Aging in Place: Design Guidelines for New Construction in Residential Design

by

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Abstract

This study examined the seven principles of universal design (equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use) represented in existing literature. Three main areas of private homes were examined as well: overall travel and hallways, bedrooms, and bathrooms. The study was qualitative and used a content analysis approach. Several current resources were examined including: codes, model codes and standards writing organizations and other sources. Credible experts in the field were interviewed as well. The study analyzed the current information provided and identified gaps in the research to see what new guidelines were needed. A comparative chart was developed to show the comparisons in the data found. The study found that the universal design principles were significant and there is a need for implementing guidelines for residential aging in place.

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This entire process would not have been possible without the guidance, help, and support of those around me.

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Chapter 1

Introduction

Interior design is of major importance; it impacts, influences and affects our world and lives in many different aspects. According to NCIDQ (2012a), interior design is "the art and science of understanding people's behavior to create functional spaces within a building" (para. 2). Interior designers apply both creative and technical solutions in order to create functional, attractive, and beneficial spaces and environments for the occupants' quality of life (NCIDQ, 2012a; Martin & Guerin, 2010). The built environment affects our daily lives; therefore, it is important that interior designers exercise their responsibility to design spaces that protect the occupant's health, safety, and welfare (Martin & Guerin, 2010). According to Martin and Guerin (2005), "interior designers are knowledgeable in human behavior and human factors, and have the expertise to combine users' needs with design theory to create space that meets project requirements" (p. xiii).

One of the main responsibilities of interior designers is protecting the health, safety, and welfare of the public. Martin and Guerin (2010) define each of these words in relation to interior design specifically, (See Figure 1).

Figure 1. Definitions of Health, Safety, and Welfare in Relation to Interior Designers.

Health	• Interior designers create interior environments that support people's soundness of body and mind; protect their physical, mental and social well-being; and prevent disease, injury, illness, or pain that could be caused by occupancy of interior environments
Safety	• Interior designers create interior environments that protect people against actual or perceived danger; protect against risk from crime, accidents, or physical hazards; and prevent injury, loss or death that could be caused by occupancy of interior environments
Welfare	• Interior designers create interior environments that support people's physical, psychological, social, and spiritual well-being; and assist with or contribute to their financial or economic management and responsibility

Martin & Guerin (2010, p. E25 - E28).

These major responsibilities of interior designers are especially important when designing spaces.

Universal design and aging in place are important to interior designers. The main goal for interior designers is to create spaces, lend knowledge, and take responsibility for critical features that protect the health, safety, and welfare of the public (NCIDQ, 2012c). Universal design is a design concept that deals with designing products and environments that can be usable by as many people of all ages and abilities as possible (Nussbaumer, 2012). Aging in place is defined when individuals continue to live in their private home through all stages of life, maintaining their independence for as long as possible (AARP, 2009; Lawlor & Thomas, 2008). With the aging population on the rise in the United States, universal design and aging in place are crucial. According to the Administration on Aging (2012), "the aging population (65 and over) increased from 35 million in 2000 to 41.4 million in 2011", and is "projected to increase to 79.7 million in 2040" (p. 1). The state of Florida alone has the largest aging population (3.4 million as of 2011), "comprising 23.6 percent of the state's population" (Scott, 2012, p. 9).

The biggest challenge facing the design community is the lack of resources to incorporate universal design and aging in place in private residences. There are resources that provide recommendations for aging in place, but no specific guidelines with the focus of the design of private residences. Therefore, in this study, the researcher will pair the few existing guidelines from codes and model codes with design recommendations from credible resources such as professional organizations, peer review literature, and textbooks to create a summary of existing guidelines and recommendations. Gaps will be noted and new knowledge will be added through the creation of proposed new guidelines that will be organized into reference sheets. These

reference sheets will provide interior designers, builders, and the client with the information needed to design homes that fit the specific needs of clients planning to age in place.

