Lifts and Residential Elevators

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 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 the people who live in and visit these homes.

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 12.

Consistent with the philosophy of universal design, residential lifts and elevators provide an appropriate and equitable means of access for many people.

Bolded terms throughout this fact sheet are defined in the Glossary on page 10.

Traditionally, a vertical platform lift is installed because of an immediate accessibility requirement, while an elevator in a private residence has been viewed as an expensive luxury exclusively for users in wheelchairs.

Now, people recognize that residential lifts and elevators can benefit many people—particularly seniors who want to remain in their homes despite loss of mobility, strength or agility, which promotes the concept of **aging in place.**

This concept is increasingly popular with families and individuals who choose to stay in their homes and neighbourhoods as they grow and age. Planning for individuals' changing needs and abilities allows for periodic home customization based on changing requirements and reduces the need for future costly renovations.

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

Designers and builders must talk to and work with as many people with disabilities as possible. 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.

This document tells you about the types of residential lifts and elevators that are commonly available in Canada. It also tells you about some of the things you should consider when you choose and install an elevator or lift.

A word about terms

The words used when discussing "lifts," "elevating devices," "elevators" and "hoists" can be confusing as the terms are often used interchangeably. To further complicate things, in Europe, "lift" is the word used for what is called an "elevator" in North America.

This document uses the terms **lift** and **residential elevator.**

Elevators utilize automatic operation, while a lift will require that you hold the button for the device to function. Operation by holding constant pressure limits your risk for pinching or shearing hazards.

Lifts will have an operating speed of 2,400 mm (96 in.) per minute. An elevator usually functions between 6,100 mm (240 in.) and 12,200 mm (480 in.) per minute.

Capacity usually isn't a factor as platform sizes are limited, but lifts will start at 250 kg (550 lb.) (most are 340 kg [750 lb.]), and elevators will range from 360 kg (800 lb.) to 635 kg (1,400 lb.).

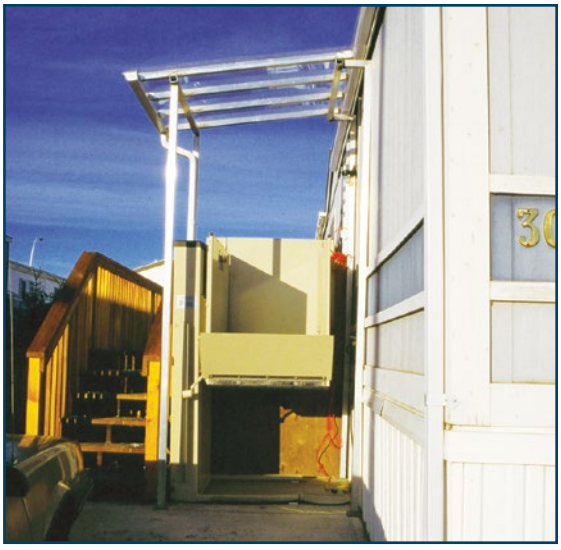

Figure 1: Exterior vertical platform lift
Photo by Ron Wickman

Lifts

A **lift** is an elevating device that can travel up and down as much as 2,450 mm (96 in.).

Lifts are typically used to provide access between different floors of a house, or from the ground level outside the house to an inside floor level (see figure 1).

There are three main types of lifts:

- Vertical platform lift
- Inclined platform lift
- Stair chairlift

Vertical platform lift

A **vertical platform lift** can be equipped with **platforms** of various sizes and must be securely mounted on a solid and stable base (typically a poured concrete slab), sheltered to protect users from rain and located away from areas where drifting snow can accumulate. An unenclosed lift can become unusable if tight-packed snow and ice accumulate under the lift platform. A grounded, 110-volt electrical supply on a dedicated circuit is typically required.

Vertical platform lifts are often enclosed to prevent falls and to stop children or animals from getting under the platform. The manufacturer can provide a lift enclosure or an enclosure can be custom-built.

If the lift is not enclosed, there should be a safety gate at the upper level to prevent falls when the lift platform is at the lower level (see figure 2).

