

## Accessible Housing by Design—House Designs and Floor Plans

### WHAT IS ACCESSIBLE HOUSE DESIGN?

Accessible house design is design that will accommodate everyone, including people with disabilities. Accessible housing includes houses that are minimally accessible, houses that can easily be made accessible at a later date, and houses that are completely accessible with power door openers, large bathrooms and so on. Some of the most common types of accessible house designs are:

#### Visitable

A visitable house includes basic accessibility features that allow most people to visit, even if they have limitations such as impaired mobility. Basic features of a visitable house include a level entry, wider doors throughout the entrance level and a washroom on the main floor.

#### Adaptable

An adaptable house is designed to be adapted economically at a later date to accommodate someone with a disability. Features include removable cupboards in a kitchen or bathroom to create knee space for a wheelchair user, or a knock-out floor panel in a closet to allow installation of an elevator. This approach is also known as **FlexHousing™**.

#### Accessible

An accessible house includes features that meet the needs of a person with a disability. Most accessible houses feature open turning spaces within rooms, wheel-in shower stalls and kitchen work surfaces with knee space below.

#### Universal

Universal house design recognizes that everyone who uses a house is different and comes with different abilities

An overview of the key concepts of universal design is provided in “The Principles of Universal Design” text box on page 17.

**Bolded** terms throughout this fact sheet are defined in the “Glossary” text box on page 16.

that change over time. Features include lever door handles that everyone can use, enhanced lighting levels to make it as easy as possible to see, stairways that feature handrails that are easy to grasp, and easy-to-use appliances.

### ASSESSING YOUR NEEDS

First, think of why you are interested in making your house more accessible and what is required to successfully complete your accessible housing design project.

### Planning for Emergencies

The design of an accessible home, whether it is a renovation or a new construction, should take into account the need to evacuate in an emergency. At least one accessible exit should be available from each floor level. An accessible exit on the ground floor level would likely be an exterior door; on an upper or a lower level, an **area of refuge** such as a balcony or exterior patio should be considered.

(See the *About Your House* fact sheet *Accessible Housing by Design—Fire Safety for You and Your Home*.)

A good starting point is listing what works well for you and your family in your existing home and what does not. Although targeted more specifically at the needs of seniors, the checklist provided in CMHC's *Maintaining Seniors' Independence Through Home Adaptations: A Self-Assessment Guide* can help all family members identify problem areas. On the basis of your list, decide what are the key elements of your accessibility improvement

project. Working from big issues down to smaller details will help you, and the designer or contractor you are working with, to clearly understand the design requirements of your project.

For example, using the kitchen sink might be identified as a problem. The reasons could be many—no knee space below the sink for someone in a wheelchair, faucet too far away from the front of the sink for a short person or a person in a wheelchair to reach, a faucet that is difficult to grasp and turn, a sink too deep to reach the bottom, or not enough space in front of the sink to “park” a wheelchair. The more specific you can be about why the sink is not usable, the easier it will be to design a solution.

Once you have developed a comprehensive list of your needs, it is time to assess how to best meet those needs. Are there technologies available to address the problems? Is there a need for personal assistance or attendant care? Would the problems be alleviated by re-designing your house?

A homeowner can tackle a simple design project, such

as re-grading a front yard to provide level entry into the house or relocating a vanity to create more space in a bathroom. More complex projects will likely require the services of a design professional, such as an architect, interior designer or architectural technologist.

### WHAT ARE THE OPTIONS?

When extensive accessibility improvements are required, the question often arises whether it is better to renovate or build a new, custom-designed home. Unfortunately, there is no simple answer.

Many factors can determine the feasibility of either strategy. They include the location of structural walls within an existing house, the available space on a lot for constructing an addition, how often existing spaces in the house are used, and the availability of a serviced lot to build a new home.

The feasibility and effectiveness of renovation versus new construction is one area where you should call on a qualified design professional to investigate and determine costs.

## Pre-designed accessible housing

There are few sources of pre-designed accessible housing available in Canada today.

However, some builders are starting to realize that there is a potential market for accessible housing that incorporates some universal features, such as larger bathrooms, and can accommodate “add-on” accessibility features, such as residential elevators and extra-wide garages. Other evolving trends in new house design include housing that is “visitable” and housing that supports “**aging in place.**”

Your local and provincial homebuilders’ associations should be able to direct you to local builders who offer universal design housing choices.

In many provinces, public housing corporations typically provide a percentage of accessible housing units in their developments. Similarly, non-profit housing associations and housing co-operatives often include accessible units. Check with your municipality for public, non-profit and co-operative housing projects.

## Altering a builder’s plan

Another strategy for achieving appropriate accessible housing is to find a builder who offers house styles that can be adapted to include accessibility features before construction.

Changes, such as wider doors, lever door hardware instead of knobs and re-grading to avoid steps at the front door, are often easy and inexpensive. Some builders allow purchasers to customize the interior layout of their base models. Widening hallways, enlarging foyers, reorganizing bathroom layouts, and so on, can improve accessibility.

## Custom-designed accessible housing

If you are considering a custom-designed accessible home, you should use a design professional who is knowledgeable and experienced in the design of accessible homes. It is also a good idea to involve an occupational therapist in the design process to help you determine your current functional needs and provide guidance on future requirements.

Finding a designer who is experienced in accessibility issues can often be a challenge. Possible sources of information include local architect and interior design associations, disability support organizations such as the March of Dimes and the Easter Seals Society, and magazines such as *Abilities* (see “Additional Resources” on page 15). Be sure to do your research, interview a short list of potential designers and ask for—and check—references.

### Case Studies

Case studies of accessible house designs are provided on the following pages. Each case study provides details on the type of house, the profile of its residents and the design features which make the house “visitable,” “adaptable,” “accessible” or “universal.” In each scenario, design features are a direct reflection on the present and future accessible design needs of the residents.

