



Exterior Spaces

Universal design

People who inhabit and visit the houses we live in come in all shapes and sizes, ranging from infants to seniors, with various ever-changing abilities and skills. As we grow up. Grow old and welcome new people to 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.

Successfully designing a universally accessible exterior space starts with assessing the space and identifying how you, your family and friends will use it. As your needs change and family members come and go, your use of the outdoors will change, so it is advisable to design an adaptable and flexible exterior space.

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.

Exterior design

The principles of universal design are being incorporated into many exterior landscape design elements, including decks, play spaces, gardens, and eating and cooking areas.

The life and usability of outdoor spaces can be extended by taking into account flexibility when selecting surface materials, seating options, areas of shade and sun, and creating play areas, rest areas and open areas.

This approach is increasingly popular with families and individuals who intend to stay in their homes and neighbourhoods as they grow and age. This promotes the concept of **aging in place**. Planning for people's changing needs and abilities in the design of outside spaces allows for periodic customization of elements and reduces the need for future expenditures.

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 18.

Bolded terms throughout this fact sheet are defined in the Glossary on page 15.



Design considerations

Consider all of the design factors associated with the outdoor space:

- Site layout
- **Wayfinding**
- Pathway and walkways
- Safety
- Maintenance
- Protection from the elements
- Accessible entrances

Designing an outdoor space to allow flexibility and adaptability maximizes the enjoyable use of the area.

Considering future needs is good practice. Principles of universal design encourage flexibility, adaptability, safety and efficiency.

Ask yourself

- How much space do we have?
- Are there **topographical constraints**?
- Are there **natural features** that can be highlighted?
- Does my family want an outside eating and cooking area?
- Does someone in my family have a disability that will affect the choice of **surface treatment**?
- Is there a need for parking?
- Which areas are shaded and which are sunny?
- Does someone in my family have a condition that may affect their well-being, such as allergies?
- Do we want a play structure, a sand box or swings?

Site layout

Ideally, patios, terraces and seating areas should be accessible by a pathway and incorporate an appropriate turning space. People who use walkers, wheelchairs or scooters need wide pathways to access various areas of the garden. Pathways should be at least 1,065 mm (42 in.) wide but 1,200 mm (48 in.) is recommended. It should be noted that a 915 mm (36 in.) pathway is wide enough for one person in a wheelchair; while a 1,200 mm (48 in.) pathway is wide enough for one person in a wheelchair and an individual standing beside. Finally, a 1,500 mm (60 in.) pathway is wide enough for two persons in wheelchairs to pass by one another (see figure 1).



Figure 1: Exterior garden view
Photo by Ron Wickman



At locations where turning is required, such as at a seating area or a door, provide an area of at least 1,500x1,500 mm (60x60 in.) (see figure 2). If you can, provide a larger turning space of 2,100x2,100 mm (83x83 in.) to better accommodate scooters and larger wheelchairs (see figure 2).

Wayfinding

Wayfinding refers to techniques used by people who are blind or have visual limitations as they move from place to place independently and safely. Wayfinding is typically divided into two categories:

orientation and mobility. Orientation concerns the ability for one to monitor his or her position in relationship to the environment; and mobility refers to one's ability to travel safely, detecting, and avoiding obstacles and other potential hazards. In general terms, wayfinding is the ability to know where you are, where you are headed and how best to get there; recognize when you have reached your destination and find your way out; all accomplished in a safe and independent manner.

Wayfinding design makes setting more efficient, safer in case of emergencies and accessible to a larger section of the population, and it can also bring about an architecture that is well articulated, rich in spatial experience and esthetically pleasing. Like colour-coding or signs in a public building, wayfinding devices create a spatial language that we read with our senses.

Wayfinding features can be incorporated into homes in ways that are subtle and effective. Changing the texture of walkway surfaces to differentiate edges or crosswalks promotes wayfinding for people who rely on a white cane to find their way through touch. Raised curbs beside a walkway also allow wayfinding when the homeowner is blind (see figure 3).