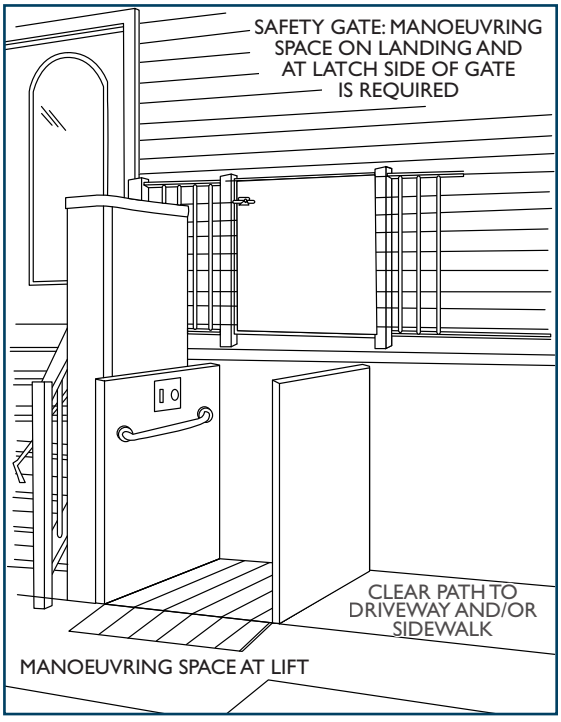

Figure 2: Unenclosed vertical platform lift
Diagram by DesignAble Environments Inc.

Inclined platform lift

Inclined platform lifts consist of a platform that moves up and down over an existing stairway (see figure 3). They are often called **stairlifts**.

They are usually employed by people who use wheelchairs, but some models incorporate a fold-down seat for people who do not use a wheelchair but have difficulty using stairs.

The platform is typically supported by a rail that is mounted to a wall on one side of the staircase. Platforms on stairlifts come in various sizes (see table 1 on page 7). Ideally, the staircase should be at least 915 mm (36 in.) wide, although some models are available for stairs as narrow as 865 mm (34 in.). Remember that the narrower the staircase, the narrower the platform. Ensure that the platform you choose is large enough to fit your wheelchair or scooter (and any wheelchair or scooter that your family or visitors may have). With a narrow staircase, often the stair handrail needs to be relocated to accommodate the platform lift. A grounded, 110-volt electrical supply on a dedicated circuit is typically required. It is a good idea to have an electrical outlet under the stairs (if accessible) or at the top or bottom of the stairway.

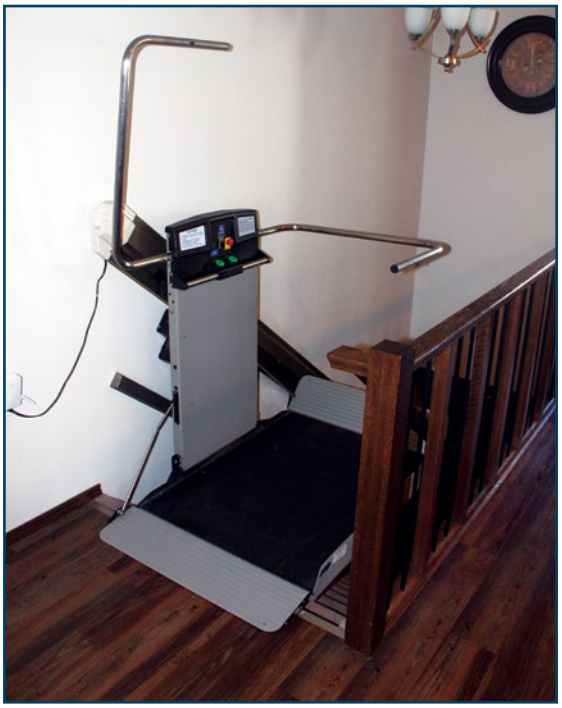

Figure 3: Stair platform lift
Photo by Ron Wickman

One of the greatest barriers to installing an inclined platform lift in an existing stairway is available headroom. Often, headroom is minimal—particularly at the bottom of the staircase. Be sure that you have enough clearance.

Inclined platform lifts are easier to install and less expensive if the staircase is a single, straight run. There are platform stairlifts available that will turn corners on curved staircases, but they require wider staircases to accommodate the platform as it turns and they are far more expensive.

Inclined platform lifts need a clear floor space at the top and bottom of the staircase to allow the user to get on and off the platform. More space is required at the bottom of the stairs because the platform has to travel beyond the end of the last stair to reach the floor level. Remember that the rails extend beyond the bottom of the last stair and will become a tripping hazard if they are not protected by a wall or some other barrier.

It is important to note that manoeuvring space of 1,500 mm (60 in.) is needed at the top of the staircase and 3,000 mm (120 in.) is needed at the bottom of the staircase.

