

## **THE ACCESSIBLE HOME**

### **An introduction to accessible design of single family residences**

by David Esau, AIA, LEED AP; principal of Michigan Accessible Homes & Cornerstone Design Inc.

"A man's home is his castle." This old saying expresses a sentiment we each (men *and* women) feel about our home: it should be a place of refuge, where we leave behind the cares of everyday life. Unfortunately, the ordinary house can be a great source of frustration for the elderly and especially for people with disabilities.

This issue will become increasingly important as the population ages; more and more people will be looking for homes that they can be confident will work for them for many years, regardless of changes in their physical condition. This has been the driving force behind the movement known as "universal design," which is pushing inclusion in all homes of the types of features discussed in this pamphlet.

This pamphlet is designed to help homeowners, renters, and builders make their homes more accessible. It touches on the main aspects of accessibility; for more information, check with your library, obtain one of the books in the Resource List at the end of this pamphlet, or contact Michigan Accessible Homes.

**Note:** This pamphlet is intended to provide helpful information for work on single family residences, which are currently not covered by barrier-free design codes in Michigan. Our recommendations can generally be modified as needed to meet your budget and personal situation (depending upon the design of your house, a ramp may need to comply with building code requirements; ask your code official).

Businesses, designers, developers, or contractors interested in finding out more about their legal obligations to provide barrier-free commercial and multifamily residential buildings should contact their local code official or Cornerstone Design Inc (734.663.7580; [www.cdiarchitects.com](http://www.cdiarchitects.com)).

## HOW TO USE THIS INFORMATION

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Most work to improve accessibility will require a building permit. Before you get too far into the planning process, check with the local building code enforcement official to determine what drawings will be required, what the permit will cost, and what local requirements might affect you.

Work on the exterior of the building, such as ramps, should also be discussed with planning or zoning officials to be sure you don't cross setback lines or violate other requirements (in some communities, including Ann Arbor, ramps are allowed to cross setback lines).

Generally, work on a residence does not require an architect or engineer to prepare and seal drawings. You or your contractor can prepare drawings and specifications to use in bidding and to submit for permits. You may, however, want to use an architect to gain additional expertise in accessibility or to help you carefully define the project so you get better bids from contractors. Look for an architect, like Michigan Accessible Homes, with previous experience in barrier free residences; that should help insure that they know *why* certain features are recommended, and how the recommendations can be adjusted to your needs without sacrificing accessibility.

## HOW TO SELECT A CONTRACTOR

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- Try to define the project before soliciting bids, so everybody is bidding on the same thing. If you can't, insist that all bidders carefully itemize what they are providing including brand names and model numbers. Before selecting a contractor, examine the bids to be sure they include everything you expect.
- Obtain at least three bids, preferably from contractors referred by friends or others with experience. Ask for and check references.
- Be sure the bidders are licensed contractors in Michigan, and have liability and Workers' Compensation insurance coverage.
- Get a written contract spelling out what will be provided, by when, for what amount, and when payments are due. Try to give no more than a minimal (ten percent or so) deposit up front.
- Insist that the contractor obtain all required permits, and follow the requirements of Michigan's Lien Law. The permit fees pay for inspectors to visit the site to be sure that the work meets at least the minimum standards contained in the building code. The permit fee should be included in the bid.
- Changes in materials, schedule, or prices during construction should be agreed on in writing.

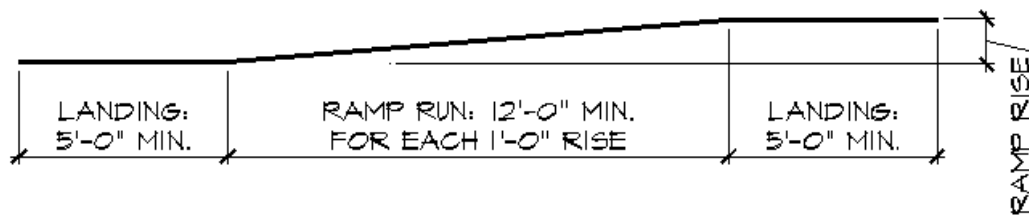
- The contract should stipulate that five to ten percent of the price is held out until work is complete, a certificate of occupancy or final inspection is obtained from the code official, and you have received warranties and product literature on any equipment installed.
- Be sure to communicate regularly with the contractor during construction to avoid surprises.