## THE VISITABLE HOUSE

### House profile

This two-storey house with a basement features open living spaces on the main floor, as well as a den and a bathroom. Stair access is provided to the upper level, which incorporates

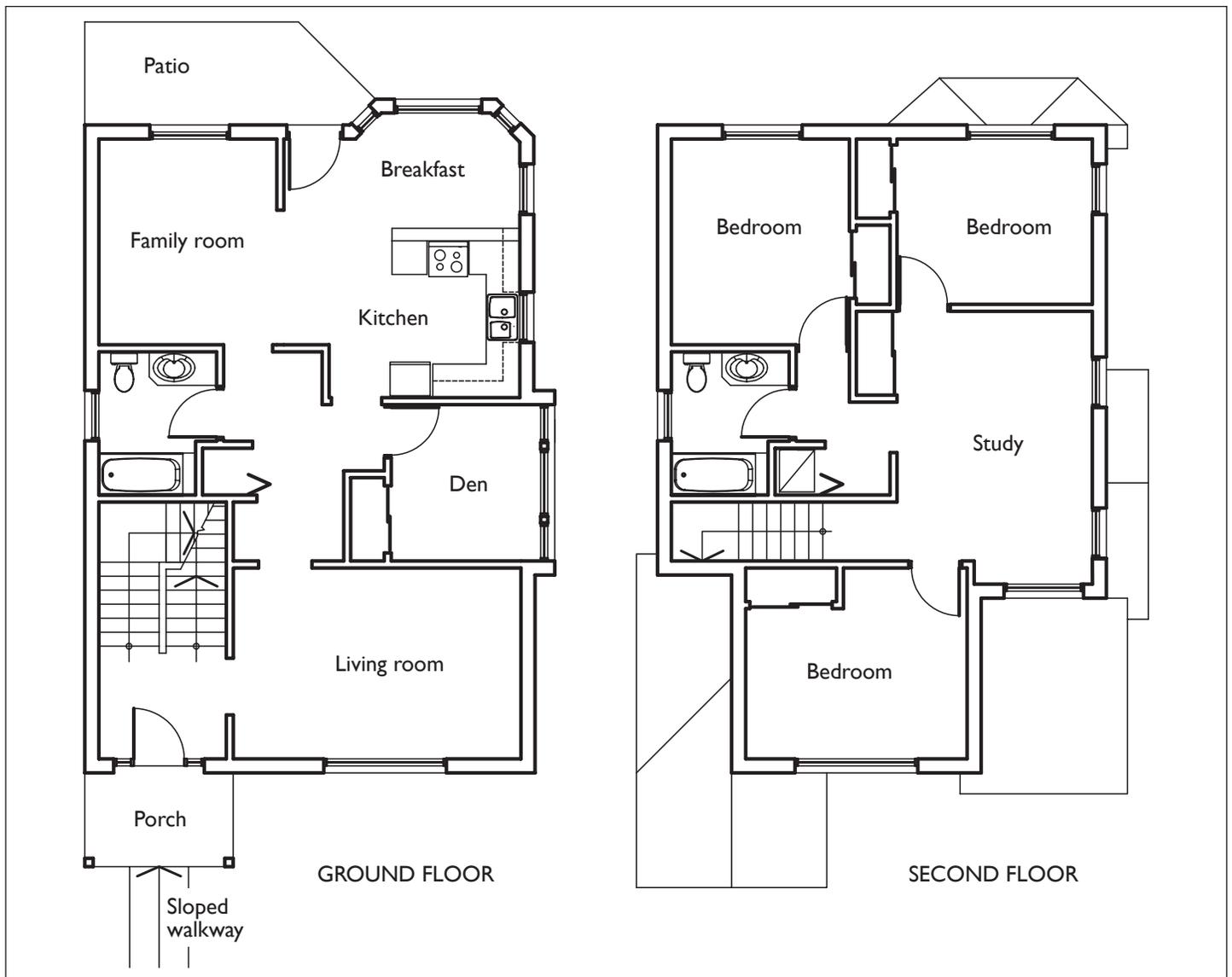
three bedrooms, a bathroom and an open study-work area (see Figure 1).

### Resident profile

The residents are Mr. and Mrs. Singh and their two teenage sons. The family entertains a lot and frequently has visits from the Singh grandparents.

### Features

The main floor of the house is designed to be visitable by everyone in the family, including the aging grandparents. Specific features include:



Drawing by: DesignAble Environments Inc.