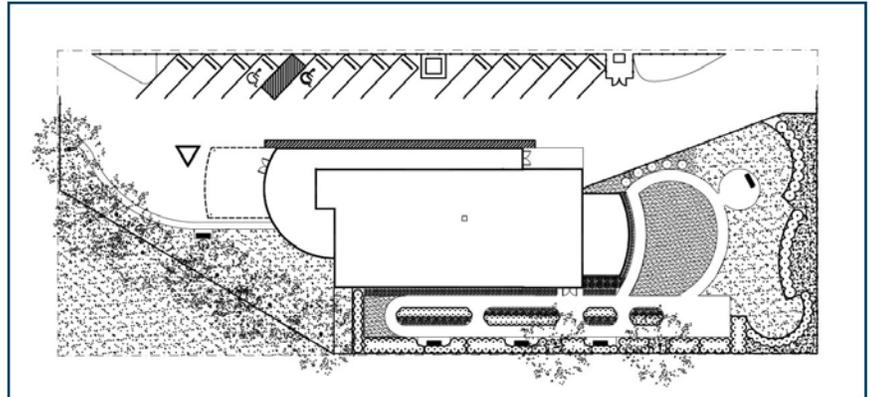


Figure 2: Sample landscape plan with pathways and turning areas
Diagram by Ron Wickman, Architect



Figure 3: Raised curbs on a walkway
Photo by Ron Wickman



Any visual wayfinding system is more than just signs. It encompasses architecture, landscape architecture, lighting, landmarks and orientation points. For example, brightly coloured planting, plants with fragrance and water features all help persons with low vision in their wayfinding. The design of spaces should assist users with spatial problem solving by providing consistent clues.

- Confirm they are at the correct start and finish point of an individual journey.
- Identify their location within a building or an external space.
- Reinforce they are travelling in the right direction.
- Orient themselves within a building or an external space.
- Understand the location and any potential hazards.
- Identify their destination on arrival.
- Escape safely in an emergency.

If you have a very large garden, make sure that the exterior walks are simple and logically laid out. You may wish to group some elements reasonably close to each other and close to the main access points to your house, to avoid having to walk long distances. This will help accommodate family and friends who may have stamina limitations. Similarly, providing seating areas along pathways will provide opportunities to rest, as well as enjoy the garden. Always ensure that there is a level, firm, open surface beside a bench for someone in a wheelchair to sit beside; also ensure that the bench has arms on it so persons who have trouble getting up have something to aid them (see figure 4).



Figure 4: Bench with wheelchair accessible space beside
Photo by Ron Wickman

Consider also designing your garden to incorporate a circuit of pathways that will bring you back to the starting point, without having to turn around. This can make it simpler and easier to negotiate for people who use mobility devices, as well as people who have dementia.

When designing and determining the location of your deck, porch or gazebo, remember to consider how these elements will coexist with your home, existing landscape and trees, and what pathways and walkways will be needed to reach each design element in your yard.

If your garden incorporates modest level changes, consider using a sloped walkway, rather than steps or a ramp. In gardens where significant level changes need to be overcome using steps or ramps or both, integrate the steps or ramps into the overall landscape design (see *Accessible Housing by Design—Ramps*). Adopting such design strategies can minimize the impact of the potentially unsightly railings associated with stairs and ramps.



Pathways and walkways

Ideally, a clear path of travel for pedestrians should be a minimum of 1,500 mm (60 in.), free of obstructions and provide a firm, even, non-slip, and glare free surface (for example, broom concrete finish). In addition, an elevation change of 13 mm (½ in.) or more should be considered a trip hazard and should not be permitted in the clear path of travel. The obvious difficulty is to provide a pedestrian environment that is suitable for everyone. For example, brick pavers provide a nostalgic esthetic, but they rarely remain even and can prove to be a trip hazard for those who move slowly and a bumpy ride for those who use wheelchairs. One positive recommendation to resolve this specific problem is to use concrete—a firm, non-slip and non-glare surface good for those persons in wheelchairs and those who move slowly—for the clear path of travel and brick pavers as esthetic accents and as tactile cues for those persons with visual limitations.