## **ACCESS TO THE INSIDE (RAMPS)**

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The main floor of a house is generally at least 6" above the surrounding ground, and often much more--especially if the house has a basement. Because steps are an imposing barrier to many people, some other way of getting up to the main level is required. Generally the answer will be a ramp. The following points should be considered:

- In general, wood ramps will be cheaper and easier for a do-it-yourselfer to construct. Concrete ramps will be longer lasting, require less maintenance, and the non-slip surface is more permanent.
- If ramps are made of wood, the wood should be pressure treated to retard deterioration. Connections should be made with hot-dipped galvanized screws and bolts, not nails. Avoid plywood for the surface of the ramp; although it's cheaper and easier to install, it will deteriorate quicker and is usually quite slippery. A better surface is to use 2x boards, spaced about 1/4" apart for drainage. Note that pressure treated wood still requires maintenance. Ask your lumber suppliers about what they recommend.
- Ramps should not be steeper than 12 feet of horizontal run for 1 foot of rise (1:12). Even this will be difficult for many people to use. 15 feet of run (or more) is recommended for every 1 foot of rise (1:15).



- If your actual rise is more or less than 1 foot, multiply the actual rise by the desired slope. For instance, a 2 foot rise with a 1:15 slope would require  $2 \times 15 = 30$

feet of run. A 6" rise (1/2 foot) with a 1:12 slope would require  $1/2 \times 12 = 6$  feet of run.

- If the slope of the ramp is shallow--1 foot of vertical "rise" (or less) for each 20 feet of horizontal "run," then no additional provisions (such as handrails) are usually necessary. In such cases, the best method is probably a slightly sloping sidewalk. A light broom finish, applied perpendicular to the direction of travel, will improve traction.
- Ramps should be at least 36" wide (clear between handrails). Level landings, at least 60" long, should be provided at the top and bottom, and 60" x 60" landings should be provided whenever the ramp changes direction. Intermediate landings, at least 60" long, should be provided for every ramp with 30" of rise or more.
- Handrails are recommended on both sides of any ramp with a rise greater than 6". The top of the handrail should be 34"-38" above the ramp. Handrails should be 1-1/2" from walls or posts (to allow fingers to wrap around the rail), and should have a gripping surface with a diameter of 1-1/4" to 1-1/2".
- Ramps should have some sort of non-slip surface. For **concrete** ramps, provide a broomed finish before the concrete is set: use an old broom to sweep across the width of the ramp, heavy enough to provide a slight texture. For **wood** ramps, sprinkle sand on the ramp prior to sealing or painting, or apply roofing paper or abrasive strips to the ramp surface. Additives to add texture to paints to make them less slippery are also available from paint stores.
- Provide a curb, wall, or vertical rail along both sides of the ramp. This will prevent wheels from rolling over the edge.
- Contact MISS DIG (1-800-482-7171) prior to excavating foundations for ramp supports. MISS DIG is sponsored by local utility companies; they will come to your home and locate any existing utility lines so you don't accidentally hit one when digging foundations.
- While ramps are required for some people, others find stairs easier to use. If at all possible, it is preferable to have both.
- Even the best-designed ramp requires maintenance. Be sure to keep the ramp clear of snow and ice, and reapply the surface texture as needed to keep the ramp from being too slippery.

- Ramps take up large amounts of space. Tight situations or very high main floors may require consideration of a wheelchair lift. Contact Michigan Accessible Homes or your contractor for additional information.
- While the main ramp is usually at the front door or at a rear deck, many people install a second ramp from their accessible bedroom for quicker exit in case of fire or other emergency.

