panels are designed. There is also a list of code requirements pertaining to the elevator doors, clearances, speed at which the elevator door closes, and the design of elevator control panels and hall call buttons. (See interpretive manuals listed at the end of this article.) There is also a requirement that the location of the elevator in the hoistway is indicated by both visual and audible signals. Audible signals sound once for up and twice for down.



Fig. 4. Elevators have many requirements in order to make them accessible.

Related to this requirement, the design of the emergency communication device (usually a telephone handset) is specified in the code, but it is recommended that the two-way communication system provide both voice and visual display intercommunication so that both persons with hearing impairments and persons with vision impairments can receive information regarding the status of a rescue.

Most elevator manufacturers will provide a checklist and certification that their product meets accessibility requirements. This documentation should be required as part of any construction project.

Stairs have a number of detailed requirements, principally for the accommodation of persons with visual impairments. These pertain to handrail design, striping treads with contrasting color, and the design of stair treads and risers. Refer to the interpretive manuals for these details.

4.2 Service Desks

Service desks should be accessible to both staff on the staff side of the desk, and to patrons on the patron side of the desk. In addition to the accessibility requirements, the design of the workstations at any service desk should take into account the tasks and motions required by any

staff person working at the desk in order to prevent repetitive stress syndrome or other job related injuries.

In general, service desks should be no deeper than 30” to facilitate the sliding of materials from patron to staff and back. Individual workstations on the staff side should also accommodate both left-handedness and right-handedness in the location of fixed barcode readers, scanners, inventory control system desensitizers, and keyboards or mice required in the discharge of library materials.

Shelves which require frequent access such as reserved book shelves should not be low shelves which can cause back injuries and be difficult for staff requiring reading glasses. If shelf sections located at 45” or lower are used for these frequently used materials, then the probability is that at least one third of the tasks will require reaching toward the bottom shelf.

Circulation, Reference, and other service desks must meet code requirements designated for built-in tables and counters. This means that there must be at least one staff station and one patron location (usually combined at the same place in the desk) must meet the following design criteria:

- Height of the countertop is between 28” and 34” above the finished floor. For the Circulation Desk, the 34” dimension is preferred because of the relatively short transaction time.
- Knee clearance is at least 27” high. For the staff side of the desk, there should be a 19” deep knee clearance space to allow the staff person to be positioned in the forward approach position rather than parallel position.
- It can be assumed that a patron will utilize a parallel approach at service desks, and that the service desk has more than one service location, so that the minimum clear area required at the desk is 36” wide.

Universal Design requires that all staff and patron positions at service desks are designed exactly the same. This means that any stand-up service desks, such as the Circulation Desk, cannot be any higher than 34” above the finished floor. In addition, the 19” knee clearance requirement on the staff side of the desk will apply. In general, these dimensions are not inconvenient or uncomfortable for ambulatory patrons and staff, and this design approach is recommended.



Fig. 5. Service Desk heights should be uniform for Universal Design (no up-down type of design).

4.3 Stacks and Collections

As noted above, aisles must be 44” wide in general, if they are serving both sides of the aisle. An exception is permitted for open library *bookstacks*, which may be 36” wide. However, for library *book shelves*, the 44” minimum width applies.

The difference between bookshelves and bookstacks depends on how the area is used. Bookshelves store commonly used publications such as current periodicals and frequently used reference materials, while bookstacks are principally structures for more compact storage of library materials.

For bookstack layout, there must be a minimum 44” wide main aisle, with minimum 36” wide side aisles. Ends of bookstack ranges should not be placed against the wall; rather, 36” side aisles should be utilized to avoid dead-ends that make it impossible for a person in a wheelchair to turn around.

If assistance is available, book shelves have no height limit according to code. However, if assistance is not available, then the height of the book shelf unit (top of the topmost shelf) is limited to 54”, with 48” preferred. For Universal Design, the 54” height limit (48” preferred) should be used for bookshelves for all frequently used publications and library materials.

There is no height limit for bookstacks.

It should be noted that in the case of a retrofit of an existing building, 15% of the total library shelving can be located on an inaccessible mezzanine area, and that multi-tiered, closed bookstacks (those restricted to staff use) are exempt from accessibility standards. Neither of these situations would comply with Universal Design Principles.