Maintaining a clear space around and above your pathways and walkways is important to ensure that people are able to navigate safely and easily. Remember to trim overhead branches so that people who are tall or have a visual impairment do not inadvertently get scratched or bump their heads on branches that extend over the route.

It is important to carefully consider the materials used to construct walkways and pathways. To choose materials that better meet your needs, consult table 1 on page 12 which provides detailed information about the most common types of finishes.

Exterior walks can provide colour and texture contrast at walkway intersections and walkway edges to help make them more identifiable to persons with visual limitations. Walkway edges that have colour and texture contrast are called “shorelines,” and they serve the same purpose as highway rumble strips. Shorelines warn pedestrians that they are moving off the pathway (see figure 5). Caution should be used for those persons with cognitive limitations, who may interpret a shadow or dark colour as a hole in the walking surface; even illumination and consistent colouring help to eliminate this issue. For those persons with hearing loss, walkways should have clear sightlines at corners and where vehicles are manoeuvring.



Figure 5: Asphalt pathway complete with gravel shorelines
Photo by Ron Wickman

Safety

In exterior environments, design should focus on separating people from automobiles. Grading and drainage must also be carefully planned to avoid puddles that can also ice over in colder weather.

Safety issues should be taken into consideration in the selection of landscape materials, including plants and trees. Plants and trees that drop a lot of debris should be avoided.



Cleanliness and ease of collection of debris is another safety issue to consider. People with environmental sensitivities should carefully consider landscape materials and vegetation, including the types of pollens. Remember to avoid creating environments that might cause mould or irritants.

Protruding and overhanging objects could be dangerous, especially to people that have reduced vision (see figure 6).

If someone who is prone to falling will be using the exterior spaces, be sure to use **resilient surfaces** where possible (see table 1 on page 12 for a comparison of materials). Safety surfaces in play areas should be provided to reduce the danger of injury.

Maintenance

Maintenance issues, such as pruning and trimming, should be carefully considered when selecting landscape features, especially if you are not able to undertake these chores yourself. Select plant species whose mature size is not too large for the available space and require little or no maintenance.

Protection from the elements

The design of your exterior space should consider a number of weather-related issues. Placement of seating areas should maximize protection from the sun and the prevailing wind. The house itself could be used as a windscreen, which may be advantageous during cool weather, but during the warmer weather an alternate seating area that allows for cooling breezes should also be considered.

Design elements, such as fencing or landscape screening, can contribute to wind protection. Similarly, shade can be maximized using deciduous or evergreen trees, trellises, umbrellas and other landscape features, including shade from the house itself.

In Canada, protection from snow and cold winds is important. Snow will accumulate below roofs and on ramps and stairs, especially if the prevailing wind brings the drifting snow onto the ramp. Again, fencing and landscape screening features can reduce snow accumulation. It is a good idea to plan where snow will be piled and what will happen as the snow melts.

To maximize the amount of time you can use your exterior space, it is important to ensure that stormwater drains away from your home and outdoor areas you access (such as patios). Careful thought should be given to ensuring that drainage does not compromise the use of access routes. Pooling water at the base of ramps and stairs can create a serious hazard. For more information on grading and stormwater management see CMHC's *Landscape Guide for Canadian Homes*.

