



Living Spaces

Universal design

People who inhabit and visit the houses we live in come in all shapes and sizes, ranging in age from infants to seniors, with various ever-changing abilities and skills. As we grow up, grow old and welcome new people into our homes, our housing needs change. A house that is designed and constructed to reflect the principles of universal design will be safer and more accommodating to the diverse range of ages and abilities of people who live in and visit these homes.

This document fact sheet provides an overview of planning issues and design elements to consider when creating, renovating or redecorating living spaces. In this fact sheet, “living spaces” are the spaces in a house where people meet, sleep, relax, watch TV, read, play cards, listen to music, and so on. Task-specific spaces such as bathrooms and kitchens are discussed in greater detail in separate CMHC’s *Accessible Housing by Design* fact sheets.

Effective universal design and construction can only occur when we truly appreciate how persons with disabilities engage the built environment. Universal design is only a subtle shift from what is typically done; designing for greater accessibility then is not a new way of designing, simply a more focused one. The life and usability of living spaces can be extended by taking into account flexibility when selecting flooring materials, seating options, areas of shade and sun, and creating open areas (see figure 1).

This approach is increasingly popular with families and individuals who choose to stay in their homes and neighbourhoods as they grow and age. This promotes the concept of **aging in place**. Planning for individuals’ changing needs and abilities in the design of living spaces allows for periodic customization of elements and reduces the need for future costly renovations. Planning for future needs is good practice. Principles of universal design encourage flexibility, adaptability, safety and efficiency.

Universal design is the design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people regardless of their age, size and ability. “The Principles of Universal Design” are found on page 16.

Bolded terms throughout this fact sheet are defined in the Glossary on page 13.



Figure 1: Large open living space
Photo by Ron Wickman



Planning your living spaces

There are many aspects to consider when designing your living spaces. They include the needs and preferences of all family members and visitors, available space and room location.

Open planning

Open concept plans, with fewer doors, fewer hallways, and rooms that flow into one another, are more accessible to people using wheelchairs and other mobility devices, than plans with smaller, more enclosed rooms.

If you are designing a new home or planning significant renovations, think carefully about how the rooms will work. Is that wall between the kitchen and dining area really necessary? How about that door between the living room and dining room? Perhaps it could be made more spacious with a wide archway? Do you really need that hallway to get to the den and spare bedroom, or could they be accessed from an adjacent room (which would make the adjacent room larger because it would use the space saved by omitting the hallway)?

Location of rooms

If you are planning a new house, give some thought to how close rooms and spaces are to each other. For example, the kitchen should be adjacent to the dining area and the bedroom close to a bathroom. Consider separating potentially noisy spaces, such as a TV room, den or recreation room, from quiet spaces, such as sleeping areas.

Think also of the distances between the rooms. If you are going to spend most of your time in the family room or kitchen, a washroom close by will minimize the amount of walking you will have to do throughout the day, which could be of great benefit to someone with limited stamina.

Also, consider the benefits of reorganizing room functions. For example, a seldom-used dining room could be converted to a bedroom or den. A rarely used living room might become an office. Take a look at how you are using your existing rooms and spaces, and consider how they might work better for you.

General space planning

A continuous accessible path of travel at least 915 mm (36 in.) wide should be provided into and throughout all living spaces. Ideally, this path should provide access to all furniture, storage units, switches and controls (see figure 2). If a room is very small, you may have to confine the path to its most important locations.