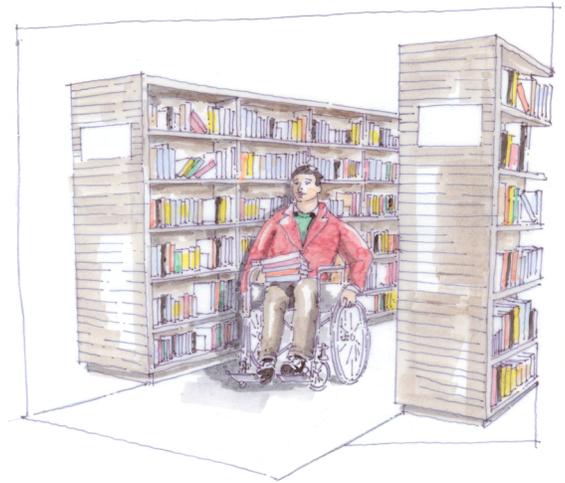


Fig. 6. Bookstack aisles can be a minimum of 36” wide and bookstacks are unlimited in height.



Fig. 7. Book shelf aisles are a minimum of 44” wide and book shelves are limited in height to 54” unless staff assistance is available.

4.4 Special Spaces

4.4.1 Community Rooms

Community rooms are considered assembly areas by code and special requirements apply. If there is fixed seating, so that the room is essentially an auditorium, then wheelchair locations must be provided in a variety of locations that offer lines of sight comparable to those for ambulatory persons.

The code requires one wheelchair accessible location per 25 seats up to four different locations for between 51 and 300 total seats. Each of the required wheelchair locations must have one “companion” fixed seat immediately adjacent to it, and an accessible route must be provided connecting all other areas of the auditorium.

In addition, the code requires at least 1% of the total seating, and not less than two seats, must be set aside for “semiambulant” persons. These semiambulant seating locations must provide at least 24” clear space between the front of the seat and the back of the seat immediately in front.

The final requirement for accessible seating is that 1% of the seating, but not less than one seat, must be aisle seats with no armrest on the aisle side, or with removable or folding armrests on the aisle side. Each of these seats must be identified by a sign or marker.

For community rooms without fixed seating, special seating areas are not required. While not required in this case, every attempt should be made to accommodate an adjacent companion seat for areas set aside for wheelchairs. If wheelchair accessible locations are not in use, easily removable seats may be temporarily placed in this location

Assistive listening systems will be required for this type of space. For auditoriums with fixed seating and an audio-amplification system, a permanently installed assistive listening system is required. In this case, the minimum number of receivers required is 4% of the total number of seats, but no less than two. This number of receivers is also required for meeting rooms without fixed seating if a permanent system will be installed as part of the design. The alternative for meeting rooms without fixed seating is to provide a portable system that is adequate to provide the number of receivers calculated for a permanent system.

4.4.2 Study and Tutoring Rooms

A quiet environment is suggested for certain types of learning disabilities, and study rooms that can be generally used can be designated for this purpose. Such special study rooms might also be equipped with certain assistive technologies.

4.4.3 Children's Room

Though children have different sizes and shapes, wheelchairs for children have dimensions similar to standard wheelchairs. At a minimum, code dimension requirements will apply in Children's Rooms.

As an objective of Universal Design, it may be desirable that smaller tables also be able to accommodate a smaller wheelchair. Wheelchairs for smaller children are typically made approximately 2" lower than adult-sized wheelchairs, so that a reading table providing 25" clear space under the table top will permit such common use.

Children's restrooms should be accessible, and will be necessarily scaled down to accommodate those with disabilities in different age groups. The interpretive manuals provide tables of recommended dimensions for toilet facilities used by children, distinguishing between kindergarten and pre-school age children, elementary school age children and children age 12 and older.

4.5 Building Components

4.5.1 Floor Finishes

Carpets

In order to allow wheelchairs to move easily over floor surfaces, carpet or carpet tiles must be securely attached and have a pile or loop not exceeding ½" in height. Exposed edges of carpet and carpet tiles must be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet pads are generally not recommended in libraries, but if they are used they must be securely attached. As an alternative, enhanced carpet backing is recommended for acoustics and comfort and is easily traversed.