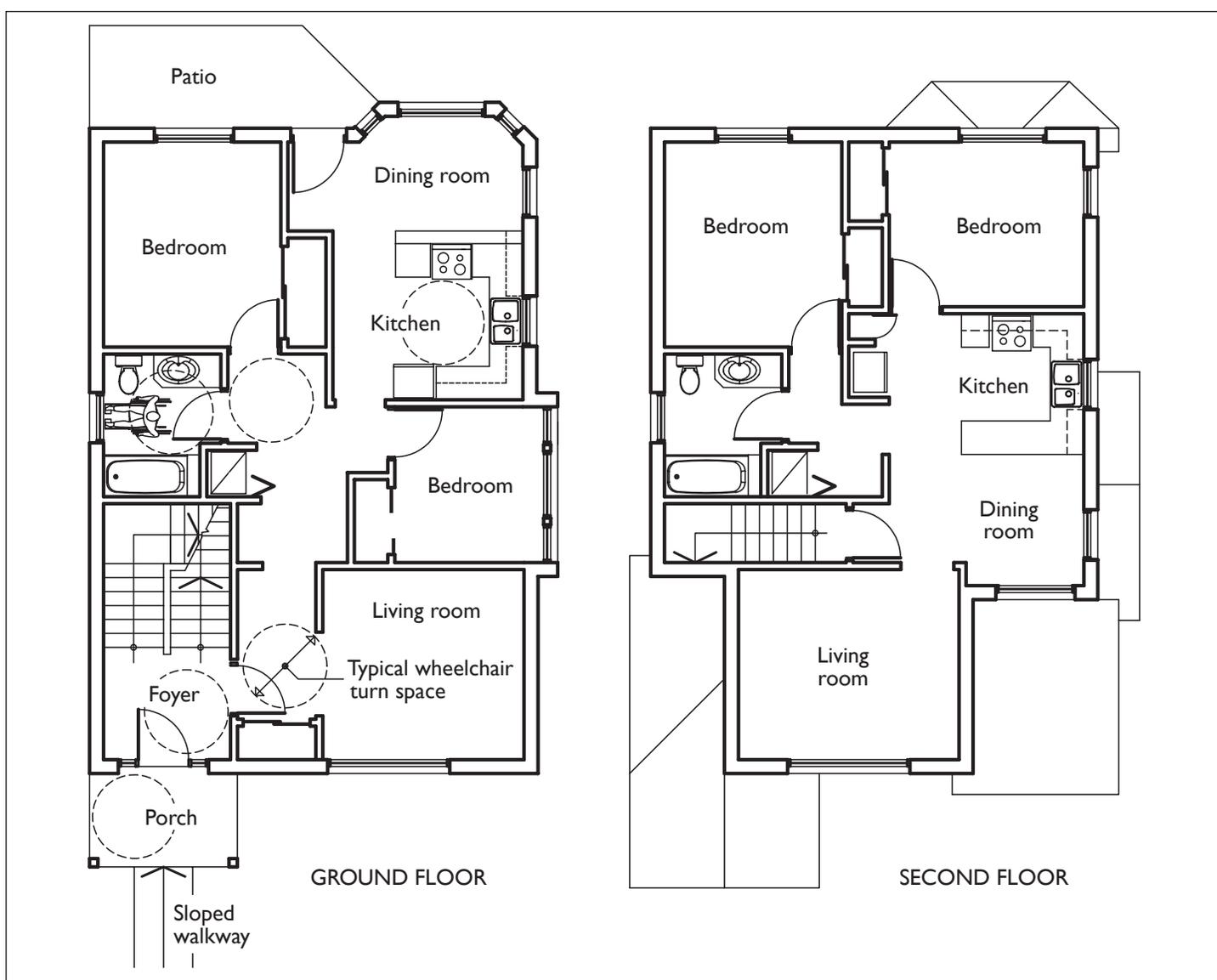
Figure 1 Example of a visitable house

- Level entry at the main entrance;
- Doors and other openings throughout the main floor that provide at least 810 mm (32 in.) of clear width;
- Wider hallways throughout the main floor to reach all of the living spaces, as well as the main floor bathroom;
- A main floor bathroom that is large enough to accommodate a person using a device such as a walker, a wheelchair or a scooter.

## THE ADAPTABLE HOUSE

### House profile

This is the same house from the previous case study, except that the design allows further modifications to be made to meet the occupant's changing needs (see Figure 2).



Drawing by: DesignAble Environments Inc.

Figure 2 Example of an adaptable house

Adaptable housing incorporates CMHC's **FlexHousing™** guidelines, which allow homeowners to reconfigure the interior space of their homes more economically.

The original house was designed to be easily and inexpensively subdivided into two units. A two-unit configuration may make the home more affordable, by allowing the homeowners to supplement their income by renting out part of the home. Alternatively, it could allow people who require a significant amount of personal care assistance to remain in their home by providing caregivers with rental accommodation in exchange for personal care assistance.

A separate living unit has been created on each floor by the addition of entrance doors, minor changes to the partition layout and the addition of kitchen facilities on the upper level.

Note: Remember to check local zoning bylaws before subdividing a single-family residence. For more information, see CMHC's fact sheet *About Your House: Secondary Suites*.

### Resident profile

The same family as in the visitable house case study, but later in life. The two sons now live in different cities. Mrs. Singh is widowed and is having some difficulty walking—she now uses a walker but may eventually need to use a wheelchair.

### Features

The main floor unit is occupied by Mrs. Singh. The upper unit is rented out to supplement her pension income. The tenants, Mr. and Mrs. Wong, have a baby. Mrs. Wong is a stay-at-home mom and supplements the family income by providing housekeeping and care assistance to Mrs. Singh. Adaptable house features include:

- Level entry at the main entrance;
- A secondary two-bedroom unit on the upper level;
- Secure entrances for both living units;
- An accessible two-bedroom main floor unit, featuring:
  - accessible floor finishes;
  - wider hallways;

- doors with lever hardware that provide at least 810 mm (32 in.) of clear space when open;
- a wheelchair-accessible kitchen;
- a wheelchair-accessible bathroom;
- an emergency exit to an exterior **area of refuge** (e.g. rear patio);
- lower switches and controls throughout.

## THE ACCESSIBLE HOUSE: RENOVATION

### Existing house profile

A two-storey, three-bedroom house with an attached two-car garage (see Figure 3). The house features a large covered porch at the front, and a sunroom and deck at the rear. Main floor includes open plan living spaces, as well as a small bedroom, bathroom and laundry room.

### Resident profile

The house is owned by Simon Jones and his partner Colin Chow, a couple in their late 60s. Simon was recently injured in an accident and now uses a powered wheelchair.

Since his accident, Simon has been restricted to the main floor of his home. The bedroom, bathroom and hallways are small and inaccessible, and there is no space for the exercise equipment that Simon requires for rehabilitation. Simon also requires personal care assistance 24 hours a day.