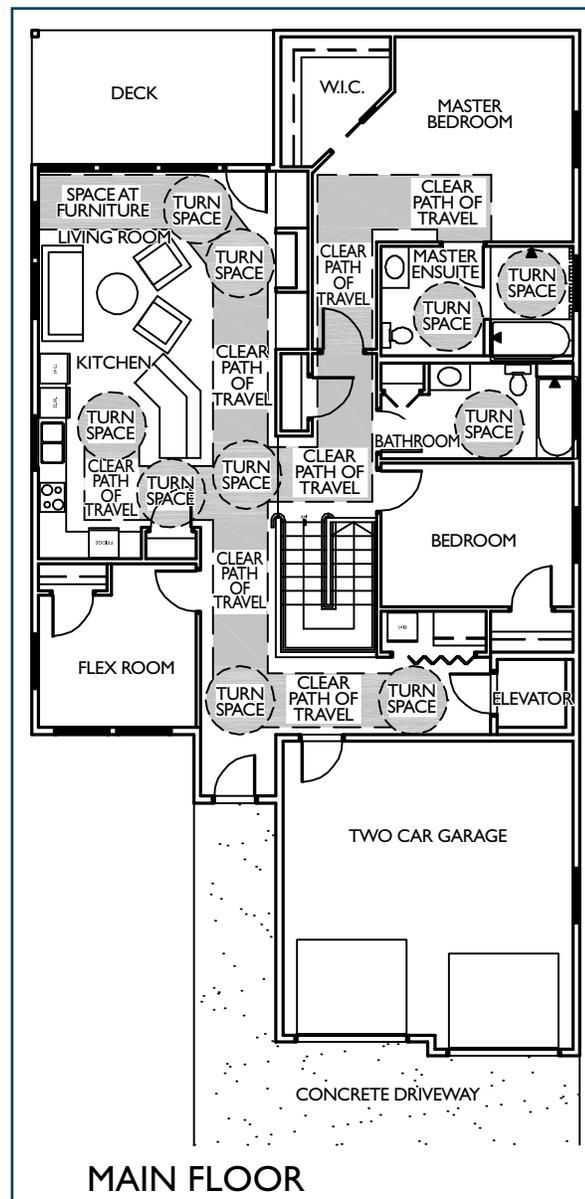


Figure 2: Accessible paths of travel in a residence
Diagram by Ron Wickman, Architect



People who use a wheelchair or scooter need a clear floor space in front of furniture and switches of at least 760x1,200 mm (30x48 in.). This space should be integrated into the seating area. If possible, provide an open space within each living area to allow a wheelchair or scooter user to turn around. A circular turning space of 1,500 mm (60 in.) in diameter will accommodate most manual wheelchairs. Sometimes, though, it's easier to find space for a three-point turn. People who use walkers also need turning space, but not as much space as wheelchair or scooter users. If there is a wheelchair, scooter or walker user who lives in or regularly visits your home, it's always a good idea to measure the amount of turning space he or she requires and design accordingly.

Planning tip

Open space under tables and work surfaces can often be used as part of the turning space for wheelchairs or scooter users—but make sure that it's high enough to accommodate users' toes and knees.

Evacuation

When planning spaces, think about how you would get out of the house in an emergency, such as a fire. There should be a clear and direct route to an outdoor place of safety from all floors. If stairs are a challenge for a member of your family or a visitor, a balcony or basement walkout can be an area of relative safety to await evacuation assistance. For more information about fire safety, see CMHC's fact sheet, *Accessible Housing by Design—Fire Safety for You and Your Home*.

List of design elements

- Foyers
- Hallways
- Door and door hardware
- Windows

Foyers

Entrance foyers, mud rooms and the hallways that connect the living spaces within a house are important elements in the creation of a universally accessible home. Hallways should provide space for approach and use. Hallways are preferably at least 1,200 mm (48 in.) wide, but should never be less than 915 mm (36 in.). Ideally, all doors along hallways should be at least 915 mm (36 in.) wide, although narrower doors may be acceptable if the hallway is at least 1,200 mm (48 in.) wide.



Hallways

If there is a wheelchair, scooter or walker user who lives in or regularly visits your home, a turnaround space should be considered at entrance areas and foyers and at the ends of hallways where a closed or locked door may be encountered. A circular turning space of 1,500 mm (60 in.) in diameter will accommodate most users; however, more space may be required for larger mobility devices such as scooters. The turnaround space may be omitted at the end of hallways if the door can be left open and there is turning space available within the room.

Handrails and wall protection in hallways can be very useful to persons with disabilities. Handrails can help persons with visual limitations navigate more easily and help persons with limited mobility navigate more safely. Wall protection is helpful in spaces heavily used by persons in wheelchairs or who use walkers.

Door and door hardware

The most accessible doorway is one without a door. To enhance your home's accessibility, consider omitting doors that are not really necessary.

How wide should a door be?

Doors should provide at least 860 mm (34 in.) of **clear passage width** when they are open. Installing a 915 mm (36 in.) wide door will usually provide the recommended clear passage width. Check with your municipal building department for recommended door sizes. This is very important as required door sizes vary from jurisdiction to jurisdiction.

Designer tip

If there is not enough room to install a 915 mm (36 in.) wide hinged door, the use of offset hinges on an 865-mm (34-in.) or 810-mm (32-in.) door will maximize the available clear passage width. The offset hinge takes the width of the door out of the clear passage width (see figure 3). Please note that there must be adequate space between the door frame and wall to accommodate the door handle when considering offset hinges.