Other Finishes

Uneven or heavily textured flooring materials, such as slate, are occasionally used in the lobby areas of a building. This material which is both durable and attractive, can add an interesting architectural detail to the lobby. However, libraries with large senior populations may want to reconsider its use as it is extremely difficult to navigate with a rolling walker or other mobility aid, and if the area is used for the movement of loaded book carts, it can be very noisy.

4.5.2 Signage

Universal signage and wayfinding recommendations are covered in depth in “Wayfinding and Signage for Libraries”, General Requirements for Public Libraries on the Libris DESIGN web site.

When any site or building feature is identified by a sign indicating that it is accessible to persons with disabilities, the symbol that must be used is the International Symbol of Accessibility. These include parking spaces, passenger loading zones, building entrances and toilet and bathing facilities.

There are two categories of signs that must meet certain size and mounting requirements in order to meet ADA requirements: signs that designate permanent rooms and spaces and signs that provide direction to or information about spaces in the building. The guiding rule is to provide signage that will allow all building users, disabled or not, to use the functional spaces conveniently and safely.

The interpretive manuals provide a chart that describes minimum character and number sizes according to the viewing distance. An example is that capital letters must be at least 2” high if they are to be seen at a distance of 50’. In any case, the minimum character height for directional signs indicating major service areas is 3”, no matter the viewing distance.

Signs designating permanent rooms should be attached to the wall at 60” above the floor, adjacent to the latch side of the door. These signs should have raised letters of the appropriate size and should include the corresponding Grade II Braille.

Overhead signs should follow the size prescription of the chart, but cannot be less than 3” capital height, and must be at least 80” above the floor level.

Refer to the illustrative manuals for details about Braille characters, raised characters, mounting heights, finish and contrast, and character proportion and height.

4.5.3 Fire and Life Safety Protection

Audible and Visible Alarms

Emergency systems must be designed so that persons with disabilities can be aware of emergency notifications and can respond without any safety disadvantage. This means that emergency warning systems must include both audible and visual alarms.

Visual alarms are required in all restrooms and other common public areas including reading rooms, meeting rooms, hallways, and lobbies. Visual alarms must be placed 80” above the highest finished floor or 6” below the ceiling, whichever is lower. No area of a room can be more

than 50' from a visual signal. In larger areas exceeding 100' across, such as auditoriums or large meeting rooms, the visual alarm devices may be placed around the room at a maximum of 100' apart, and no devices need to be suspended from the ceiling.

To ensure that they can be heard above surrounding noise, audible alarms must produce a sound that exceeds the normal sound in an area by at least 15 dbA, or the loudest sound which lasts at least 60 seconds in a space by 5 dbA. Audible alarms can not exceed 120 dbA (level of sound near a jet aircraft engine!)

Areas of Rescue Assistance

If any required fire exit is not accessible to disabled persons, then it must include a space for a wheelchair to park and wait safely for assistance unless the building has a supervised automatic sprinkler system, or unless the building project involves alterations to an existing library building. Such special areas in the exiting system are called *areas of evacuation or refuge assistance*. There are many possible configurations of this type of space, depending on the particular design of the stair and related exiting system; refer to the interpretive manuals for various diagrams and detailed requirements.

4.5.4 Lighting

Visually impaired persons need higher lighting levels or assistive technologies or devices in order to move through the various types of environments or to use library media and equipment. Good lighting design in general, meaning minimizing glare and providing the right balance of brightness and contrast with both electrical lighting and daylighting, assists both the younger persons with excellent vision and those with some impairment due to age or physical impairment. Some design strategies for those with less than perfect vision may also be considered, such as switches on timers for bookstack aisles, should higher vertical light levels be desired by an elderly patron searching titles.

The accessibility standards specify certain minimum lighting levels for safety, such as 2 foot-candles in exterior environments like parking lots and 5 foot-candles in elevators. There is also a requirement that light controls be mounted no more than 48" above the floor, to allow ease of use by a person in a wheelchair.

4.6 Public Amenities

4.6.1 Restrooms

Accessibility requirements for restrooms are spelled out in detail by the code, and many diagrams are provided in the interpretive manuals for toilet room layout, accessory items, hardware, and

lavatories. Proper design requires the assistance of a professional. The following is a short list of tips or items to watch out for in the design of toilet facilities.

