

Universal Design Recommendations for Accessible Housing

Mauricio A. Lizama, Ph.D., ATP

The features listed here are called universal design or lifetime design features. Universal design accommodates varying needs throughout a person's life. These features are safe and easy for all residents to operate and maintain.

Listed features include important factors that must be considered at the design stage and other recommendations which do not need to be addressed until the occupancy stage. However, we include all (structural and non-structural) recommendations in order to provide a clear view of the desired goal: home **accessibility and usability** throughout the life span.

General Features throughout the House

- Doorways to rooms should be at least 32 inches wide (have a 32-inch clear passage), preferably 36 inches wide.
- Clear floor space (18" minimum) beside door on pull side at latch jamb provides space to move out of the way of the door swing when pulling it open.
- 5 lbs maximum pull or push weight for opening doors.
- Hallways at least 42" inches wide (preferably 48 inches wide) allow access to bedrooms and bathrooms by persons using mobility devices.
- Eliminate door headers or use an easily removable material for future installation of ceiling mounted transfer systems.
- At least one bedroom and accessible bathroom should be located on an accessible ground floor entry level (same level as kitchen, living room, etc.).
- Turning space in all rooms (at least 60" diameter).
- An open plan design, minimizing hallways and doorways and maximizing sight lines.
- At least one telephone should be located where it will be accessible to a person who is unable to stand. Telephone jacks in the kitchen, living area, and bedroom allow residents to install telephones in accessible locations that meet their health needs.
- There should be good, even lighting throughout the house. Light fixtures, lamps, and window treatments should be selected and placed to avoid glare on smooth surfaces.
- Smoke detectors (with light and sound) should be located on each floor of the house, especially near the bedrooms.

- Flooring materials should be hard (anti-slip), even surfaces or tightly woven, low pile carpeting over a thin pad.
- Provide extra cabling on each space of the house for future installation of devices (visual and sound alerts, motion sensing equipment, etc.) (e.g. install closed outlet boxes in each room, hallway, etc. with 350MHz Cat. 5E cable-4 pair unshielded twisted pair cable)

Switches, Outlets and Controls

- Light switches should be located within easy reach at the entrance of each room and should be reachable from a seated position (42 to 48 inches from the floor).
- 54" maximum side reach, 48" maximum front reach.
- Electrical outlets at 18" minimum height, allows for easy reach from a sitting position as well as for those who have trouble bending over. Install outlets in enough locations to eliminate the need for extension cords (which may interfere with wheelchair use and become a danger to blind persons).
- Use of deep switch and outlet boxes is required for future substitution of normal outlet/switches for remote controlled modules (e.g. most X10 controlled wall switches do not fit into standard shallow outlet boxes).
- Run neutral wire through all switch boxes for future installation of light controllers. (e.g. X10 control signals do not pass through non-incandescent light making it necessary for the remote controlled switch to be connected to the neutral wire for signal transmission)
- Easy-touch rocker or motion activated switches.
- Additional electrical outlets at bed locations and desk for equipment, four-plex boxes on each side of the bed for computer and electronic equipment as well as personal use equipment (artificial respirator, suction machine, alarm, communication device, etc.).
- Install one electric outlet over each entrance door (on the inside part of the house) for future installation of automatic door opener.
- Provide an electrical outlet under each window (except window in shower area, if provided) for future installation of automatic drapery or window opener.
- Provide an electrical outlet beside each sliding door for future installation of automatic door opener.
- Provide an electrical outlets under kitchen counter for future installation of electrically powered adjustable height counters, cook-tops and sinks
- Provide electrical outlet adjacent to each toilet (preferably below water tank level) for future installation of motion sensing auto-flush or automatic toileting system.
- Install lighted rocker switches outside each closet in which lighting is required or use door activated switches.
- Electrical panel with top no more than 54" above floor located with a minimum 30" x 40" clear floor space in front.

Entrances

- At least one entrance to the home should be usable without going up or down steps. For some residents, a ramp may be needed with a pitch of no greater than 1 to 12 (for every 1 foot in rise, 12 feet in length) and preferably 1 to 20.