What types of doors are available?

Hinged doors are by far the most common type. They are inexpensive and easy to use, but should have some clear floor space next to the door handle so that the door can be opened without having to step back (or wheel back) at the same time. A clear space of at least 600 mm (24 in.) is recommended at the latch side of the door on the pull side and 300 mm (12 in.) on the push side (see figure 4).



Figure 3: Offset hinge
Photo by Ron Wickman

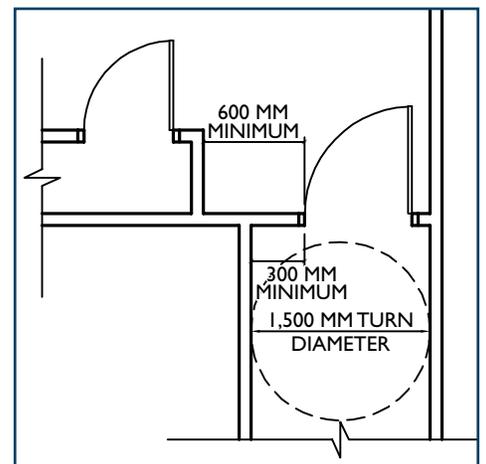


Figure 4: Clear floor space at doors
Diagram by Ron Wickman, Architect



Other door types to consider, particularly if there is not enough space to provide the necessary clearances for hinged doors, are sliding doors, pocket doors, bifold doors and accordion doors (see figure 5).

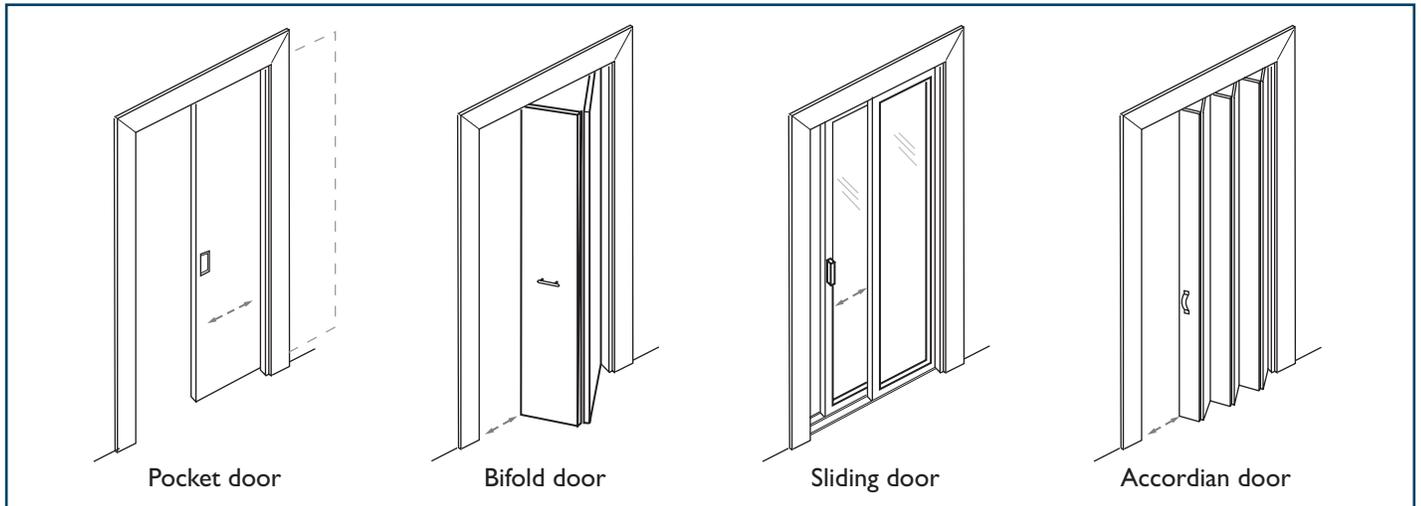


Figure 5: Common door types
Diagram by DesignAble Environments Inc.

What type of door handles and locks should I use?

A door handle and lock that can be operated using only one hand, without tight grasping, pinching or twisting of the wrist, is recommended. Lever door handles are a great solution for everyone, whether it is a senior with arthritis, a child with small hands or an adult with arms full of grocery bags.

Push-button locking mechanisms are much easier to use than those that incorporate keys or small turning mechanisms.

New technologies are available that can unlock and open a door with a remote control device. Slide bolt locks can also provide a universal design solution, as long as the bolt slides easily and is not too small. However, slide bolt locks are not usually designed to be opened from the outside in an emergency... so they may not be the best choice for a bathroom or child's bedroom.