- Do not put any signs on the doors of restrooms that have pictograms, lettering or Braille. Use only the geometric symbol required by the State of California. Room identification should be provided by signs that are mounted on the wall, in order to avoid the door opening on the disabled user while that person is trying to read the sign.
- When a toilet room has six or more stalls, it is also required to provide a stall that is known as a semi-ambulatory stall in addition to the one wheelchair stall required. This type of stall is basically sized slightly larger than the standard stall.



Fig. 8. Lavatory sink dimensions must allow unencumbered approach and use.

- Do not forget the loop or U-shaped handle that is required on both the inside and outside of the accessible stall door immediately below the latch. This item is frequently overlooked.
- The lavatory fixture selected must be fairly shallow. The required knee clearance under the lavatory must be a minimum of 27" high and extend back at this dimension for at least a full 8" from the front edge. Also, drain piping cannot encroach into this zone. This usually means a maximum bowl depth of about 6" and restricts choice of model because of the drain design.

4.6.2 Drinking Fountains

By code, at least 50% of all drinking fountains must be accessible, but no less than one. In a multi-story building, if drinking fountains are provided on each level, then an accessible drinking fountain must be provided on each level. By Universal Design, *all* drinking fountain locations would provide a fountain accessible to persons in wheelchairs.

In addition to a wheelchair accessible drinking fountain, there must be a drinking fountain that is accessible to individuals who have difficulty bending

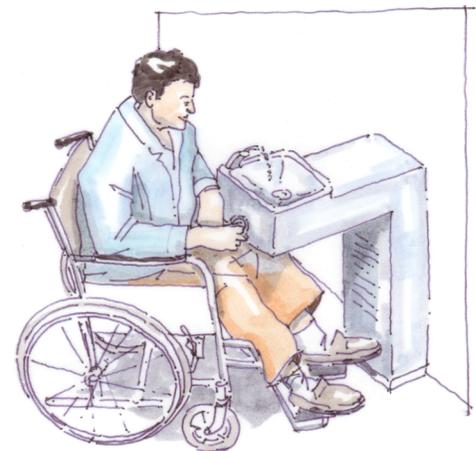


Fig. 9. Clearance and approach dimensions apply to drinking fountains.

or stooping. This requirement is usually met by providing two drinking fountains side by side—one at wheelchair accessible height and one at a higher level. When a single drinking fountain is provided, this type of accommodation can be achieved by adding either a paper cup dispenser adjacent to the wheelchair-accessible fountain or specifying that the single fountain be a high and low flow fountain which can accommodate both requirements.

4.6.3 Telephones

If public telephones are provided, then no less than 50% of the telephones on each floor, and not less than one, should be accessible. These numbers apply to each separate bank of telephones as well. Furthermore, if a total of four or more public pay telephones are provided at both the site and inside the building, then at least one interior public text telephone must be provided, and must be identified by the international TTY symbol.

Accessible phones should be hearing-aid-compatible with volume controls capable of a minimum of 12dbA and a maximum of 18 dbA above normal. The minimum length of telephone cord is 29” from telephone to handset.

The side-reach and forward-reach vertical height requirements of 54” and 48” above the floor, respectively, are required for the location of any operable parts of the telephone. For a pay telephone to be fully accessible, the coin slot, card slot or keypad must be within reach. Phone books and writing surfaces should also be accessible. These requirements are the same as for the book drop, vending machines, and other similar amenities.

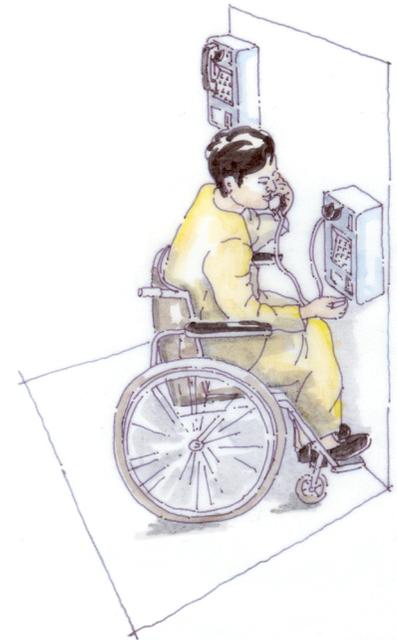


Fig. 10. Telephones have both dimensional and assistive technology requirements.