## Features

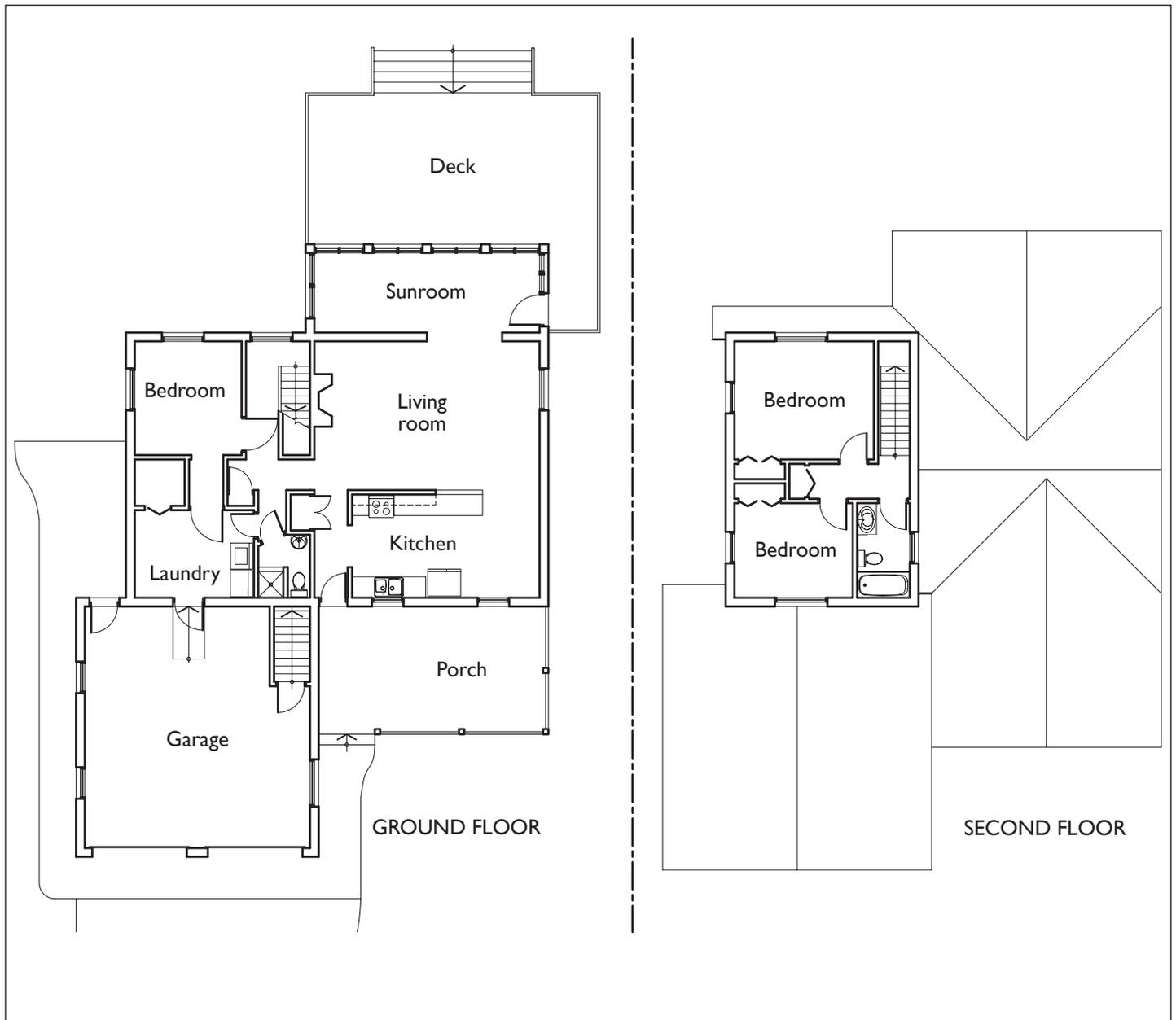
The renovation reorganized the main floor spaces to make them wheelchair accessible and installed a residential elevator for access from the garage floor level to the main and second floors. An exterior balcony was added to the second floor as an **area of refuge** which can be used in case of fire (see Figure 4).

### Assessing Your Needs

The assessment of client needs, a critical part of the design process, showed that Mr. Jones required an 1,800 mm (71 in.) diameter turning space for his wheelchair—which is larger than the typical wheelchair turning space specified by most accessibility codes and standards. If you use assistive equipment such as a walker, a wheelchair or a scooter, be sure to measure the space you need, and design accordingly.

Other significant changes included creating an accessible front entrance, altering the interior to make the main floor hallway more accessible, incorporating wheelchair-accessible bathroom and kitchen facilities, creating a large accessible master suite on the second floor, and providing a separate space for a personal care attendant. Specific features include:

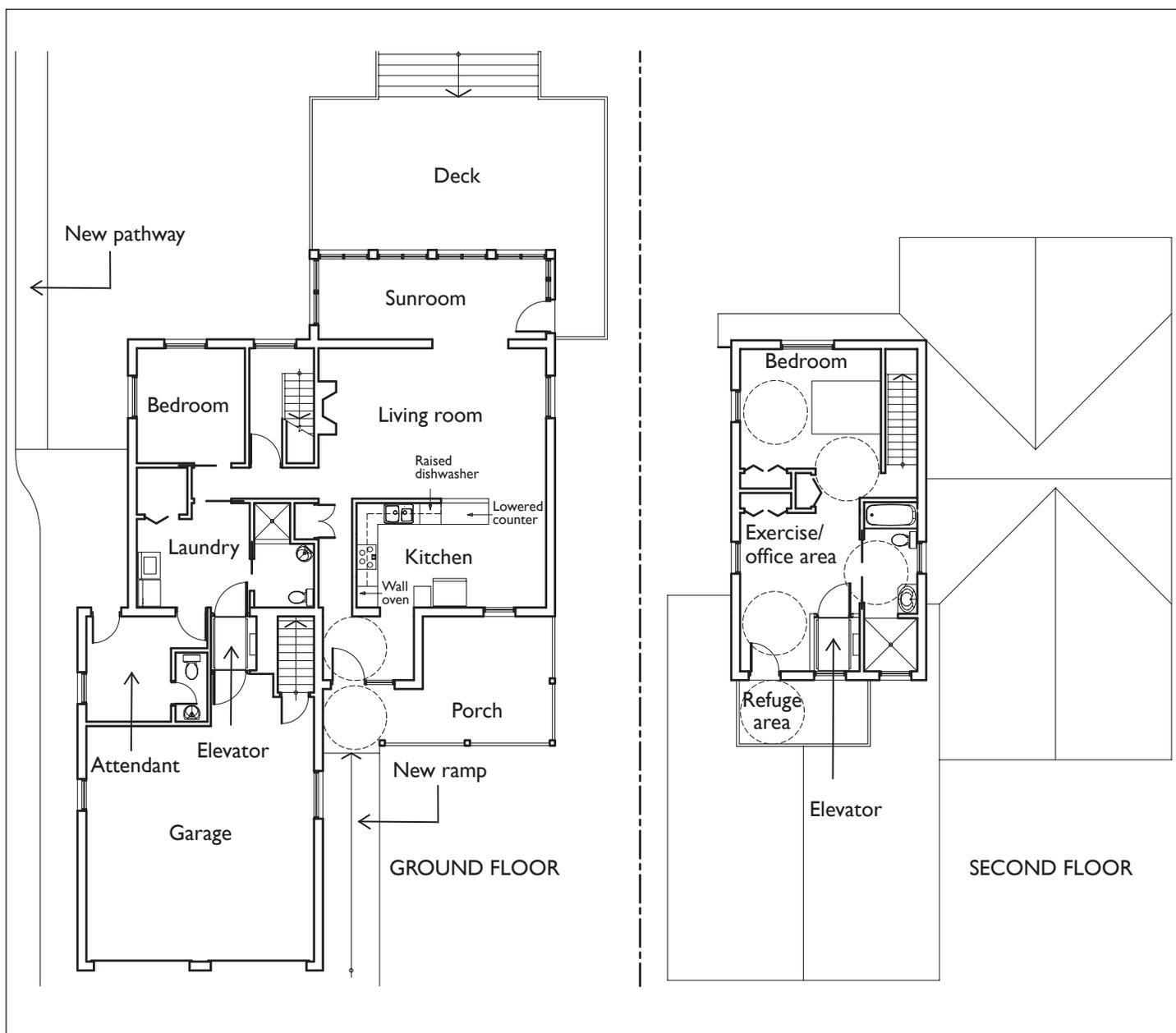
- Level entry at front door;
- 1,800 mm (71 in.) diameter wheelchair turning spaces at critical locations throughout the house;
- An accessible kitchen with:
  - lowered counters;
  - raised dishwasher;
  - countertop-mounted cooktop with knee space;
  - wall-mounted oven with side-hinged door and insulated pull-out shelf below;
  - shallow sink with knee space below, accessible faucet and insulated hot-water pipes and drain line;
  - side-by-side refrigerator–freezer;
- Doors featuring 860 mm (34 in.) clear space when open, as well as lever-type hardware;
- An accessible main-floor laundry room with raised washer and dryer with front-mounted controls;
- An accessible powder room on the main floor;
- A three-stop residential elevator;
- Ceramic tile and hardwood floor finishes;
- A caregiver’s room with separate entrance and two-piece bathroom;
- A secondary exit from ground floor to deck at the rear of the house;
- An exit on second floor to an exterior area of refuge;
- A wired-in, interlinked smoke detector system;
- A carbon monoxide alarm system;
- Switches and controls mounted 400–1,200 mm (16–47 in.) above the floor, that are easy to operate using one hand;