## **FLOOR SURFACES**

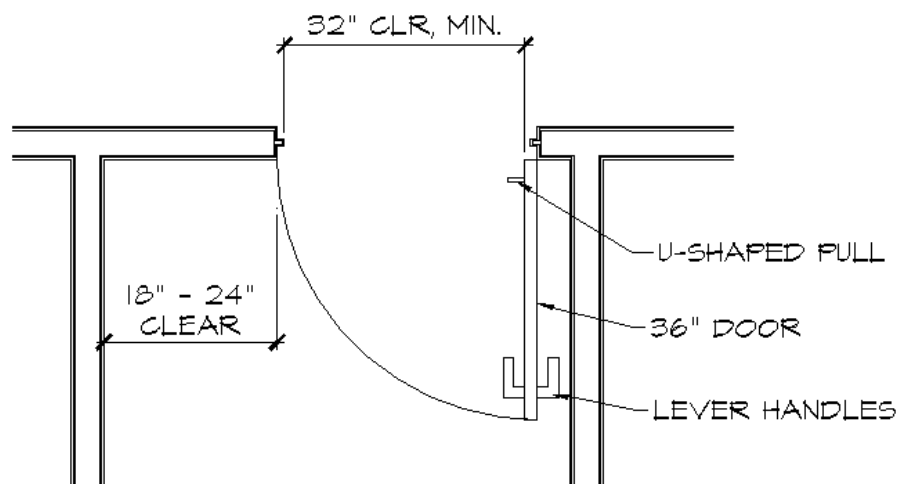
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- Avoid changes in level. At changes in material, try to keep differences in height to less than 1/4". Where that is not possible, provide beveled transition strips.
- Carpet should be low-pile (1/2" maximum thickness) with a firm pad or no pad. Commercial-type level loop glue-down carpet is ideal. Provide edge trim at all exposed edges.

## **DOORS & WINDOWS**

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- Doors should all be 36" wide. This allows a clear width, when the door is open, of at least 32" for the passage of a person in a wheelchair. Door handles should be levers instead of knobs.
- On the pull side of the door, allow space (18"-24") next to the lever so a person in a wheelchair can approach the door without blocking the door swing.



- An additional U-shaped door pull next to the hinges will make it easier for wheelchair users to pull doors shut behind them. For a lower-cost alternative, tie a string to the door handle.
- Exterior doors should have barrier-free type thresholds: beveled, and no more than 1/2" high (3/4" high at exterior sliding doors).
- Crank-type casement or awning windows are easier to operate than traditional double-hung windows. Look for windows that tilt in to allow cleaning of the exterior face from the inside.