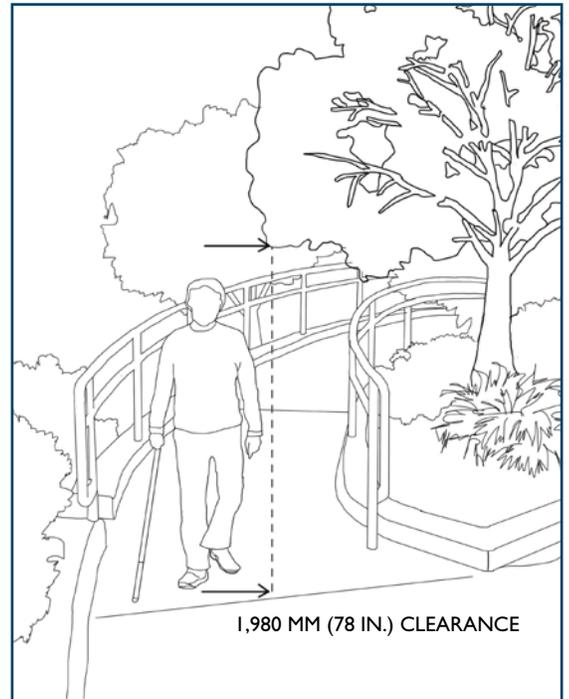


Figure 6: Overhanging objects
Diagram by Ron Wickman, Architect



Accessible entrances

Entrances to homes should come with a no-step entrance, low door threshold and a 915 mm (36 in.) wide door. Ideally, the entrance should provide covered protection from the elements. Accessible entrances should also provide the following.

- A shelf or bench should be located at an individual residence entrance that can be used to hold any packages, backpack, or groceries.
- Doorbells, intercoms and mailboxes can be made accessible to persons in wheelchairs or scooters; doorbells, intercom control buttons and mailboxes should be located between 1,050 mm (42 in.) and 1,400 mm (54 in.) above the floor.
- Intercoms and mailboxes can be made accessible to persons with visual limitations; signs and indicators should be in contrasting colour and in raised letters.
- Motion sensor lighting should be supplied and installed at places of residence.
- The doorbell includes a built-in speaker phone and security camera to provide visual and audible surveillance of the entry.
- The automatic door lock is releasable from any of the house phones.

Design elements

The major design elements of a universal exterior space are:

- decks and patios;
- porches and gazebos;
- raised gardens;
- seating areas;
- electrical outlets, switches and other operating mechanisms;
- lighting; and
- materials and finishes.

Decks and patios

Decks and patios come in a wide variety of sizes and shapes, designed to suit a range of needs and preferences. In some cases, decks and patios are designed solely as a landing area at the entrance to the home. In many cases however, decks and patios are designed to be an extension of a home's living space, providing a firm and level surface outdoors for leisure and recreation. Decks are traditionally raised off the ground, and patios are generally at ground level. When constructing a deck or patio, ensure that there is adequate manoeuvring space at landings.

When designing a deck or patio, it is important to address the same safety considerations that you would for the interior of your home.



Stairs should have uniform step heights and tread depths to ensure that people do not trip. The **riser** of each stair should be enclosed. Stairs should have handrails that are a comfortable size and shape for grasping. A circular shape 30 to 40 mm (1¼ to 1½ in.) in diameter is appropriate for most people, although children and others with small hands may prefer smaller diameters of 25 to 35 mm (1 to 1½ in.). The height of handrails should be 860 to 920 mm (34 to 36 in.) and a second handrail at a height of 665 to 700 mm (26 to 28 in.) is recommended if children will be using the stairs (see figure 7).

Before starting to build a deck, porch, gazebo or garden shed, contact your local building department to find out whether you need a building permit.

For homes that have a large vertical rise between the ground and entry, a deck may have several levels connected by stairs or ramps. Where there is a very large vertical rise, consider installing a lift (see *Accessible Housing by Design—Lifts and Residential Elevators*).

Ramps are particularly useful for overcoming level changes up to about 760 mm (30 in.). Using ramps for level changes greater than this requires a great deal of space—which may or may not be practical. The slope of the ramp should be maximum 1:12, but 1:15 is preferred if space permits.

Installing a guardrail around the deck will ensure everyone’s safety, especially if there is a vertical drop to the ground.