- Entryways should be protected from rain. The entrance between the garage/parking and the house should not require going up steps. An attached garage with automatic door opener is ideal.
- Thresholds should be level or beveled and no more than 1/2 inch higher than the floor.
- The doorway should have a clear, unobstructed opening at least 32 inches in width and preferably 36 inches wide.
- The door should have a secure lock that can be reached by a seated person.
- View of callers for all people, including children and seated users through wide angle door viewers, TV monitors, windows in doors, and/or windows nearby.
- A place to put packages while opening doors: built-in shelf, bench or table with knee space below located on the outside next to the door.
- A way for visitors to communicate with residents such as a hardwired intercom, intercom with telephone link, etc. (installed at a reachable height).
- Intercom at 48" maximum front approach, 54" maximum side approach, and 30"x48" minimum clear floor space in front of buzzer or intercom.
- Space at entry doors should be a minimum 5' x 5' level clear space inside and outside of entry door for maneuvering while opening or closing door. (Can be smaller if automatic power door is provided.)
- Good lighting at entry doors: focused light on lockset, general illumination for seeing visitors at night, and/or motion detector controls that turn on lights when someone approaches the door.
- Address/house number should be large, high contrast, well lit located in a prominent place, easy for friends and emergency personnel to locate.

Windows

- Sills of windows in the living, dining, and bedroom areas should be no higher than 30 inches so that a person seated or lying in bed can see outdoors.
- Windows should be easy to open (crank operated windows are desirable).

Sliding Doors

- Exterior sliding doors: drop frame and threshold into sub floor to reduce upstanding threshold track.
- Interior pocket doors: When fully open, door should extend 2" minimum outside door jamb and be equipped with open-loop handles for easy gripping.
- By- passing closet doors - each panel should create an opening at least 32" clear

Kitchen

- Standard kitchen counters are 36 inches high. This is too high for people who are seated. Counter heights of 30, 32, and 34 inches are more comfortable for a seated person to use for food preparation. The usual height for a wheelchair armrest is 29 inches. Adequate knee space requires at least 24 inches. Adjustable height work surfaces (28" - 42") allow

in-kitchen work for people of all heights, those with back trouble, people who are seated, and/or children.

- **Uniform Height Counter:** A uniform lowered height is not a recommended solution for a number of reasons:
 - Inconvenience for standing users.
 - Appliances such as dishwashers, trash compactors, and ranges are designed for 36 inch counter heights.
 - Lowered counters may make resale of the house difficult without restoring counters to the standard height.
- **Dual Height Counter:** A dual height kitchen includes lowered counter segments to provide work areas for seated people. Each lowered segment must have clear knee space below. Clear vertical space of 30 inches at the front of the counter will provide enough clearance for most wheelchairs.
- **Manually Adjustable Segments:** Mechanically adjustable counter segments; some with sinks and disposal units, some with cook tops, adjustable in 2" increments (28" - 42"). A design of this type allows counter height to be adjusted with minimal work. An "adaptable design" approach such as this is ideal for a rental unit where tenants may change relatively frequently. This can be accomplished in a couple of ways:
 - *Wall mounted brackets:* Counters may be mounted with heavy duty commercial shelf brackets and standards. Shelving of this type is found in many retail store shelving units.
 - *Movable wood support:* A wooden support strip can be attached to the sides of base cabinets and the countertop to allow for some adjustability.
- **Electrically Adjustable Height:** Electrically powered, continuously adjustable counter segments, some with cook tops and/or sinks and disposal units. This option provides a uniquely flexible, highly accessible solution.
- **Breadboards, chopping blocks, and pull-out work surfaces:** Provide a variety of work heights for different jobs (such as cutting, mixing or beating). These accessories work best when at a height of 27", and at least 30" wide by 24" deep.
- Space between face of cabinets and opposite walls should be 48" minimum.
- Clear knee space under cook-top/sink (29" high minimum) allows someone to use the cook-top/sink from a seated position. May be open knee space or achieved by means of removable base cabinets or fold-back, bi-fold, or self-storing doors. Pipe protection panels must be provided to prevent contact with hot or sharp surfaces
- Color contrasts at the front and back edges of counter tops serve as visual cues to persons with impaired vision. Use contrasting colors on counter edges to increase visibility for those with visual impairments. Light-colored counter tops reflect available light and are desirable for persons with limited vision.
- Round corners on all countertops, especially for visually impaired persons
- Stretches of continuous counter tops for easy sliding of heavy items, particularly between the refrigerator, sink, and stove top, for easy one-level food flow.
- Full-extension, pull-out drawers, shelves and racks in base cabinets for easy access to all storage space.
- Adjustable height shelves in wall cabinets.