5. LIBRARY FURNITURE—GENERAL DESIGN RULES

5.1 Tables, Carrels and Counters

Table and carrel work surface height is comfortably set at 29” for most people. To be accessible for persons in wheelchairs, there must be 27” clear space underneath the work surface, resulting in a generally thin profile for the table edge. Note that this clear space cannot have a keyboard carrier within it. To allow forward seating at tables, carrels or counters, there must be 19” clear in the forward direction under the work surface.

5% of all types of patron seats at tables and carrels must be accessible; Universal Design requires that *all* such seats be accessible.

5.2 Chairs

In general, 5% of each seating type in the library must be accessible as described above. Chairs that require being moved in order to be used must not be located in accessible seating locations. Seating for those with limited mobility can be provided simply by setting the seat height at 17" above the floor and with a seat slope no more than 4 degrees; armrests are recommended.

5.3 Specialized Furniture and Equipment

The design and clearances for catalogs, magazine display racks, dictionary stands, and technology furniture are governed by the standard set of dimensions specified generally in the regulations for accommodating wheelchairs.

- The required clear space in front of the furniture item is 48" x 48" if capability for both parallel and forward approaches is desired. Otherwise, the clear space is 48" x 30", with the 48" dimension in the direction of travel of the wheelchair. This means that a front approach requires 48" clear and a side approach requires 30" clear in front of the furniture item.
- The maximum reach of someone in a wheelchair is 48" above the floor when reaching from the front and 54" above the floor when reaching from the side. In general, the 48" dimension is preferred, and governs when the furniture item can be approached from any direction.
- The longest reach across a work surface is 24", which requires that any feature of the furniture item that must be reached, such as a data outlet, must be within 24" of the edge of that work surface. This will affect counter design dimensions.



Fig. 11. Recommended maximum height of any object to be manipulated is 48".

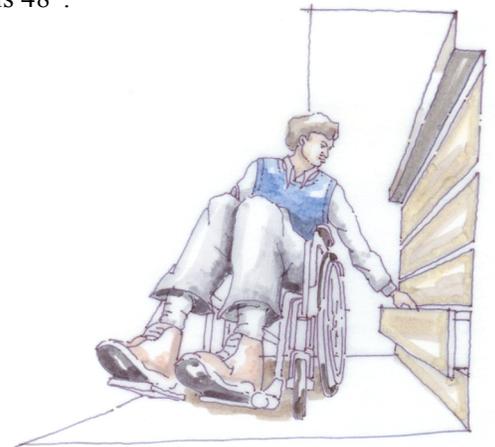


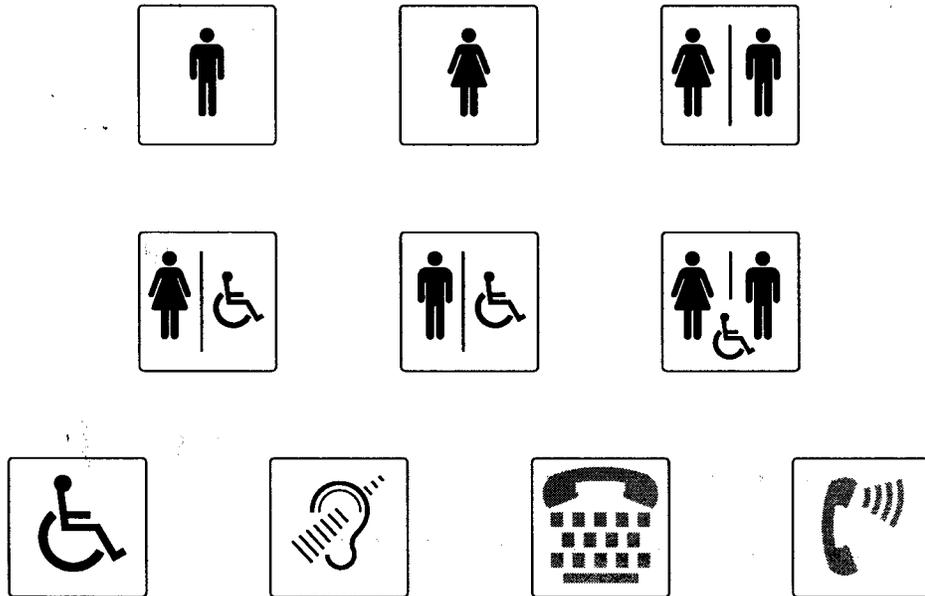
Fig. 12. Recommended lowest height of any object to be manipulated is 9".