Drawing by: DesignAble Environments Inc.

Figure 3 House design before renovation

- An accessible second-floor suite incorporating sleeping, exercise and work areas;
- An accessible second-floor bathroom with:
  - raised toilet fixture;
  - curbless shower area with accessible controls and shower head on a flexible hose;



Drawing by: DesignAble Environments Inc.

Figure 4 Accessible house design after renovation

- vanity with knee space and accessible faucet;
- bathtub with accessible faucets;
- grab bars for toilet, tub and shower stall.

## THE ACCESSIBLE HOUSE: NEW CONSTRUCTION

### House profile

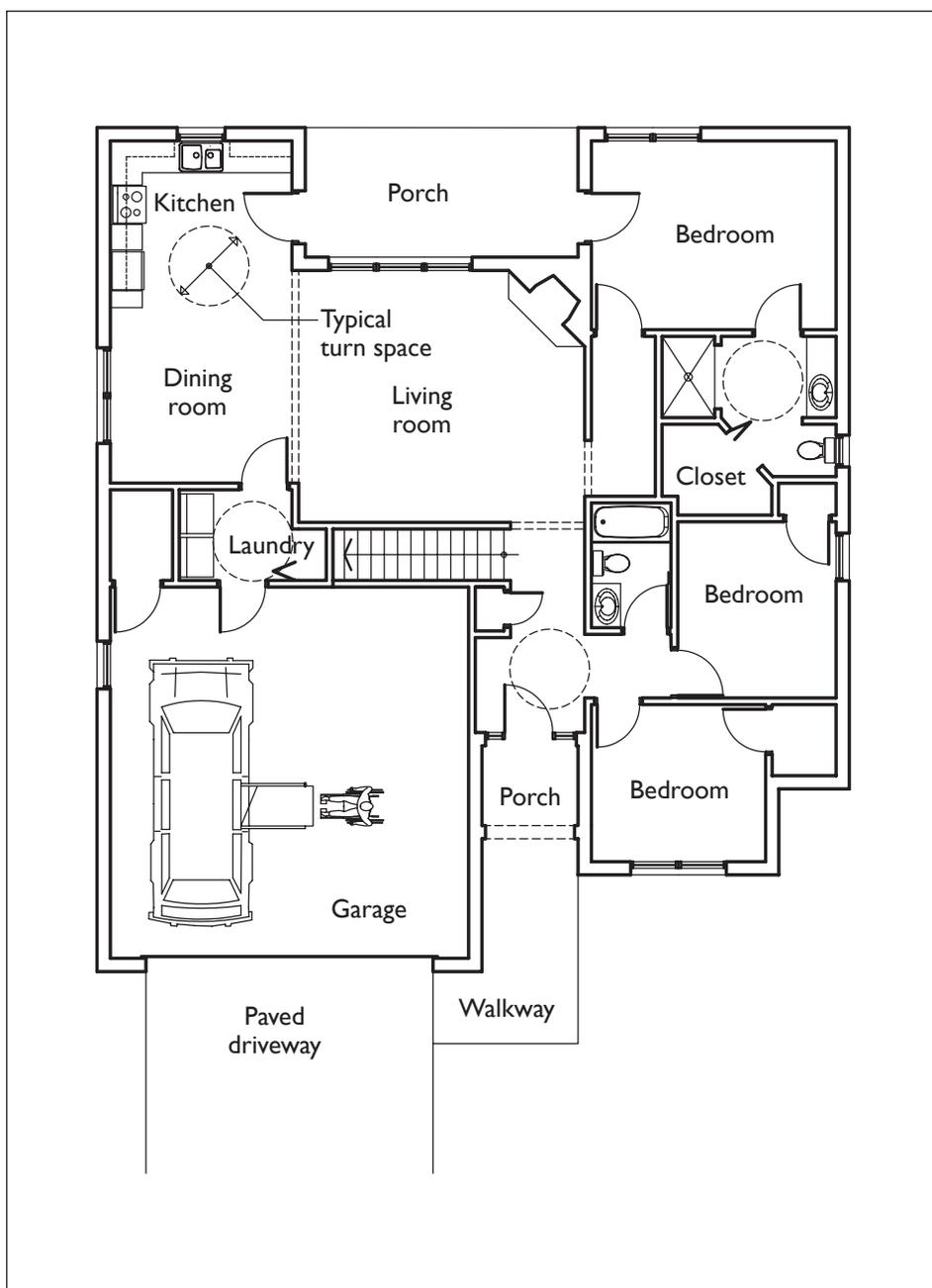
A newly constructed, three-bedroom bungalow with basement and attached, two-car garage (see Figure 5). The open plan main floor includes three bedrooms, two bathrooms and a laundry room.