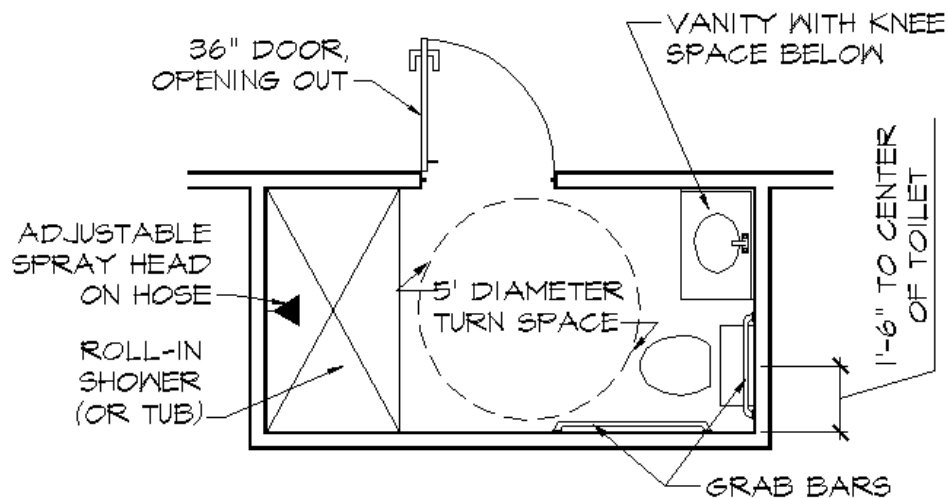
## **BATHROOMS**

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- The inside of the bathroom should have a clear area of at least 48" x 48" (60" x 60" is preferred). The door, if it swings into the bathroom, should not cross the clear area. It's better if the bathroom door swings out; if someone falls inside the bathroom (a common place for accidents, due to water and slippery surfaces), a rescuer won't have to push him or her out of the way with the door in order to get inside to provide assistance.
- The floor area in front of and below the sink should be clear of obstructions. Any existing cabinets below the sink should be removed, with brackets added to support the countertop (provide about 29" clear below the lip of the vanity for knee space). The clear area should be at least 30" wide. This allows a wheelchair user to roll up to the lavatory and to be able to reach the handles and faucet.
- Faucet handles should be lever-type--preferably a single lever. The faucet should be one that mixes hot and cold water together, instead of having two separate faucets.
- **VERY IMPORTANT:** Water heaters should be set at a maximum of 120 degrees F, and exposed drain pipes and hot water lines should be insulated or covered by trim panels. This will help avoid scalding. Many people who use wheelchairs have little or no feeling in their legs, and could be severely burned without realizing it is happening.
- Bathtub and shower guidelines are extremely complex, and highly dependent on personal preferences. Fortunately, many prefabricated units are available, simplifying the choices greatly. Important considerations include:
  - 1) Whether you prefer a shower or bathtub;
  - 2) Adequate quantity and location of grab bars;
  - 3) A comfortable seat;

- 4) Whether you prefer to roll a wheelchair all the way into the shower, or to transfer from the chair to the seat.
- Roll-in showers, whether a prefab unit or a tile shower, need to be recessed into the floor to avoid having a lip or ramp at the entry. Careful planning is important, because you can't just cut into the floor structure to create the recess; you may need to redo part of the structure in an existing building, or frame the shower area separately in a new building.
  - The toilet should be in a corner to allow for installation of grab bars, and should be placed 18" to 21" away from the side wall (measured to the centerline of the toilet).
  - The top of the toilet seat should be 17" to 19" above the floor. This is 1"-5" higher than standard toilets. American Standard, Kohler, and other manufacturers make toilets that meet this requirement. Special seats are available to modify an existing toilet at a lower cost. Elongated bowls are preferred to round ones.

The sketch below shows a very basic bathroom layout. Additional space is always welcomed, especially for storage at the vanity, and for additional maneuvering space between the toilet and the vanity to allow a side transfer. Locate the shower head where it will work best for you.



- Grab bars are very useful for some people with disabilities, but others consider them stigmatizing. If you do not need grab bars now, consider installing blocking for them in the walls at likely locations (such as around toilets, baths, and showers). Blocking can take two forms:
  - 1) 2x scrap lumber can be installed between studs. This option is cheaper, but harder to locate when drywall is installed.

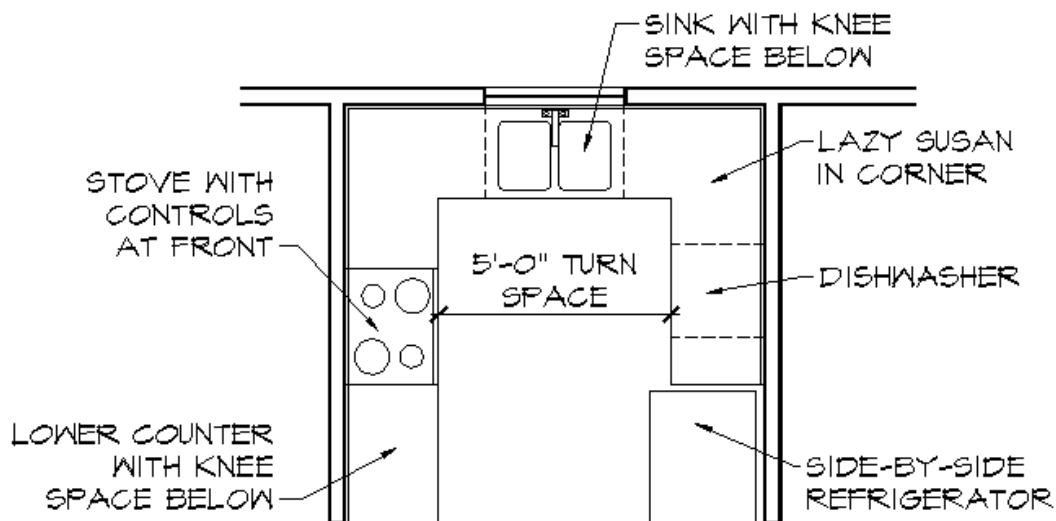
- 2) 3/4" plywood can be installed over the studs before installation of drywall. This option allows considerable flexibility in locating grab bars later on. If plywood is used, install a full sheet to get an installation sturdy enough to support the grab bars.

There are some new grab bar attachments that claim to provide adequate strength into drywall without blocking, and may be worth trying if you don't have to open up the wall otherwise.