- Pantry storage with easy access pull-out and/or adjustable height shelves for easy reaching of otherwise hard-to-get items.
- Front or side mounted controls on appliances to facilitate easy reach.
- Control knobs on the range and oven should be front-mounted or side-mounted to eliminate the need to reach over hot burners. Appliance dials 1½ inches or greater in diameter are easier to turn. Controls should have readable settings and directions with large print and good contrast.
- Side-by-side refrigerator/freezers have accessible space in both the refrigerator and freezer sections for persons with limited reach, particularly if pull-out shelving is provided. Self-defrosting units are easier for persons with limited strength to maintain.
- Drop in range with knee space beside, top set at 32”-34” above finished floor.
- If provided, dishwasher raised on a platform or drawer unit, so top rack is level with adjacent counter top, puts bottom racks within easy reach requiring less bending.
- If possible, mount controls and faucets on the side of the sink rather than the back are easier for seated persons to reach. Use sprayer with a flexible hose.
- Cabinet doors and drawers should be easy to open. D-shaped handles or magnetic closures are easier to use.
- Storage that includes pullout shelves, baskets, and lazy susans makes items more accessible.
- Wall-hung cabinets should be at the appropriate height for the user. If they are too high, much of the space will not be usable by persons who are small, seated, or have limited reach. Consider having them installed 15 inches above the counter top rather than 18 inches.
- Wall-mounted ovens can be installed at any height to meet the user's needs, and wall ovens with side opening doors are ideal. Self-cleaning ovens aid persons with limited strength.
- Microwave ovens with side-opening doors are safe and easy for most people to use.
- Counter space should be located near all ovens for placing hot dishes.
- Kitchens may have some low work surfaces for preparing a meal while seated. For example, a pullout work surface, such as a cutting board, located 24 to 30 inches above the floor can serve this purpose.
- Floors and walls under the sink and cook top should be finished in the event that any base cabinets need to be removed at a later time to lower the work surfaces or create knee space for seated users.
- Below a sink or cook top, base cabinets with no shelves can be used by a seated person when the cabinet doors are open.
- Adequate glare-free task lighting is needed in the kitchen. Fluorescent lighting installed underneath wall-hung cupboards provides light for working at the counter top.
- In case the refrigerator needs to be moved to an alternate location in order to provide adequate handling space for a wheelchair, an outlet and a water pipe (to connect an ice maker) should be installed at the alternate location.
- Ensure fire extinguisher is within easy reach of oven and range, and is usable by persons with impaired mobility and dexterity.

Bathroom

- Bathroom doors should be at least 32 inches wide and open out (or both ways) so that if a person falls in the bathroom, they do not block the door.
- Adequate maneuvering space: 60" diameter turning space in the room and 30" x 48" clear floor spaces at each fixture. Spaces may overlap.
- At least one bathroom must have one deep curb less shower (minimum 5' x 3', 5' x 4' preferred), waterproof floor, and a floor drain. Other bathrooms in the same house may have a tub with an integral seat.
- Integral transfer seat in tub and in 3' x 3' shower stall allows people to sit in tub/shower without needing additional equipment.
- Clear space (36") in front and to one side of toilet allows for easy maneuvering at toilet. Toilet centered 18" from any side wall, cabinet or tub.
- Lavatory counter height (32" minimum, 34" maximum).
- Knee space under lavatory (29" high) allows someone to use lavatory from a seated position. May be open knee space or achieved by means of removable vanity or fold-back or self-storing doors. Pipe protection must be provided to prevent contact with hot or sharp surfaces.
- 6½" bowl deep
- Countertop lavatories preferred with 6½" deep bowl mounted as close to front edge as possible. Wall hung lavatories acceptable with appropriate pipe protection. Pedestal lavatories are not acceptable.
- Long mirrors should be placed with bottom no more than 36" above finished floor and top at least 72" high. Full-length mirrors are good choices.
- Provide adequate space and anchoring surface for future installation of grab bars. Grab bars should be considered a safety feature to prevent falls. Grab bars should be able to support 250 pounds. Towel bars are not usually safe to be used as grab bars.
- Bathtub water controls and faucets are sometimes easier to reach if they are located off center, near the entry side of the tub. Offset controls in tub/shower with adjacent clear floor space allows for easy access from outside the tub with no inconvenience when inside.
- Non-slip surfaces and flooring in the bathroom helps prevent falls.