### Resident profile

Jenny Giocametti is a successful lawyer in her early 30s who lives in her own home. She rents one of the bedrooms to a tenant. Jenny can stand and walk short distances but generally uses a scooter for mobility. She drives a converted mini-van, which is equipped with a side-lift for her scooter. Jenny has contracted with a builder to construct her house from the floor plan of an accessible home she found on the Internet.

### Features

Jenny worked with the builder to customize the design to meet her specific needs. The customized features include:



*Drawing by: DesignAble Environments Inc.*

**Figure 5** Example of an accessible house

- A kitchen that incorporates work surfaces for both standing and seated use—Jenny prefers to stand for kitchen activities but can become fatigued at times, requiring the use of her scooter;

- A kitchen that maximizes storage options within Jenny's reach. Storage cupboards feature pull-out shelves to make it easier to reach items;
- Lower windows to provide unobstructed viewing from a seated position;
- Raised, front-loading laundry appliances;
- To reduce fatigue and conserve energy, Jenny installed a central environmental control system that allows her to control her environment from a central panel located in the living room. She can control lights, wall outlets and the thermostat, as well as the TV and the entertainment system. The system also incorporates a video connection to the main entrance, to allow Jenny to remotely answer and unlock the door (see *Accessible Housing by Design—Home Automation*);
- The stairway to the basement is configured as a straight run, with lots of headroom and space at the bottom of the stair for future installation of an inclined-platform stair lift.

## THE UNIVERSAL GARDEN SUITE

### House profile

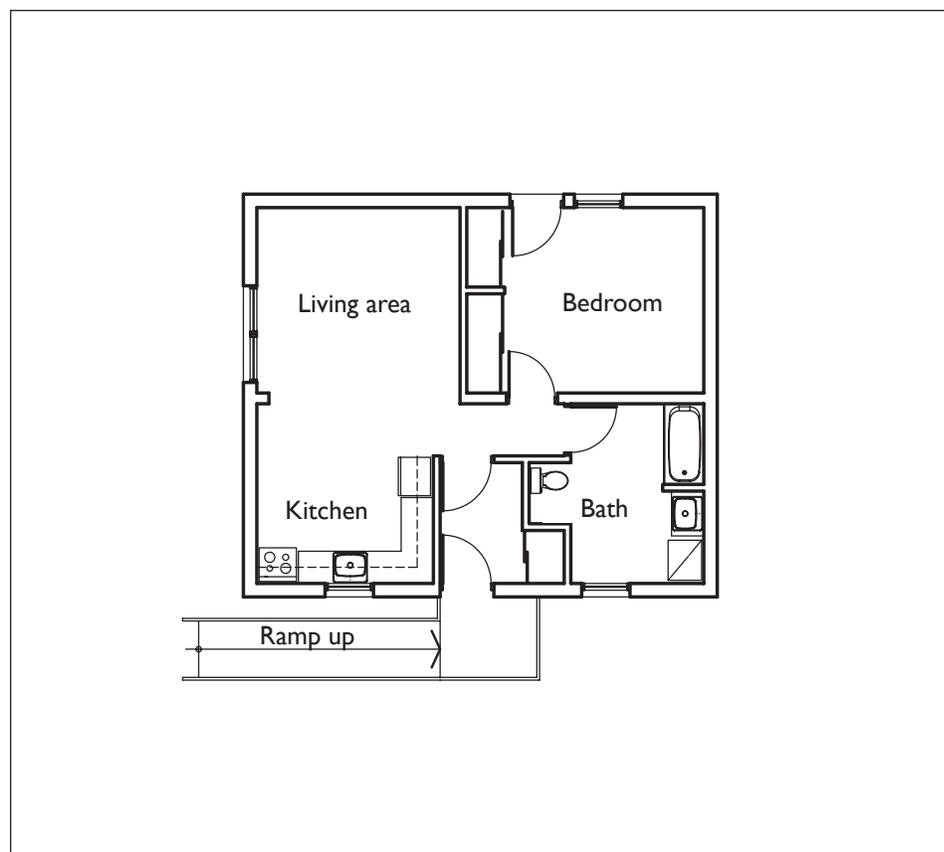
A modest, single-storey secondary unit, built as a separate house on a lot with an existing house. (See CMHC's fact sheet *About Your House: Garden Suites*.)

The suite features an entrance foyer, open living area, bedroom and bathroom with

integrated laundry facilities (see Figure 6).

### Resident profile

Mrs. Rafsanjani, a woman in her 70s, lives in the universal garden suite, which is located at the rear of her son's home. She is dealing with the effects of macular degeneration, resulting in poor vision. Otherwise, Mrs. Rafsanjani's abilities are excellent.



Drawing by: DesignAble Environments Inc.

Figure 6 Example of a universal garden suite

### Features

The unit incorporates numerous features to assist Mrs. Rafsanjani to make the most effective use of her limited vision, including:

- Significant use of contrasting surfaces and finishes to make them easier to see. Specifically:
  - contrasting coloured baseboards and door trim are used to better define room perimeter and door location;
  - a light-coloured countertop with a dark-coloured front edge and backsplash is used in the kitchen—the light colour helps define the location of objects on the countertop, and the colour-contrasting front edge and backsplash help define the extent of the surface;
  - colour-contrasting hardware on doors and cabinets;
  - wall switches and outlets are a different colour from the wall finish;
  - different flooring materials define the boundaries of the various

functional zones within the open plan living area—seating area (low pile carpet), kitchen/eating area (ceramic tile) and circulation/hall area (hardwood);

- Finishes and window coverings minimize direct sunlight and reflective glare. Matte surfaces are used throughout and adjustable blinds are used on all windows;
- Enhanced levels of lighting. Lighting can be increased in key areas, such as kitchen work surfaces and reading areas;
- Appliances feature large, colour-contrasting controls and displays. Some of the controls provide sound cues to the user;
- Lots of electrical outlets minimize the need for extension cords and the potential tripping hazard caused by appliance cords.