Placing a parcel shelf next to exterior doors is inexpensive and useful, allowing users to place items they are carrying on the shelf, freeing their hands to unlock and open the door.

Should I consider glass doors?

Fully glazed doors, or smaller glass **vision panels** within doors, are frequently used to bring light into a room. They also enhance safety and security by allowing users to see if there is anyone on the other side of the door. People who are deaf or hard of hearing also appreciate windows in doors so they can see if someone is approaching.

Fully glazed doors should not be installed near areas where falls are likely, such as at a flight of stairs, and should always be made of laminated glass so they don't shatter into sharp pieces if broken. If a fully glazed door features clear or lightly tinted glass, put a decal on the glass at eye level (1,350 to 1,525 mm or 53 to 60 in. from the floor) to visually alert users that it is a glass door.



On doors with glass panels, the lowest edge of the glass should be no higher than 915 mm (36 in.) so seated persons and smaller persons (including children) can see through the panels.

If the door is solid, a good idea is to have a full height glass window on the latch side of the door so residents can easily see who is at the entrance (see figure 6).

Other things to consider

- Ideally, door **thresholds** should be levelled, but never more than 12 mm (1/2 in.) high. Where not levelled, the threshold should be bevelled so it isn't a tripping hazard.
- It is a good idea to have exterior doors protected from the elements with a sheltered roof or canopy.
- Some doors, such as those from a garage to a house, have self-closing devices that some people find difficult to use. Install a self-closing device with a delay-closing feature that will keep the door fully open for a few seconds before starting to close.
- If there is someone in your family who does not have the reach, strength or dexterity to open doors or use a lock, consider installing power door operators. These devices can unlock and open doors with a push plate or remote control. If you are using push plates, be sure to place them so they are easy to reach and out of the way of the door when it is opening.
- If the bottom of your doors are scuffed, scratched and damaged as a result of people using their feet or wheelchair footrests to open the door, consider installing a 305 mm (12 in.) high kickplate on both sides of the door.
- Consider painting doors in a colour that contrasts with the wall surfaces to make doors easier to identify in low light and for people with low vision. Similarly, choose door handles that contrast in colour with the door.
- Consider using two peepholes in a solid door. One peephole can be located at a height of 1,500 mm (60 in.) and the second at 1,200 mm (48 in.). A better option is a wide angle door peephole scope that allows the viewer to stand at a distance of up to 2,100 mm (84 in.) from inside the door and see an image of the visitor outside.



Figure 6: Full height glass window beside entrance door
Photo by Ron Wickman



Windows

Windows are used to bring light and fresh air into rooms, and they come in many shapes, sizes and styles (see figure 7). When choosing a window, first consider its size.

Windows should be large enough to bring sufficient light into a room but not so large that they create over-illumination and glare. Consider using adjustable blinds or curtains to control light levels. Over-illumination and glare are of particular concern for older people, as they can “wash out” the features of a room, making obstacles and tripping hazards difficult to see.

If the primary purpose of a window is to provide views to the outdoors, the sill height of the window should be carefully considered. Will the window be used by small people, such as children, or from a seated position, such as on a sofa or in a wheelchair? Is there a benefit from having the sill low enough to see out the window when lying in bed? The recommended sill height for viewing from a seated position is no higher than 765 mm (30 in.), and no higher than 610 mm (24 in.) from a horizontal position. Note: If the window is operable, be sure to use safety locks and limit the opening space to ensure that a child cannot climb through.

Consider the usability of a window—particularly the opening and locking mechanisms. Casement, awning and hopper windows can be opened with one hand using a crank handle or lever, and the opening and locking mechanisms are usually easy to reach. Some casement windows have locks at both the top and bottom of the window. If someone in your family has limited reaching abilities, ask the supplier to provide a linkage bar to allow both locks to be operated from the bottom.

Sliding windows are also a good choice as they are usually easy to reach and open. However, larger sliding windows (and sliding patio doors) can be heavy and may not be the best choice for someone with limited strength. Note that double-hung windows typically require fine finger control and the use of two hands to open.

Some window manufacturers make windows that can be opened with a remote control. See CMHC’s fact sheet, *Accessible Housing by Design—Home Automation*.