6. GLOSSARY OF TERMS

Accessibility The combination of various elements in a building or area that allows access, circulation and the full use of the building by persons with disabilities.

Accessibility Type of signage identifying rooms or facilities that are accessible to disabled persons or provide assistive devices for the hearing-impaired.

Pictograms



Accessible Route A continuous unobstructed path connecting all accessible elements and spaces of a building that can be negotiated by a person using a wheelchair.

Access Aisle An accessible pedestrian space between elements, such as parking spaces or seating, which provides clearances appropriate for use by a disabled person.

Area of Refuge or Area of Rescue Assistance An area that has direct access to an exit, where people who are unable to use stairs may remain temporarily in safety to await further instructions or assistance during emergency evacuation.

Assistive Device An aid, tool or instrument used by persons with disabilities to assist in activities of daily living.

Cross Slope The slope that is perpendicular to the direction of travel.

Curb Ramp A short ramp cutting through a curb or built up to it.

Detectable A standardized surface or feature built in or applied to walking surfaces or other elements

Warning to warn visually impaired people of hazards on a circulation path.

Equivalent Facilitation An alternate means of complying with the literal requirements of the State accessibility standards.

International Symbol of Accessibility The symbol adopted by Rehabilitation International’s 11th World Congress for the purpose of indicating that buildings and facilities are accessible to persons with disabilities.



DISPLAY CONDITIONS

Nosing That portion of a stair tread projecting beyond the face of the riser immediately below.

Open Riser Vertical air space between the front edge of one stair tread and the back of the stair tread below (that is, the upright portion of a step in a stair); also, the absence of any solid material in this vertical space. (Not allowed by code.)

Panic Hardware Door latching assembly incorporating an unlatching device, which is activated by pushing on a portion of the device which extends across at least one half the width of the door leaf on which it is installed.

Pedestrian Ramp A walking surface that has a running slope greater than a 1:20 gradient (5%).

Running Slope The slope that is parallel to the direction of travel.

Van-Accessible Parking Space An accessible parking space for vans that are designed for the transport of persons in wheelchairs. The accessible aisle adjacent to the parking space must be 8’-0” wide rather than the normal requirement of 5’-0”.

7. FURTHER INFORMATION – UNIVERSAL DESIGN

Websites:

ADA home page: <http://www.usdoj.gov/crt/ada/adahom1.htm>

Concept of Universal Design:

http://www.ap.buffalo.edu/IDEA/publications/free_pubs/pubs_cud.html

Universal Design and automated doors:
http://www.ap.buffalo.edu/IDEA/publications/free_pubs/pubs_auto.html

Societies and Organizations (Most of these have websites)

Adaptive Environments (www.adaptiveenvironments.org)

Center for Universal Design, North Carolina State University (www.design.ncsu.edu/cud)

Center for Inclusive Design and Environmental Access (IDEA), State University of New York at Buffalo (www.ap.buffalo.edu/IDEA)

Trace Research and Engineering Center, University of Wisconsin-Madison, (<http://www.trace.wisc.edu/>); for more information on universal design principles, see also http://www.trace.wisc.edu/world/gen_ud.html.

State of California's Division of the State Architect Universal Design website:
<http://www.dsa.dgs.ca.gov/UniversalDesign/default.htm>

Publications

¹ *California Building Code, Volume 1*, California Building Standards Commission and ICBO, latest edition (currently 2001).

² Gibbens, Michael P., *California Disabled Accessibility Guidebook 2003 (CalDAG), 5th Edition*, ICBO, 2003;

³ *CARM: California Accessibility Manual, Code & Checklist*, Builder's Book, Inc., Bookstore (Canoga Park, CA, 2003);

⁴ *California Access Compliance Reference Manual*, State of California, Department of General Services, Division of the State Architect, published by Builder's Book, Inc. (Canoga Park, CA, 2003)

⁵ B. Knecht, "Accessibility Regulations and a Universal Design Philosophy Inspire the Design Process", *Architectural Record*, January 2004, pp. 145-150.

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