This is especially important for children, people with visual impairments and others who may not be able to see the edge and for people with mobility devices who may inadvertently roll off the deck.

Be sure to check with your local building department regarding **property line setback** requirements for gazebos and decks, as well as deck guardrail regulations. In many jurisdictions, guardrails are mandatory.

In the past, decks were built of wood. Now there are several products that look and feel like wood, such as wood-plastic composites, and plastic and rubber boards. Common patio building materials include poured concrete, interlocking stones, paving slabs, asphalt and rubberized surfaces. For more information about these materials, see table 1 on page 12.

Regardless of the surface treatment, a minimum **cross slope** of 1:50 is required to ensure proper drainage, which is especially important if your deck or patio is adjacent to your house.

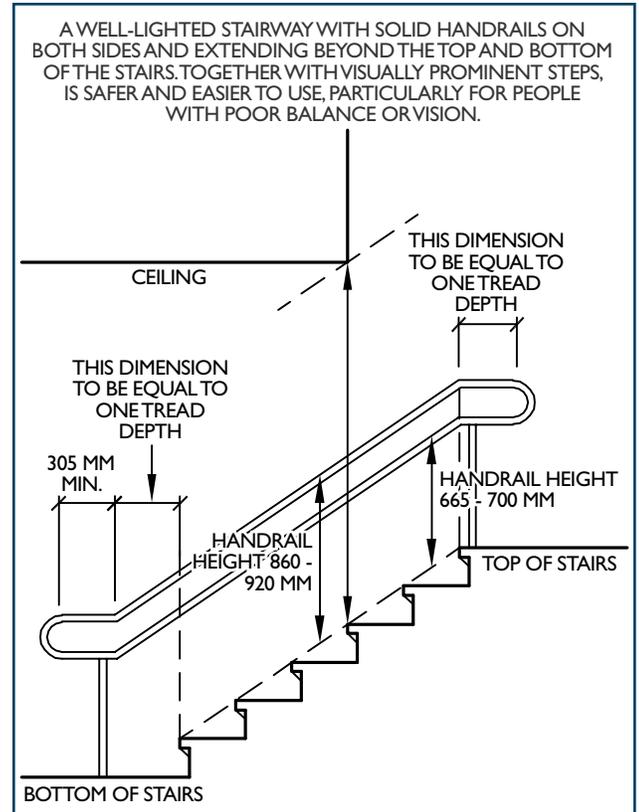


Figure 7: Typical stair and handrail detail
Diagram by Ron Wickman, Architect



Porches and gazebos

Porches and gazebos are traditionally covered with a canopy or a roof and, like decks, they provide a firm, level surface that can be enjoyed by all.

Healthy Housing™ choices

Consider the following recommendations for resource efficiency, environmental responsibility and a healthier living environment:

- Use water-based paint and stain finishes.
- Prevent mould growth in spaces under decks, porches and gazebos with proper ventilation.

It is important to consider the same factors for gazebo entrances as for your house entrances. The doors should have a minimum clear width of at least 810 mm (32 in.). There should be a clear and level manoeuvring space at the entrance of at least 1,500x1,500 mm (60x60 in.), greater if possible. This will ensure that the gazebo is accessible to everyone, including parents with strollers and people who use walkers and wheelchairs.

If the gazebo or porch is also to be used as a gardening centre, incorporate storage where gardening materials can easily be seen and reached and a place to sit down to work. Work areas are traditionally at a height of 915 mm (36 in.) but a countertop at a height of 860 mm (34 in.) is more convenient for children, people who are short or those who use a wheelchair. Children or people of a shorter stature or those who use a wheelchair may appreciate a counter at a height of 740 mm (29 in.). When designing a work area for someone who uses a walker or a wheelchair, allow a manoeuvring space of 760x1,200 mm (29½x48 in.) in front of the counter.