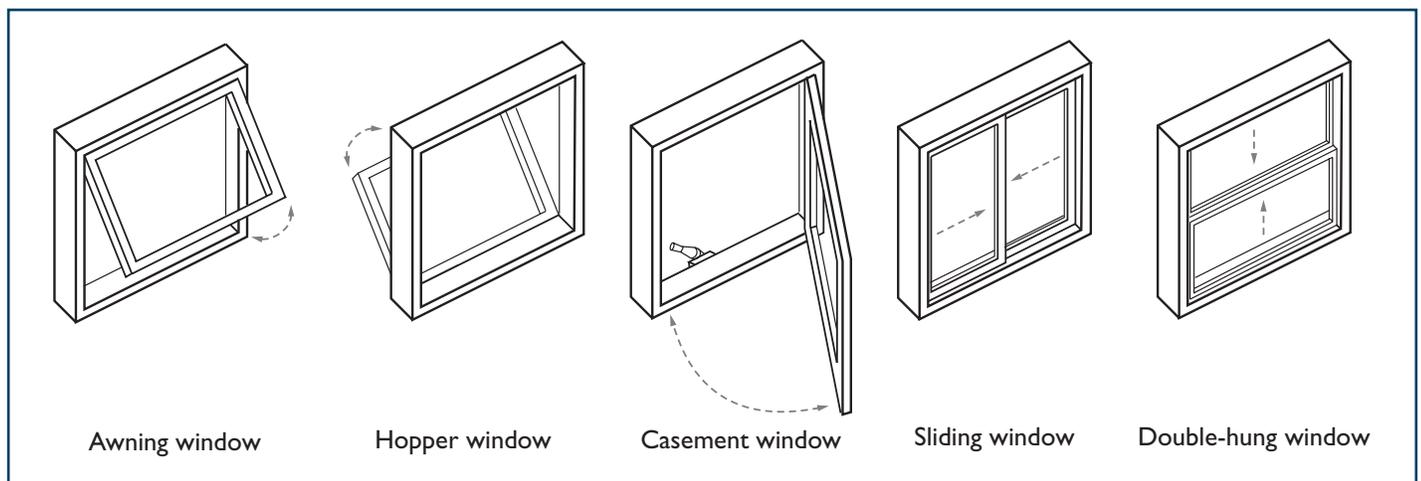


Figure 7: Common window types
Diagram by DesignAble Environments Inc.



Window opening and locking mechanisms should be between 610 and 1,200 mm (24 and 48 in.) from the floor, with a clear floor space in front so people can use the controls without reaching over furniture. If someone in your family or a frequent visitor uses a wheelchair or scooter, consider providing at least 760x1,200 mm (30x48 in.) of clear space in front of the window controls. Window openers and locks are easier to see if they are colour-contrasted with the window frame.

Some types of windows are much easier to clean from the inside than others. Be sure to ask the supplier about ease of cleaning and, if possible, try out the window cleaning features in the showroom.

Cabinets and storage

In planning shelving, storage units, display units and other built-in cabinets, consider the different heights and reaching abilities of family members and the fact that these abilities change as children grow and adults age. Adjustable shelving and storage systems can be customized and changed as necessary. Avoid cabinets and other storage systems that require the use of step stools.

If there is someone in your family or a frequent visitor who uses a wheelchair, maximize storage options within a 400- to 1,200-mm (16- to 48-in.) reach, which is a comfortable range from a seated position. Remember to leave space in front of storage units to allow a wheelchair or scooter user to get close.

Choose cabinet hardware (drawer pulls, locks, door pulls and so on) that can be operated with one hand, without tight grasping, pinching or twisting of the wrist. Large D-shaped handles work well for most people, as do **touch latches**. Pull-out shelving and drawer storage are excellent choices, as they are easier for everyone to use.

Colour contrast enhances accessibility for people with low vision—and for everyone when lighting levels are low. Contrasting-coloured door handles are easier to locate. A light-coloured top surface makes objects easier to see. Consider painting the wall a contrasting colour to the top surface of the cabinets. A contrasting strip at the front of the top surface is also useful for identifying the edge.

Furniture

Although most furniture is not intended to be used for support, it is often used that way. Choose furniture that is sturdy and stable.

If someone in your family or a visitor has difficulty in getting up from a seated position, consider providing at least one seat with a seat height of 450 to 500 mm (18 to 20 in.). The seat should have a firm cushion or pad and stable armrests.

Choosing height-adjustable furniture is an excellent idea as it allows the furniture to be customized to meet the specific needs of the user. It also provides the flexibility to deal with future changes in ability.