Stair chairlift

Stair chairlifts consist of a seat that travels up and down a stairway (see figure 4). The seat runs on a track or rails mounted either on the surface of the stairs or on an adjacent wall. If a stair-mounted track is used, it reduces the usable width of the stairs. This is of particular concern on narrow stairs.

The person using the stair chairlift can be seated sideways to the stairs or facing down the stairs. In addition, there are models with chairs that swivel to make it easier to get on and off the seat. More stairway width is required to sit sideways across the stairs.

Stair chairlifts are easier to install and are less expensive if the staircase is a single straight run. There are stair chairlifts available that can turn corners on curved staircases.

Curved stairlifts can be custom-built or come off the shelf. A custom-built curved stairlift ensures the tightest possible fit to minimize any obstructions on the stairs. The entire process to build and install the custom lift usually takes four to eight weeks. Some suppliers offer standard "off the shelf" bends. The risk to using standard tracks is wider turns or uneven spacing where the track winds around landings. One advantage of "off the shelf" parts is that they can typically be provided in under four weeks. Both custom and "off the shelf" curved stairlifts sell for approximately the same price.

Figure 4: Stair chairlift
Photo by Ron Wickman

Stair chairlifts require a clear floor space at the top and bottom of the staircase so the user can get on and off the chair. Wheelchair users will need a wheelchair on each floor level served by the lift.

A concern about stair chairlifts is getting off the chair at one of the most dangerous places in a house—the top of a flight of stairs. A stair chairlift may not be the safest solution for people with transfer, balance or visual limitations.

Residential elevators

Residential elevator is the commonly used term for a lift that is enclosed in a shaft and can travel vertically as much as 15 m (590 in.). Such elevators can be equipped with platforms of various sizes. The first thing to consider is the platform size, with the minimum size being 864x1,372 mm (34x54 in.). A good rule of thumb is to use an elevator sized big enough for someone in a wheelchair; the small added expense now eliminates the need for any future costly modifications to the elevator (see figure 5).

The second thing to consider is car configuration. Cars with the entrances on the same side at each level will save you money, as you will only need one gate, one elevator door, and one light

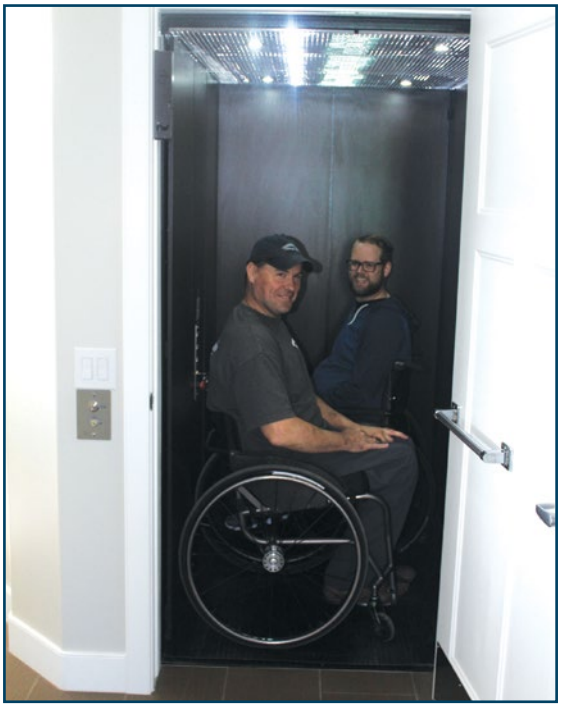

Figure 5: Residential elevator
Photo by Ron Wickman

curtain to travel with the elevator car. If you have entrances across from each other in the car you will have to add the cost of the gate, door or light curtain. This extra cost however may be worth it, as it is always easier for a wheelchair user to drive straight through the car as opposed to backing in and out. Adjacent or 90-degree access is also a possibility, but it is recommended you increase your car size to 1,000x1,500 mm (40x60 in.) if you choose this configuration.

Door selection is next: gates, elevator doors or light screens. An automatic elevator door is probably the most esthetically pleasing and is very easy to use (it automatically opens and closes), but it is by far the most costly option. A light curtain is a very universal solution. It operates using a series of light beams that shoot across the entrance way, if the beam is "broken" the elevator ceases to operate until the obstruction is removed and a floor is selected. For users in wheelchairs or anyone with limited mobility, not having to reach back and close a gate eases the use of a home elevator.