Also consider the space needed to access storage areas in garden and tool sheds. Provide pathways to storage areas, as well as sufficient space to turn around if the pathway system does not continue. Organize storage shelves so there is a clear space of at least 760x1,200 mm (30x48 in.) in front of all the shelves, cupboards and other storage elements.

Many gazebos and porches also incorporate seasonal storage and shelving. Flexibility and efficiency of effort can be achieved by providing storage options at a variety of heights. Storing related things in the same cupboard where they are easy to find is appreciated by everyone but is especially important for someone with limited mobility or a visual impairment.

If your garden has a water supply from a tap or a hose, or features switches, electrical outlets or other controls, provide an appropriate pathway to reach them, as well as a clear space of at least 760x1,200 mm (30x48 in.) in front and make sure they are no lower than 400 mm (15¾ in.) and no higher than 1,200 mm (48 in.) (see figure 8).

When arranging garden furniture, be sure to leave enough clear space for those who use wheelchairs or other mobility aids to reach the seating area, as well as a clear space of at least 760x1,200 mm (30x48 in.) for them to “park.”

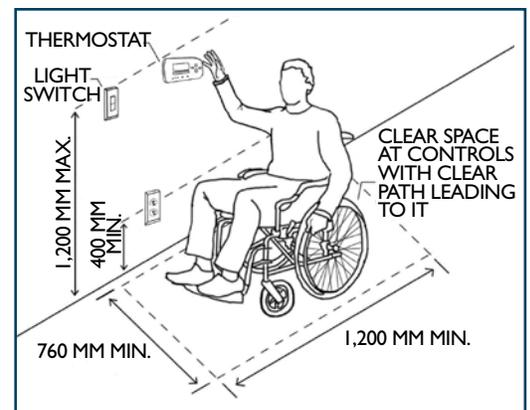


Figure 8: Typical stair and handrail detail
Diagram by Ron Wickman, Architect



If you have a garden shed, be sure to incorporate a door that will accommodate a wheelbarrow—which also has the benefit of accommodating a walker, wheelchair or scooter. The door should provide a clear opening width of at least 810 mm (32 in.), and it should incorporate clear space beside the latch on both sides of the door; at least 610 mm (24 in.) on the pull side, and 300 mm (12 in.) on the push side. It is highly recommended to use 915 mm (36 in.) wide doors inside and outside of residences.

Raised gardens

Raised gardens are a point of interest and can extend the usability of the garden for people who find it difficult to reach down to ground level.

Raised gardens should be at least 800 mm (32 in.) high and be surrounded with clear pathways for ease of access (see figure 9).

Storage for gardening equipment, easy access to water and protection from the sun should be located close to the garden area.

Seating areas

A variety of seating options should be considered. Furnishings may include chairs, tables and benches. Seating should be stable, firm and easy to get out of. Armrests should be provided at a height of 700 mm (27½ in.). Many older people prefer seating at a height of 450 to 500 mm (17¾ to 19¹¹/₁₆ in.) with armrests and a backrest for support. Seating should be located on a level, firm surface and provision should be made for people who use wheelchairs in the seating area.

Tables, such as picnic tables, should be placed on or beside an accessible route—that is, a firm and slip-resistant pathway that connects with the parking area and entrance route. Picnic tables should be designed so that they provide adequate knee space, free of obstructions.

Seating areas for people who use wheelchairs should be provided at the picnic table. This is easy to do by simply extending the table top, creating clear knee space. The height of the picnic table should be between 730 to 860 mm (28¾ to 34 in.) and 680 mm (26¾ in.) of knee space should be provided.

Furnishings should be safe and comfortable to use and free of hazards such as sharp edges and splinters. Edges should be rounded to prevent injury and colour-contrasted.

The seating area should also incorporate appropriate lighting and protection from the sun and weather.