While the primary decision on the colour and finish of furniture will always be based on personal preference and taste, consider also the visibility of the furniture. If the floors, walls and furniture are all the same colour, they can be difficult to see in low lighting or by a person with low vision.

If there is someone in your family or a frequent visitor who uses a wheelchair, be sure to consider space for them to sit. Remember that some users in wheelchairs like to transfer into a comfortable chair and will need transfer space next to or in front of the chair.



Lighting and other electrical considerations

Lighting contributes greatly to the ambiance and esthetic quality of the home and provides light for paths of travel, safety and security. Appropriate lighting is particularly important for people who are deaf or hard of hearing, as it makes lip-reading easier. The use of dimmer switches is an excellent way to adjust a room's ambiance, while still allowing the space to be brighter for those who need it.

For maximum safety, lighting should be bright and consistent—especially along hallways and at stairs. To enhance safety and convenience, consider providing permanent night lighting along hallways at bedrooms and bathrooms. Linear LED lighting is a good choice for this type of lighting.

If the space features glossy floor, wall or ceiling surfaces, glare can be a problem, particularly for older people. Ideally, glossy surfaces should be changed to matte surfaces. Otherwise, choose indirect lighting sources to minimize glare.

Table and floor lamps enhance lighting levels at reading areas and writing surfaces. Having plenty of electrical outlets, evenly distributed around a room, minimizes the chances of tripping over cables and extension cords. Electrical outlets should be installed no lower than 400 mm (15¾ in.) from the floor. An electrical outlet in the ceiling above a sitting area will allow for the future installation of a ceiling lift (see figure 8). See CMHC's fact sheet, *Accessible Housing by Design—Residential Hoists and Ceiling Lifts*.

Install light switches in places where people can find them easily when they enter the room. Wheelchair or scooter users will require clear floor space of 760 x 1,200 mm (30x48 in.) in front of light switches. Controls installed 860 to 960 mm (34 to 38 in.) from the floor are usable by most people (see figure 9).



Figure 8: Ceiling lift above chair in living room
Photo by Ron Wickman,

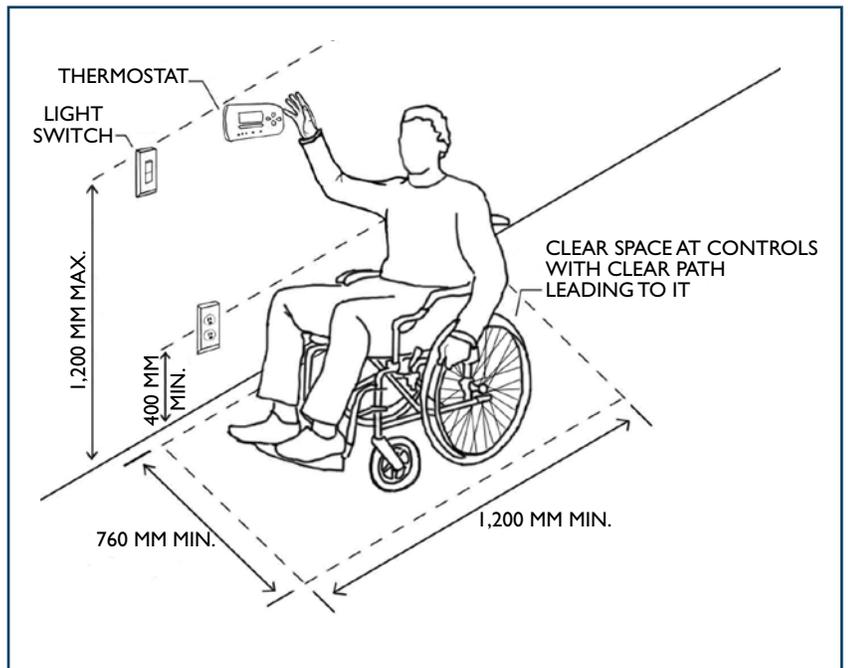


Figure 9: Optimal reach range for controls
Diagram by Ron Wickman, Architect



Acoustics

Acoustics can help or hinder the ability to hear people talking, the television or the doorbell. If a room will be used by a family member or visitor who has a vision and/or hearing loss, a quiet environment is desirable. Rooms with a lot of hard surfaces and non-upholstered furniture can be very noisy from background noises and reflected sounds. Adding “soft” elements to the room, such as carpets, draperies, upholstered furniture and acoustic ceiling tiles will improve the space’s acoustic quality.