Fixture Controls

- Single-lever water controls at all plumbing fixtures and faucets.
- Hand-held showers in all tubs and showers, in addition to fixed heads, if provided. Single lever diverter valves if needed.
- Adjustable height, movable hand-held shower head or 60" flexible hose allows easy use by people of all heights.
- Mixer valve with pressure balancing and hot water limiter prevents scalding people who cannot move out of the way if water temperature and/or pressure changes suddenly.
- Handles on faucets should have levers rather than knobs for easier use.

Bedroom

- A telephone and light switch should be within easy reach of the bed.
- Some closet rods should be adjustable or positioned low enough to be reached from a sitting position (no higher than 48 inches from the floor).
- There should be an uninterrupted path from the bed to the bathroom, free from throw rugs, cords, and other obstacles. A night light in this area is a safety feature.

Laundry Area

- Laundry area located on the main floor.
- Laundry sink and counter top surface no more than 34” above finished floor with knee space below.
- Clear floor space 36” wide across in front of washer and dryer and extending at least 18” beyond right and left sides. (Extended space can be part of knee space under counter tops, sink, etc.)
- Provide space for side to side washer and dryer rather than stacked “combos”
- Front-loading washers and dryers may be easier for a seated person to use.
- Front loading appliances can be mounted on risers for easier use by a standing person.
- Front or side controls on the washer and dryer are more accessible to a seated person than controls mounted at the back of the appliance.
- A table or counter located near the washer and dryer at a height usable by a seated person (28 to 30 inches) is useful for sorting or folding clothes.

Stairs

- Steps should have rounded nosings (edges) with sloping risers. Step height (risers) should be no greater than 7 inches high (preferably 6 inches) and steps should be at least 10inches deep to fit most shoe sizes.
- All stairs should have appropriate width and space at the bottom for later installation of a platform lift, if needed.
- Stair handrails to extend horizontally beyond top and bottom risers.
- Light switches should be located at both the top and bottom of the stairs, and the stairway should be adequately lit.
- If a two-story dwelling: at least one set of stacked closets, pantries, or storage spaces with knock-out floor for later use as an elevator shaft or a residential elevator with minimum 3’ x 4’ clear floor installed at the time of initial construction.

Storage

- 50% of storage to be no more than 54” high.
- Adjustable height closet rods and shelves allows for flexibility of storage options.
- At least one electrical outlet inside each closet for future installation of motorized cabinets that raise and lower, as well as power operated clothing carousels.

Garages and Carports

- Power operated overhead doors.
- Door height and headroom clearances (8' minimum) for tall vehicles or provide alternative on site outdoor parking space.
- Extra length and width inside for easy movement around parked cars.
- No ramp in garages.

Hardware

- Easy to use hardware, requiring little or no strength or flexibility:
 - lever door handles
 - push plates
 - loop handle pulls on drawers and cabinet doors-no knobs
 - touch latches
 - magnetic latches in lieu of mechanical, keyless locks

Light and Color

- Color contrast between floor surfaces and trim allows easy recognition of the junction of floor surfaces and walls. Avoid glossy surfaces.
- Color contrast difference between treads and risers on stairs.
- Ambient and focused lighting allows lots of light.

Home Automation

- Motion detector light switches in garages, utility spaces, entrances, bathrooms, hallways and basements.
- Remote controls for selected lights.
- Remote controls for air-conditioning systems.
- Doorbell intercoms that connect to cordless telephones.
- Audible and visual alarms for doorbell, baby monitor, smoke detectors, etc.