Figure 9: Raised planter
Photo by Ron Wickman



Electrical outlets, switches and other operating mechanisms

Controls should be easy and intuitive to operate for everyone, regardless of language, cognitive ability, ability to grasp and fine motor movements. Also, since the controls will be used by different people, they should be clearly visible, easy to manipulate and located within the reach of both seated and standing persons. These features will benefit people with small, dirty or wet hands and people with arthritis. This is the universal approach to design. These types of controls are easy to use for everyone, not just for persons with disabilities.

In order to ensure that everyone can reach and use exterior taps, switches and electrical outlets, there should be an appropriate pathway. The controls, switches and outlets should be at a height of between 400 to 1,200 mm (15¾–47¼ in.)—see figure 8 on page 9.

There are weather and environmental safety features to consider. Because of the risk of moisture in switches and outlets, it is useful to have them protected by a cover that forms a watertight seal when not in use. If you are away from your home a great deal, you may want to have exterior outlets and water taps equipped with a lock-out feature to prevent access.

Exterior lighting

There is an interesting range of options for exterior illumination. Illumination can enhance safety and visibility, and it can be used to create atmosphere, help people find their way and increase security.

Additionally, energy-efficient options, such as solar lighting, motion activators and timers, are available. A universal design approach to exterior lighting systems considers adjustability, adaptability and sustainability. As with the selection of other landscape design features, the starting point is to identify your family's needs. Exterior lighting can be part of your home's automatic system (see *Accessible Housing by Design—Home Automation*).

Materials and finishes

The choice of materials and finishes for your decks, patios, pathways and walkways is based on esthetics, personal preference, environmental impact and cost.



Table I outlines the functional characteristics of finish materials and how they affect usability. Some examples of suitable materials for specific applications are provided. There is a vast array of materials—be sure to check their characteristics as one may be better suited to your needs than another.

Table I Surface types and characteristics

Surface characteristics	Considerations
Asphalt	
Slip resistance	Slip-resistant, even when wet. Minimal grade and proper drainage are important to prevent water from pooling, which is hazardous if it freezes in winter.
Smoothness	Very smooth when new and ideal for people with mobility aids. Can become rough and broken over time, especially if tree roots extend under the surface or if heaving occurs during the freeze-thaw cycle.
Resilience	Very hard surface. Not ideal for people who are prone to falls.
Colour	Black.
Ease of maintenance	Relatively easy to maintain and clean. May require application of a sealant over time.
Uses	Suitable for patios, walkways, pathways and gazebo floors.
Interlocking Stones	
Slip resistance	Come in a wide variety of textures and finishes. Some can be slippery when wet.
Smoothness	Smoothness depends on the type and shape of stones, and whether the edges of each stone are bevelled. Provide an overall firm but bumpy surface; if tolerance to minor vibration is low, interlocking stones may not be the best choice. It is important that the stones be properly installed to ensure a level surface, free of tripping hazards.
Resilience	Very hard surface. Not ideal for people prone to falls.
Colour	Wide variety of colour shades, shapes and textures.
Ease of maintenance	Periodic lifting and re-laying of some stones is necessary to ensure a safe, level surface. It is quite common for some of the individual bricks to settle or heave, resulting in a potential tripping hazard.
Uses	Suitable for patios, walkways, pathways and gazebo floors.



Paving Slabs	
Slip resistance	Slippery when wet. Proper drainage is important to prevent water from pooling, which is hazardous if it freezes in the winter.
Smoothness	Smooth. Ideal for people who use mobility devices.
Resilience	Very hard surface. Not ideal for people who are prone to falls.
Colour	Variety of colours.
Ease of maintenance	Easy to maintain and clean.
Uses	Suitable for patios, walkways, pathways and gazebo floors.
Poured Concrete	
Slip resistance	Not slippery when wet if surface is brush finished. Minimal grade and proper drainage are important to prevent water from pooling, which is hazardous if it freezes in winter.
Smoothness	Very smooth. Ideal for people who use mobility devices. Texture can be added when concrete is wet by “stamping.”
Resilience	Very hard surface. Not ideal for people prone to falls.
Colour	Predominately white/grey, although available in a variety of shades. Existing concrete can be coloured with chemical finishes or painted.
Ease of maintenance	Easy to maintain and clean. More expensive and difficult to maintain than paving slabs (since only affected paving slabs need to be fixed or replaced).
Uses	Suitable for patios, walkways, pathways, porches and gazebo floors.
Rubberized Surfaces	
Slip resistance	Excellent slip-resistant properties.
Smoothness	Available in smooth and textured surfaces. Overall, they provide a firm, level surface.
Resilience	Offer excellent resilience. Excellent surface for people prone to falls. Note: Firmness of rubberized surfaces can vary greatly.
Colour	Variety of colours.
Ease of maintenance	Very easy to maintain and clean.
Uses	Suitable for patios, walkways, pathways and gazebo floors.