Other design considerations that can create a quieter environment include:

- design ceiling shapes so that echoes do not occur;
- minimizing background noise from mechanical equipment by choosing quiet equipment;
- using sound-dampening installation practices;
- soundproofing walls and ceilings;
- installing soundproof doors and windows; and
- placing noisy exterior equipment, such as air conditioners, far from windows and doors.

A room used by a family member or visitor who has low vision or is blind and uses reflected sound to assist with orientation needs to be “acoustically alive.” “Hard” elements, such as ceramic flooring or metal panelling, enhance reflected sounds.

Colour considerations

As mentioned previously, the appropriate use of colour contrast can enhance accessibility for everyone and particularly for people with low vision. Colour contrast can help identify and differentiate paths of travel, activity areas, furniture, built-in elements, potential hazards and the location of switches and controls.

Materials and finishes

The choice of materials and finishes within a home is very much based on esthetics, personal preference and cost. But there are also functional and environmental issues to consider. Environmental issues include the material’s impact on the environment and on the indoor air quality of your home.

Table 1 on pages 11 and 12 outlines the functional characteristics of finish materials and how those characteristics can affect usability. Examples are provided of suitable materials for specific applications but keep in mind that a wide array of materials is available, with new materials and finishes being introduced almost daily. Choose materials carefully and ask your supplier for information about their characteristics.

In accessible house design, it is a good idea to consult with a professional, such as an occupational therapist. It also helps to consult with an architect, an interior designer or another design professional who is familiar with the design of accessible residences. During the design, work with the designer and occupational therapist to determine the most positive house layout and best living space design.



Table I Key characteristics of materials and finishes

Characteristic		Considerations
Slip resistance	Floor	Choose finishes that are slip-resistant. Choices include low-pile carpet, hardwood, laminate, vinyl, PVC, resin, rubber, matte and/or textured ceramics, cork and linoleum. In areas that can become wet, ensure slip resistance is maintained when the floor is wet. Choices include enhanced slip-resistance resin and PVC, profiled and/or matte ceramics and clay tiles.
Smoothness	Floor	Smoother floor finishes require less effort to walk or wheel across than textured finishes—although very smooth finishes can be hazardous. Materials that reduce the level of effort include hardwood, laminate, vinyl, PVC, resin, ceramics, cork and linoleum. The smoothness of flooring will affect its slip resistance, glare, tactile identification, acoustic quality and ease of maintenance.
	Wall	Along walking routes avoid very abrasive wall finishes, such as textured concrete, exposed brick or profiled wood. The smoothness of a wall surface will affect its glare, acoustic quality and ease of maintenance.
	Ceiling	The smoothness of a ceiling surface will affect its glare, acoustic quality and ease of maintenance.
Resilience	Floor	Resilient surfaces may reduce injury from falls and are less susceptible to impact damage. Choices include low-pile carpet, cushioned vinyl, PVC, resin, rubber, cork and linoleum.
	Wall	If falls are anticipated in a particular space, or if family members are susceptible to injuring themselves, consider cushioned or padded wall finishes. Choices include low-pile carpet, cushioned fabric and cork.
Colour	Floor	Contrasting colours help identify primary routes and functional areas. Locations for the colour contrast include wall-floor borders along hallways, borders within spaces, borders between spaces and at potential hazards.
	Wall	Use contrasting colours to help identify architectural components for people with low vision—a reality for many older people. Locations include wall-floor, wall-ceiling, wall-door, door-handle, wall-switch and wall-outlet.
	Ceiling	Consider colour contrast to further define primary routes and functional areas.
Tactile identification	Floor	Use textural contrast to help people with low vision or who are blind identify primary routes and functional areas. Locations include borders along hallways; textured borders within spaces; textured borders or different textures between spaces; and textured borders or different textures at potential hazards. Finishes include carpet-hardwood, carpet-vinyl, hardwood-ceramic and carpet-ceramic.
	Wall	Use textural contrast to identify primary routes and functional areas. Chair rails and changes in wall finishes can help define routes and areas.