The design of the universal garden suite also features a no-step entry, wider doors, easy-to-use switches and controls, and sufficient space to accommodate a walker or a wheelchair in the future.

## THE UNIVERSAL HOUSE

### House profile

The universal house is a large, two-storey, four-bedroom house with a full basement and an attached two-car garage (see Figure 7). Main floor accommodation includes open plan living space, an office, a bathroom and a large master bedroom suite. The second floor incorporates three bedrooms, one with an ensuite bathroom, as well as a large hall and a family bathroom.

### Resident profile

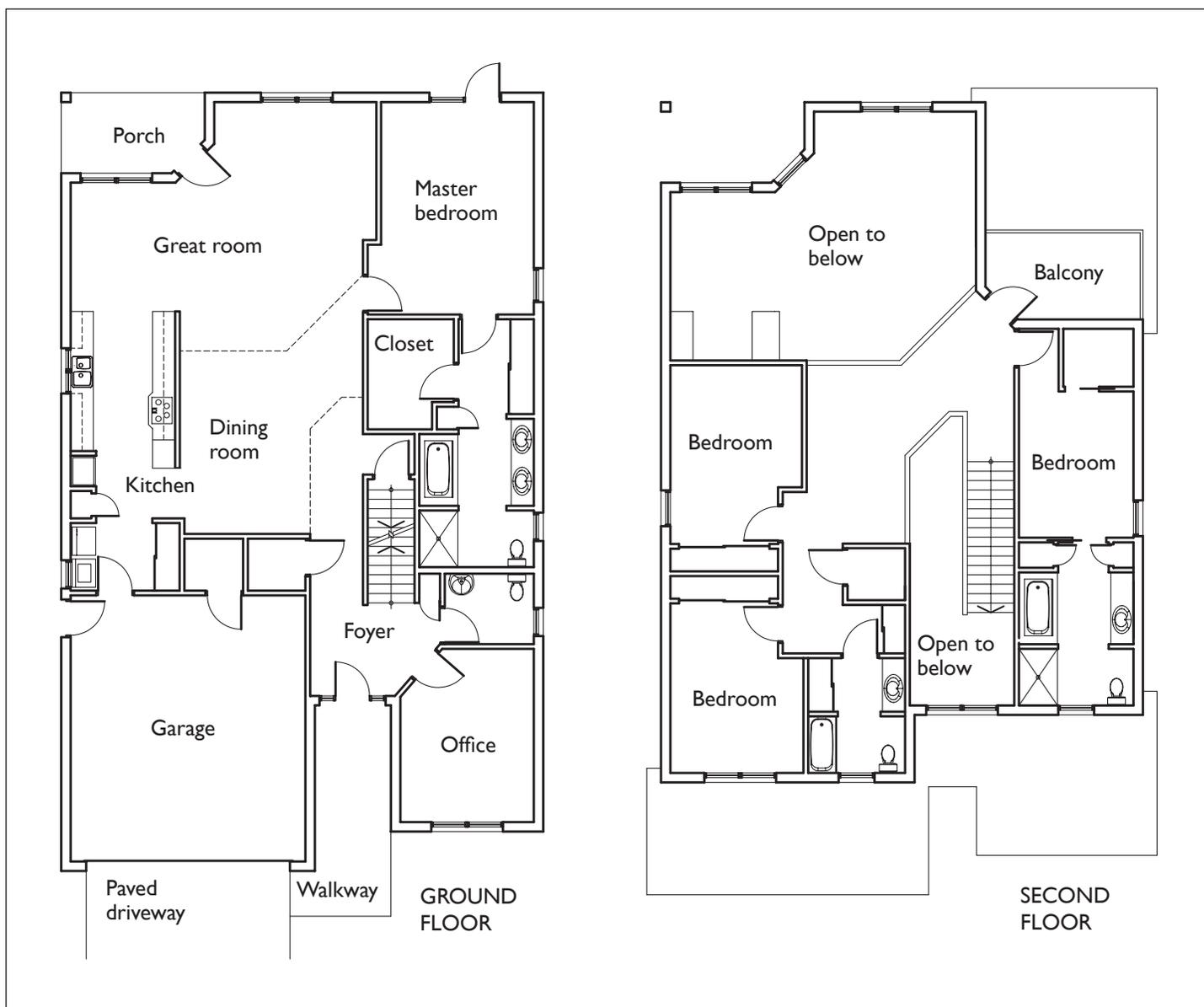
A busy family of seven lives here: Mr. and Mrs. Lambie and their five children, aged 4 to 17. One of the children, Sarah, is hard of hearing.

### Features

The house features many basic elements that contribute to universal accessibility and are of benefit to everyone. Examples include:

- Entrances that are free of steps and stairs—providing greater safety;
- Floor finishes that are level, smooth, slip-resistant and glare-free—providing enhanced safety and comfort;

- Doorways that provide at least 860 mm (34 in.) clear space when open—wide enough to negotiate while carrying grocery bags or a child;
- Lever-type door hardware that is easy to open with minimal strength using one hand or an elbow—which is good for small children, or when carrying objects;
- Windows that feature easy-to-operate opening and locking systems, as well as shades or blinds to adjust interior lighting;



Drawing by: DesignAble Environments Inc.