## **KITCHENS AND UTILITY AREAS**

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- Knee spaces should be provided into areas below work counters, cooktops, and sinks. Provide at least one lower work counter (with the top at 30" to 34" above the floor; check what works best for you and your wheelchair). Extra space should be allotted for the kitchen, so storage is not lost because of knee spaces, shorter cabinets, and so on.
- If you don't have the option of designing an accessible kitchen from scratch, you will need to consider removing cabinets and/or adding counters to provide accessible work areas, sinks, and storage.
- Upper cabinets can be installed with their bottom shelves 48" above the floor, instead of the standard 51" to 54".



- Cabinets should be arranged around a 60" x 60" clear floor area, to allow a person in a wheelchair to turn around.



- Pull-out shelves in base cabinets make items in the backs of cabinets much easier to reach. This is becoming a standard feature in many cabinets.
- U-shaped pulls on doors and drawers are easier to use than round pulls. Be sure the pulls selected project out from the door or drawer front enough (3/4" to 1") to allow fingers to reach behind them. On upper cabinets, place the pulls close to the bottom of the doors.
- At least one bowl of the sink should be no deeper than 6-1/2" (to allow for knee space below). Drains should be toward the backs of the bowls, instead of centered, to allow for deeper knee spaces under the sink. Faucets should be single-lever type. A spray with a flexible hose is also recommended.
- **VERY IMPORTANT:** Provide trim panels to hide under-sink plumbing, or limit hot water temperatures to 120 degrees F. and insulate exposed hot water and drain pipes.
- Garbage disposals will block the knee space under the sink. If a garbage disposal is desired, the knee space should extend on the other side of the sink to be at least 30" wide. Also, be sure the disposal switch is in an accessible location.
- Side-by-side refrigerators are preferred, so both freezer and refrigerator are within reach of persons in a wheelchair. An alternative is to find a refrigerator with a pull-out freezer on the bottom.
- Stove controls should be on the side or front, to avoid having to reach across the burners. Electrical heat is generally preferred to gas (to avoid open flames).
- When possible, cooktops should have knee spaces underneath (at least 30" wide) to allow a person in a wheelchair to roll up to the range and reach the back burners. If this is done, however, the bottom of the cooktop should be insulated or otherwise protected to prevent burns or electrical shock. If a knee space is not available under the cooktop (for instance, if a standard range is used instead of a separate cooktop and oven), put a counter with a knee space adjacent to the cooktop.
- A mirror over the cook-top (treated to avoid fogging up) will allow cooks in wheelchairs to see the progress of the food.
- Be sure outlets for small appliances are within reach of work areas.

## **Kitchens and utility areas, cont.**

- In dishwashers, all rack space should be accessible from the front. Consider raising the dishwasher on a 6" platform so loading and unloading the bottom rack can be done with less stooping or bending.
- Front loading clothes washers and dryers are preferred. Controls should be front-mounted, and doors should swing to the side, to allow for a closer approach to the machines.

## **CLOSETS**

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- Walk-in or roll-in closets should have a 36" door, preferably swinging out into the room or hall. The inside of the closet should have a clear floor space of at least 30" x 48"; 60" x 60" is preferred to allow space to turn around.
- Other closets should have doors that expose as much as possible of the storage space, avoiding unreachable corners. Bifold doors will allow a wider opening than sliding doors.
- At closet doors, provide levers (if the door latches) or U-shaped handles instead of knobs or round pulls.
- The closet rod or top shelf should be a maximum of 54" above the floor (48" is preferred). You'll probably also want a section with a higher rod, to accommodate long coats or dresses.

## **ELECTRICAL/TELEPHONE**

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- Switches should be centered 36" to 48" above the floor (42" is a good compromise location). Avoid locations requiring a person to reach across counters or furniture to operate switches.
- Locate electrical outlets, phone outlets, and so on no less than 18" above the floor.
- Locate telephone and electrical outlets liberally, to avoid the need to move furniture or to move quickly from room to room to answer the phone.
- Consider installing intercoms and/or emergency call systems.

- If you have a hearing impairment, there are a number of products you may wish to incorporate for your own safety and convenience, such as flashing visual alarms (to supplement smoke detectors). Although most products can be added after construction, you may want to plan ahead by providing additional phone or electrical outlets where you want the products located. For a catalog of products designed for people with hearing impairments, contact HARC Mercantile at [www.harcmercantile.com](http://www.harcmercantile.com).