Finally is the **hoistway** construction. Sometimes a homebuilder will simply stack a 1,500x1,500 mm (60x60 in.) closet on each floor with the idea that an elevator can be added at a later date. While this is a great idea and shows foresight on the part of the builder, we need to go one step further. The homebuilder needs to incorporate the above-mentioned information and build for site-specific drawings. Each elevator manufacturer has different criteria when it comes to hoistway construction. It is important to have a structural engineer confirm the construction details of the elevator shaft.

Pit depth, rail wall blocking and required overhead hoistway size are all unique variables. Hydraulic units, in particular, can have some added construction requirements, such as machine rooms, cylinder bore holes and, in some jurisdictions, hydraulic oil separators. This is to ensure leaking fluid cannot enter the water table.

Residential elevator styles range from the most basic, unfinished platform to fully enclosed cabins with safety gates and interior finishes, such as hardwood, ceramic tile, marble and granite.

Residential elevators must be securely mounted on a solid and stable base (typically a poured concrete slab), as well as braced to the structure of the house. There must also be a depression in the floor below the lift shaft—typically 200 to 350 mm (8 to 14 in.) below the floor level of the lowest stop (see figure 6). A grounded, 220-volt electrical supply on a dedicated circuit is typically required.

Figure 6: Elevator shaft depression in concrete floor
Photo by Ron Wickman

The elevator platform and drive mechanisms are enclosed within a shaft, with access to the platform through a door or gate, which can be either at the narrow end or on the long side of the platform.

Doors and gates should have a safety **interlock mechanism** so they cannot be opened unless the platform is at their floor level. Doors can be manually operated or linked to the lift control system to open automatically when the lift arrives at a floor. Features can include automatic homing, hands-free phone systems and custom interior finishes.

In new home construction, consider planning for the addition of a residential elevator by stacking closets above each other on the various floor levels. This space can later serve as a hoistway. If the closets are suitably sized and incorporate a knockout floor panel, adding an elevator later can be simple and cost-effective.

A machine-room-less elevator or MRL is a device that typically houses the drive mechanism at the top of the hoistway. By doing this, the need for a machine room is eliminated, as the entire device is contained within the elevator footprint. Units that require a machine room (like most hydraulic drives) will also require the electrical and hydraulic hoses to be run through a wall from the machine room to the elevator hoistway. In cases where the machine room is not adjacent to the elevator, a remote machine room will be required. This can be costly and create logistical problems with the running of hydraulic hoses through the floor or ceiling or in the walls. The second advantage is quite simple; with an MRL elevator you do not have to allocate the additional space to house the drive mechanism.

Another option for vertical movement is a "no hoistway" lift. The system works by dropping a piece of the floor in place when the lift travels to the lower level. There are pressure-sensitive plates on both the top and bottom of the lift to ensure that no one is in danger when the device is in use. The major benefit of this lift is when the device is not being used, it can be sent to the basement and maintain the sightlines through the living space (see figures 7 and 8).

Is a residential elevator the same as a commercial elevator?

A residential elevator is less complex (and less expensive) than an elevator in an office, high-rise apartment or condominium building.

Commercial elevators are regulated provincially and must be licensed and regularly inspected. Residential lifts and elevators do not need licences.

The access route

Regardless of the type of lifting device chosen, careful consideration should be given to the route used to reach the platform. There should be a clear and level area at least 1,500x1,500 mm (60x60 in.) in size right in front of the platform. Preferably, this area should be 2,100x2,100 mm (83x83 in.), particularly for scooters and larger wheelchairs. Ideally, there should be at least 600 mm (24 in.) of clear floor space adjacent to the latch side of the door or gate.

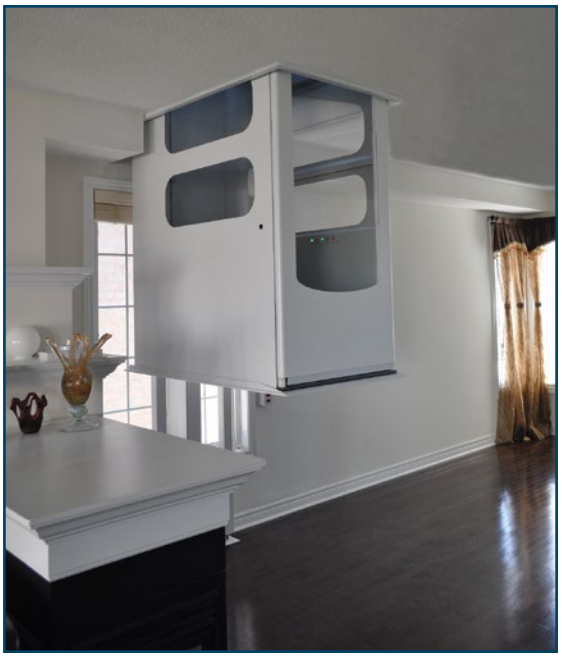

Figure 7: No hoistway lift halfway up the floor
Photo by Ron Wickman

Figure 8: No hoistway lift all the way up in the floor above
Photo by Ron Wickman