Figure 7 Example of a universal house

- Enhanced levels of lighting throughout—easy to adjust to suit all needs and preferences;
  - Additional lighting where it is most needed—under upper cupboards in the kitchen, illuminating the work surfaces;
  - Kitchen cupboards and work surfaces with contrasting colours, making doors, door handles, counters, and so on, easier to see and use;
  - Kitchen cabinets that incorporate lots of drawers and pull-out shelves. This brings items closer to the user, eliminating the need to reach to the back of cupboards;
  - Stairs that feature steps that are deeper and shorter, as well as safety-designed nosings (the front part of a step that hangs over the step below). Stair nosings should be shaped to guide the foot over the front of the step;
  - Stairways that feature continuous handrails on both sides that are easy to grasp for small and large hands;
  - Appliances that feature large, easy-to-read controls that are comfortable to reach;
  - Faucets and other controls that can be operated with minimal strength—such as hands-free faucets and motion-sensing light switches.
- The house also incorporates features that can benefit people with limited mobility, including:
- Stacked storage closets on each of the floor levels, with knock-out floor panels that will accommodate a residential elevator with minimal cost and disruption;
  - Walls in bathrooms are reinforced to accommodate grab bars if they are needed in the future;
  - Bathrooms that feature enough space to accommodate a walker or a wheelchair;
  - Bathrooms that incorporate larger, spa-type, curbless shower stalls, capable of accommodating a seat or stool and featuring easy-to-use controls;
  - Appliances with front-mounted controls which are easy to reach and operate.
- The house has a number of features that will particularly benefit Sarah Lambie (who is hard of hearing):
- A smoke alarm system that provides audible alarm sounds as well as visual signals (flashing strobe lights);
  - An intercom, a door bell and a telephone system that feature visual signals as well as sounds;
  - Enhanced levels of evenly distributed, glare-free lighting, to facilitate lip-reading and the use of sign language;
  - Quiet mechanical systems and appliances that reduce background noise and provide the best environment for people with limited hearing ability.

## ADDITIONAL RESOURCES

### Books

Covington, G. A. and Hannah, B. (1996). *Access by Design*. New York: Van Nostrand Reinhold.

Leibrock, C. and Terry, J. E. (1999). *Beautiful Universal Design: A Visual Guide*. New York: John Wiley & Sons.

Young, L. C. and Pace, R. J. (2000). *Accessible Multifamily Housing*. Raleigh, NC: The Center for Universal Design. Retrieved October 13, 2010, from [http://www.ncsu.edu/www/ncsu/design/sod5/cud/pubs\\_p/docs/accessible\\_multifamilyhousing.pdf](http://www.ncsu.edu/www/ncsu/design/sod5/cud/pubs_p/docs/accessible_multifamilyhousing.pdf)

### Websites

**AARP—Livable Communities** (June 2010)  
<http://www.aarp.org/home-garden/livable-communities/>

**ABLEDATA—Informed Consumer's Guide to Accessible Housing** (June 2010)  
[http://www.abledata.com/abledata\\_docs/icg-hous.htm](http://www.abledata.com/abledata_docs/icg-hous.htm)

**Australian Network for Universal Housing Design** (June 2010)  
[www.anuhd.org](http://www.anuhd.org)

**Canadian Abilities Foundation** (June 2010)  
[www.abilities.ca](http://www.abilities.ca)

**Canadian Centre on Disability Studies—Welcome to Visitability Canada** (June 2010)  
[www.visitablehousingcanada.com](http://www.visitablehousingcanada.com)

**The Center for Universal Design** (June 2010)  
<http://www.design.ncsu.edu/cud/index.htm>

**Concrete Change** (June 2010)  
[www.concretechange.org](http://www.concretechange.org)

**Disability Services Commission—Access and Universal Design** (June 2010)  
<http://www.disability.wa.gov.au/aud.html>

**The District of Saanich—Adaptable Housing** (June 2010)  
<http://www.saanich.ca/business/adaptable/adaptable.html>

**Manitoba Family Services and Housing—Visitable Housing Design** (June 2010)  
[http://www.gov.mb.ca/housing/visitable\\_housing.html](http://www.gov.mb.ca/housing/visitable_housing.html)

### 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.

**Area of refuge:** A fire rated area where a person, unable to evacuate independently, can safely wait for assistance. Some building codes require an area of refuge served by an exit or firefighters' elevator. Balconies are sometimes considered acceptable areas of refuge.

**FlexHousing™:** A practical approach to designing and building housing that allows residents to convert space to meet their changing needs. For more information, visit CMHC's website at [www.cmhc.ca](http://www.cmhc.ca) and enter "FlexHousing" in the search field.

## The Principles of Universal Design

Universal design is defined as:

“The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.”

The concept is an evolving design philosophy.

### ***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 all 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.

## About Your House

Accessible Housing by Design—House Designs and Floor Plans

**To find more *About Your House* fact sheets plus a wide variety of information products, visit our website at [www.cmhc.ca](http://www.cmhc.ca). You can also reach us by telephone at 1-800-668-2642 or by fax at 1-800-245-9274.**

### Priced Publications

<i>FlexHousing™: Homes that Adapt to Life's Changes</i>	Order No. 60945
<i>FlexHousing™: The Professional's Guide</i>	Order No. 61844
<i>Healthy Housing™ Renovation Planner</i>	Order No. 60957

### Free Publications

<i>Design Options for Barrier-Free and Adaptable Housing</i>	Order No. 63909
<i>Maintaining Seniors' Independence Through Home Adaptations: A Self-Assessment Guide</i>	Order No. 61087

### **About Your House** fact sheets

"Accessible Housing by Design" series

<i>Appliances</i>	Order No. 65080
<i>Bathrooms</i>	Order No. 65686
<i>Fire Safety for You and Your Home</i>	Order No. 66091
<i>Home Automation</i>	Order No. 65889
<i>Kitchens</i>	Order No. 65588
<i>Lifts and Residential Elevators</i>	Order No. 65542
<i>Living Spaces</i>	Order No. 66095
<i>Ramps</i>	Order No. 65023
<i>Residential Hoists and Ceiling Lifts</i>	Order No. 65544
<i>Garden Suites</i>	Order No. 65009
<i>Hiring a Contractor</i>	Order No. 62277
<i>Preventing Falls on Stairs</i>	Order No. 63637
<i>Secondary Suites</i>	Order No. 66497
<b>Research Highlight</b> fact sheets	
<i>Evaluation of Optimal Bath Grab Bar Placement for Seniors</i>	Order No. 63245
<i>Measuring the Effort Needed to Climb Access Ramps in a Manual Wheelchair</i>	Order No. 63916

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