Cedar and Pressure-Treated Woods	
Slip resistance	Fairly slip-resistant when dry. Slippery when wet.
Smoothness	Results in an overall firm but bumpy surface if the deck is made of long boards. If tolerance to vibration is low, wood decking may not be the best choice. Smooth when finished with plywood but proper drainage required to prevent water from pooling.
Resilience	Firm surface that provides some resilience.
Colour	Usually yellow, turning grey as it ages. May have a green tint when pressure treated with herbicides. Redwood and cedar have a light pink/red colour. Can be stained in a variety of colours.
Ease of maintenance	Very easy to maintain and clean.
Uses	Suitable for decks, porches and gazebo floors.
Wood Chips	
Slip resistance	Fairly slip-resistant when dry. Slippery when wet.
Smoothness	Very uneven. Relatively good walking surface. Can be used by people using mobility aids when placed over a firm sub surface.
Resilience	Very resilient surface and ideal for people who are prone to falls.
Colour	Available in a variety of colours.
Ease of maintenance	Maintenance includes ensuring subsurface is in good condition, free of ruts and holes, and surface is well covered with wood chips. Surface needs to be topped up or replaced on a regular basis as wood chips decompose. May also require weeding.
Uses	Suitable for walkways, pathways and floors.
Wood Composites and Engineered Decking	
Slip resistance	Wood composites are slip-resistant, dry or wet. Some manufactured decking is slippery when wet.
Smoothness	Designed to look and feel like wood. Result is an overall firm but bumpy surface. Not the best choice if tolerance to vibration is low.
Resilience	Varies widely. Be sure to investigate the properties of each product.
Colour	A wide variety of colours are available.
Ease of maintenance	Very easy to maintain and clean. Some products require a sealant.
Uses	Suitable for decks, walkways, porches and gazebo floors.



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.

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

Property line setback: The minimum distance required from the property line to the leading edge of a built structure.

Resilient surface: Surface that is relatively firm and can bounce back to its original surface profile after compression.

Riser: The vertical board under the tread (horizontal part of the step) in stairs.

Surface treatment: Different ground or building products that can be used to create paths, walkways, decks, and porches (see table 1 on page 12).

Topographical constraints / Natural features: Elements of the natural setting that may pose a limitation on the design.

Wayfinding: Encompasses all of the ways in which people orient themselves in physical space and navigate from place to place.



Additional resources

Books

Barrier Free Environments Inc. *The Accessible Housing Design File*. New York: John Wiley & Sons, 1991.

Behar, S., and C. Leibrock. *Beautiful Barrier-Free: A Visual Guide to Accessibility*. New York: Van Nostrand Reinhold, 1993.

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Mace, R. *Residential Remodeling and Universal Design: Making Homes more Comfortable and Accessible*. Darby, PA: Diane Publishing Co, 1996.

Pierce, Deborah. *The Accessible Home: Designing for All Ages and Abilities*. Newtown, CT: The Taunton Press, 2012.

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=home+garden%2Fhome+improvement>

Institute for Human Centered Design (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/>

NC State University: College of Design (May 2016)

<http://www.design.ncsu.edu>



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.