The platform size

Vertical and inclined lifts incorporate a **platform**—the floor surface of the lifting device. Tables 1 and 2 provide standard platform sizes for vertical and inclined lifts.

Taking into consideration the needs of all family members and visitors will help you decide on the device size and floor space required. If you use a wheelchair or scooter, you should carefully measure the length and width of your mobility device and choose the platform size accordingly.

If you use your wheelchair in a reclined position or if you use footrests, be sure to measure the chair while you are seated in a comfortable position. Remember also to include space for your caregiver or assistant if you require one.

Table 1 Standard platform sizes for vertical lifts

Width	Length
914 mm (36 in.)	1,220 mm (48 in.)
914 mm (36 in.)	1,372 mm (54 in.)
914 mm (36 in.)	1,524 mm (60 in.)
1,067 mm (42 in.)	1,524 mm (60 in.)

Table 2 Standard platform sizes for inclined lifts

Width	Length
710 mm (28 in.)	914 mm (36 in.)
760 mm (30 in.)	1,120 mm (44 in.)
760 mm (30 in.)	1,524 mm (60 in.)

Safety considerations

Recommended safety features for lifts and residential elevators include:

- **interlock mechanisms** on doors and gates;
- a manual system in case of a power outage or a mechanical malfunction;
- sensors that prevent the lift or elevator platform from crushing objects that may be underneath it;
- a **backup system**;
- safety gates at locations where there is a drop-off when the lift or elevator platform is at a different level;
- handrails on platforms;
- proper lighting; and
- an emergency telephone or other on-device communication system.

A lift or residential elevator should never be used in an emergency. In an emergency, there may be a loss of power to the device, the elevator shaft may become contaminated with smoke, or the lift may take you into greater danger.

Always plan another way of leaving each level of your home. Strategies might include ramped exit routes or areas of refuge—areas of relative safety for use in an emergency situation, where people with limited mobility can await evacuation. In a residence, an outdoor balcony, deck or patio can be an area of refuge, as long as there is an accessible route to get there from inside the house. See the fact sheet *Accessible Housing by Design—Fire Safety in the Home* for more information.

Frequently asked questions

When should you consider installing a lift or residential elevator?

Lifts and residential elevators are typically used when the vertical change between two or more floor levels is significant and there is not enough space to construct a ramp. It is usually impossible to find space for a ramp inside a house if the change in floor levels is more than 200 mm (8 in.). See CMHC's *Accessible Housing by Design—Ramps*, for more information about household ramps.

Lifts are also frequently used outside residences and in garages for access from the exterior ground level into the house (see figure 9). Again, lifts are typically used if there is not enough space for a ramp, if the vertical change is so great that the ramp length would be excessive or if a resident or caregiver cannot negotiate a ramp.

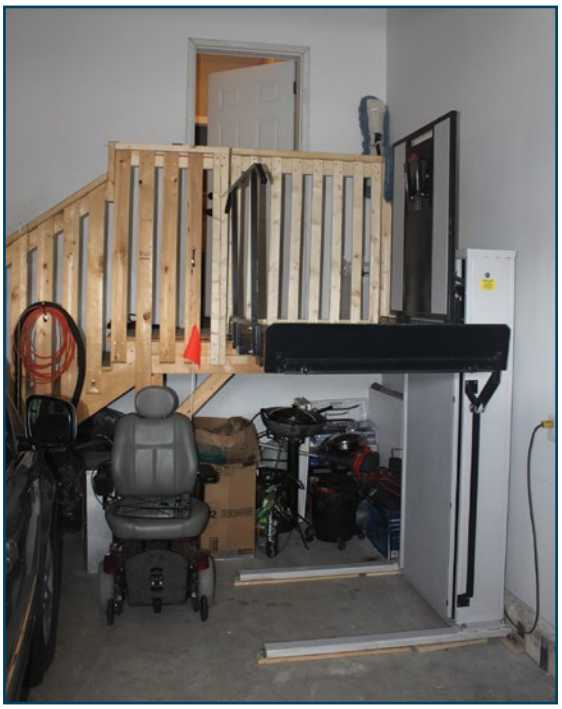

Figure 9: Porch lift located in garage
Photo by Ron Wickman

Do I need a building permit?