## **GARAGE**

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- Most garages are lower than the main floor. This used to be required by building codes; it helps keep dangerous fumes from entering the house, and helps keep water out of the house. For new construction, omit the step down into the garage and simply slope the garage floor away from the house door (to a floor drain or the garage door) to handle drainage. If you already have a step down, install a ramp or lift.
- Include an automatic garage-door opener, with controls mounted no higher than 48" above the floor.
- Garage doors should be at least 8'0" high (compared to the usual 7'0") if the use of a lift-equipped van is anticipated. Some vans can even need a 9' high door in order to provide adequate clearance.
- If your site is sloped, place your garage next to the house, so the car does the climbing instead of you.

## **HALLWAYS AND MISCELLANEOUS ITEMS**

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- Hallways should be at least 36" wide; 42" to 48" will make it much easier to turn into doorways. Cased openings (doorways, without doors in them) should be no less than 32" wide, and no more than 24" deep.
- If possible, provide a 60" diameter or 60" x 60" turning space at the end of the hall. This will prevent a wheelchair user having to back out of the hall if, for instance, the bathroom is occupied.
- If you have or prefer a two-story home, consider installing a residential elevator. A 3' x 4' elevator can hold a person in a wheelchair, and an attendant, and requires little space and few special structural or electrical modifications. If you can't afford that now, but you're building a new home and may want an elevator in the future, construct stacking closets large enough for the elevator, provide

electrical service to the room, and frame the floor so it can easily be removed in the future.

## **ABOUT MICHIGAN ACCESSIBLE HOMES**

Michigan Accessible Homes is a division of Cornerstone Design Inc, and focuses on design of accessible, barrier free and universally designed homes. Cornerstone Design Inc is a 20-year old architectural firm located in Ann Arbor, MI. Most of CDI's work is commercial, but principal David Esau has extensive accessibility experience in residential as well (see below).

For additional information about how Michigan Accessible Homes might assist you with your project, contact us at:

- 734.663.7580 (Voice)
- 734.663.1180 (Fax)
- Email: [desau@mi-accessible-homes.com](mailto:desau@mi-accessible-homes.com)
- Website: [www.mi-accessible-homes.com](http://www.mi-accessible-homes.com)

## **ABOUT THE AUTHOR**

David Esau, AIA, LEED AP is an architect with extensive experience in accessibility issues for both commercial and residential structures. David has worked as an accessibility consultant with the Ann Arbor Center for Independent Living since the ADA took effect. David also consults with other AACIL staff about accessibility issues for people with disabilities. David is a principal in Cornerstone Design, an Ann Arbor, MI architecture firm, and founder of the firm's Michigan Accessible Homes division, providing universal design of residential and commercial structures.

# RESOURCE LIST

## For people interested in constructing accessible homes

### DESIGN BOOKS

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**Note:** These are books we consider to have useful information about accessible design, instead of just pretty pictures. Note that most books on accessibility cover pretty much the same ground; there is little advantage to obtaining more than one or two.

*Accessible Housing Design File*, by Barrier Free Environments, Inc. from Barrier Free Environments, 1-919-782-7823. Published by Van Nostrand Reinhold, NY, copyright 1991. ISBN # 0-442-00775-2. A good, easily understandable, and comprehensive look at what is required to make an accessible home, and why each feature is needed, by the original accessibility specialists. Strongly recommended.

*The Complete Guide to Barrier-Free Housing*, by Gary D. Branson. Published by Betterway Publications, Inc., White Hall, VA, copyright 1991. ISBN #1-55870-188-5. Includes several sample floor plans for accessible homes.

*Building for a Lifetime; the Design and Construction of Fully Accessible Homes*, by Margaret Wylde, Adrian Baron-Robbins and Sam Clark. Published by Tauron Books and Videos, Newtown, CT, copyright 1994. ISBN # 1-56158-036-8.

*Healthy House Building*, by John Bower. Published by The Healthy House Institute, Unionville, IN, copyright 1993. An excellent, comprehensive review of design techniques to minimize indoor air pollution for people with chemical sensitivities.