Characteristic		Considerations
Glare	Floor	Use matte and low-gloss finishes. Avoid highly polished surfaces, particularly near large expanses of glass or direct overhead lighting.
	Wall	Use matte and low-gloss finishes. Avoid highly polished surfaces and mirrored walls.
	Ceiling	Use matte and low-gloss finishes. Avoid highly polished surfaces.
Acoustic quality	Floor	An “acoustically deadened” environment eliminates unwanted background noise, which helps people who are hard of hearing. Floor materials that help suppress background noise include carpet, cork, textured ceramics and rubber. An “acoustically alive” environment helps people with low vision or blind people who use reflected sound to assist with orientation. Floor materials that enhance reflected sound include hardwood, ceramics, laminates, granite and marble.
	Wall	Wall materials that help create an “acoustically deadened” environment include carpet, cork, textured ceramics, fabric or rubber. Wall materials that help create an “acoustically alive” environment include glazed ceramics, metals, laminates, granite and marble.
	Ceiling	Ceiling materials that help create an “acoustically deadened” environment include textured gypsum board and lay-in acoustic tile. Ceiling materials that help create an “acoustically alive” environment include painted gypsum board, sheet metals and prefinished lay-in tiles.
Ease of maintenance	Floor	Choose finish materials that require minimal maintenance, for example, no-wax hardwoods, vinyl, PVC, ceramics or laminates.
	Wall	Choose finish materials that require minimal maintenance, such as vinyl wall coverings, ceramics, metals, granite, panelling, gloss-painted gypsum board, prefinished gypsum board and marble. If someone in your family or a frequent visitor uses a wheelchair consider kickplates and corner guards along hallways and other high-traffic areas to minimize damage from footrests.
	Ceiling	Choose finish materials that require minimal maintenance, such as painted gypsum board and prefinished sheet or board materials.



Glossary

Aging in place: The ability to remain in one's home safely, independently and comfortably, regardless of age, income or ability level throughout one's changing lifetime.

Clear passage width: The clear opening width that is available when a door is in its open position.

Resilient surface: A relatively firm surface that can reshape itself back to its original surface profile after it is compressed.

Threshold: The sill of a doorway, usually a shaped piece of metal, wood or stone placed beneath a door.

Touch latches: Cabinet hardware that is activated by simply pushing the door (it also latches the door by simply pushing it closed).

Vision panel: A glazed panel (window) within a door.



Additional resources

Books

- Baldrice, N. *The Accessible Home: Updating Your Home for Changing Physical Needs*. Chanhassen, MN: Creative Publishing International, 2003.
- Barrier Free Environments Inc. *The Accessible Housing Design File*. New York: John Wiley & Sons, 1991.
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- Wylde, Margaret, Adrian Baron-Robins, and Sam Clark. *Building for a Lifetime: The Design and Construction of Fully Accessible Homes*. Newtown, CT: The Taunton Press, 1994.



Websites

American Association of Retired Persons— AARP (May 2016)

<http://search.aarp.org/everywhere?Ntt=universal%20design&intcmp=DSO-SRCH-EWHERE>

Concrete Change (May 2016)

www.concretechange.org

NC State University: College of Design (May 2016)

www.design.ncsu.edu/

The Design Linc— Accessibility Design & Resources (May 2016)

www.designlinc.com/

Institute for Human Centered Design—Adaptive Environments (May 2016)

<http://humancentereddesign.org/>

IDEA Center for Inclusive Design and Environmental Access (May 2016)

<http://idea.ap.buffalo.edu/>

Home for Life (May 2016)

<http://www.homeforlife.ca/>

Livable Housing Australia (May 2016)

<http://livablehousingaustralia.org.au/>



The Principles of Universal Design

Principle 1: Equitable use

This principle focuses on providing equitable access for everyone in an integrated and dignified manner. It implies that the design is appealing to everyone and provides an equal level of safety for all users.

Principle 2: Flexibility in use

This principle implies that the design of the house or product has been developed considering a wide range of individual preferences and abilities throughout the life cycle of the occupants.

Principle 3: Simple and intuitive

The layout and design of the home and devices should be easy to understand, regardless of the user's experience or cognitive ability. This principle requires that design elements be simple and work intuitively.

Principle 4: Perceptible information

The provision of information using a combination of different modes, whether using visual, audible or tactile methods, will ensure that everyone is able to use the elements of the home safely and effectively. Principle 4 encourages the provision of information through some of our senses—sight, hearing and touch—when interacting with our home environment.

Principle 5: Tolerance for error

This principle incorporates a tolerance for error, minimizing the potential for unintended results. This implies design considerations that include fail-safe features and gives thought to how all users may use the space or product safely.

Principle 6: Low physical effort

This principle deals with limiting the strength, stamina and dexterity required to access spaces or use controls and products.

Principle 7: Size and space for approach and use

This principle focuses on the amount of room needed to access space, equipment and controls. This includes designing for the appropriate size and space so that all family members and visitors can safely reach, see and operate all elements of the home.