Other than for the simplest stairlift installations, you will likely need a building permit. It is important to note that a building permit is necessary whenever the installation of a lift or residential elevator requires structural changes to the house or affects safety systems, such as stairs, fire separations, guardrails, and so on. A structural engineer will likely need to be engaged.

Are there standards, licences and inspections?

Lifts and residential elevators should be regularly inspected and serviced.

Elevators fall under the B-44 code, while lifts are built to meet the B-613 code. It is these codes that provide the distinction between products.

Residential elevators may have to meet specific safety standards. They may need a licence, and they may need an inspection. Call your municipal office and ask a building inspector about safety standards, licensing and inspection for residential elevators.

Lifts and residential elevators should comply with the latest Canadian Standards Association (CSA) standards.

CSA standards for lifts and residential elevators:

- CAN/CSA-B355-00 *Lifts for Persons with Physical Disabilities*
- B355S1-02 Supplement #1 to CAN/CSA-B355-00 *Lifts for Persons with Physical Disabilities*
- CAN/CSA-B613-00 *Private Residence Lifts for Persons with Physical Disabilities*

What type of maintenance is required?

Lifts and residential elevators are mechanical devices that can break down and therefore need regular servicing. Maintenance is generally complex and should be done by an expert.

Purchasing a maintenance contract from a reputable supplier is a very good idea.

What about cost?

As with all construction, cost can vary significantly depending on the equipment, materials and finishes that you choose, as well as the configuration of the existing house.

Table 3 provides cost estimates for general budgeting purposes only. Cost may vary significantly, depending on site conditions, market conditions and inflation, among other factors.

To make your dollars go further, consider buying from a company that sells refurbished equipment. Residential lift and elevator equipment is frequently recycled, providing a reliable, cost-effective and environment-friendly solution.

Table 3 Approximate purchase and installation cost of various types of lifts

Type	Cost
Unenclosed vertical platform lift	$5,000-8,000
Enclosed vertical platform lift	$15,000 and up
Residential elevator	$20,000 and up
Inclined platform lift	$10,000-12,000 (significantly more if staircase is curved)
Stair chairlift	$3,000-8,000 (significantly more if staircase is curved)
Lift service contract	$200-500 per year

Where do I start and who can help me?

The design of a lift or residential elevator installation is typically complex, involving architectural, structural and electrical elements. It is not a project to be tackled by a handyman.

One place to start is lift and residential elevator manufacturers or local medical equipment suppliers. A home visit is always required, at which time the supplier makes recommendations about the feasibility of different types of lifts and residential elevators. It is always a good idea to have a health professional, such as an occupational therapist, present for the site visit, to ensure that the type of device being recommended will meet your current and future needs.

You can also start by consulting 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 a knowledgeable health professional to determine the best type of lift or residential elevator to meet your needs.

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.

Backup system: A system that provides electricity to a lift or residential elevating device when the primary power source is not available, such as during a blackout.

Hoistway: The clear space within which the residential elevator platform and related equipment are located.

Inclined platform lift: A lift device consisting of a platform that travels up and down a stairway on a track.

Interlock mechanism: A safety mechanism that locks a door or gate, preventing access to a lift or residential elevator platform unless the platform is at the floor level of the door or gate.

Lift: A mechanical device used to overcome changes in floor and ground level.

Platform: The floor surface of a lift or residential elevator on which the user stands or positions his/her wheelchair or scooter.

Residential elevator: A commonly used term for a vertical platform lift that is enclosed within a shaft.

Stairlift: A commonly used term for an inclined platform lift.

Stair chairlift: A lift device consisting of a seat that travels up and down a stairway on a track

Vertical platform lift: A lifting device consisting of a platform that travels up and down.

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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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

Régie du bâtiment du Québec—Lifting Device for Disabled Persons or Mobility Impaired Persons (June 2016)
https://www.rbq.gouv.qc.ca/en/citizen/disabled-person/lifting-device-for-disabled-persons.html

NC State University: College of Design (June 2016)
http://www.design.ncsu.edu

Home for Life (June 2016)
http://www.homeforlife.ca/

Institute for Human Centered Design (June 2016)
http://humancentereddesign.org/

Livable Housing Australia (June 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.

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