Purpose

The purpose of this study is to examine the seven principles of universal design (equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use) represented in existing literature. This study will look at the current information provided and look at the gaps in the research to see what new guidelines are needed. A comparative chart will be developed to show relationships in the data found. By doing this research, new guidelines and reference sheets will be developed for professionals designing for the growing market of residential aging in place.

Justification

There is a lack of resources in existing literature to provide concrete and measurable guidelines to incorporate universal design and aging in place in private residences. With the lack of codes, guidelines, and standards, the researcher suggests the need for specific guidelines to design for those planning to age in place. Therefore, by developing new reference sheets with guidelines catered to specific needs, interior designers, builders, and clients will be able to access the guidelines that best fit the design needs of the client. The state of Florida will be the main focus of the study because of its large aging population.

Limitations

This study exhibits several limitations in relation to sampling and methodology. The first limitation is the sample size and limiting the study to only the state of Florida. A larger number of credible experts and other states ultimately need to be taken into consideration. Only one state was chosen for the study, therefore, limiting its generalizability to other states. However, this

study can be a starting point for creating guidelines for other states as well. The use of a convenience sample is a limitation in itself because of lack of ability to generalize the results for the entire population. This results in a low external validity and sampling bias. Using content analysis can result in limitations as well (Leedy & Ormrod, 2010). For example: content analysis describes what is there, but does not answer 'why', therefore, it is a purely descriptive method and causal relationships cannot be proven. Also, the analysis is limited by the availability of materials and it is a time-consuming method of research. However, it is a beginning effort to fill a void in available resources for the design of private residences for aging in place.

Research Questions

The study's main goal is to develop reference sheets with new guidelines for residential aging in place for clients in Florida. There will be three steps in order to reach this goal. The three steps are as follows:

1) Information- gathering through a codes search as well as input from credible experts.
2) Analyze and summarize the existing information.
3) Fill in gaps with new information and create reference sheets.

These steps will be explained in more detail in the methods section.

Definition of Terms

The following definitions provided are ones that may be unfamiliar to the reader or that may have varied definitions within literature.

> **Aging in Place –** "a concept in which individuals continue to live in their long-term homes and communities where they feel safe and comfortable and are able to maintain their independence for as long as possible, regardless of age, income level, or physical ability" (AARP, 2009, p. 1).

Americans with Disabilities Act (ADA) – "a comprehensive civil rights law that protects individuals with disabilities in the areas of employment (Title I), state and local government services and public transportation (Title II), public accommodations and commercial facilities (Title III), and telecommunication services (Title, IV)" (Harmon & Kennon, 2008, p. 28).

Building codes – "regulations that stress the construction of a building and the hazardous materials or equipment used inside" (Harmon & Kennon, 2008, p. 465).

Interior Design - "the art and science of understanding people's behavior to create functional spaces within a building" (NCIDQ, 2012b, para. 2).

Interior Designer – " designs interior spaces that embody their understanding and responsibility to protect the occupant's health, safety, and welfare" (Martin & Guerin, 2010, p. 16).

International Building Codes (IBC) – a model building code developed by the International Code Council, which provides minimum standards to insure the health, safety, and welfare of the public as they relate to the building construction (Harmon & Kennon, 2008).

Model building code – has no legal status until it is adopted or adapted by government regulation (Harmon & Kennon, 2008).

Standard – " a definition, a recommended practice, a test method, a classification, or a required specification that must be met" (Harmon & Kennon, 2008, p. 33).

Universal design – designing products and environments that can be usable by as many people of all ages and abilities as possible (Nussbaumer, 2012).

Chapter 2

Literature Review

Universal design and aging in place are important to interior designers. The main goal for interior designers is to create spaces, lend knowledge, and take responsibility for critical features that protect the health, safety, and welfare of the public (NCIDQ, 2012c). Residential design for aging in place informs design professionals about the aging process and the need to create homes that implement accessibility and adaptability no matter the age or abilities of the occupants (Lawlor & Thomas, 2008, p. xiv). Designing new homes from the ground up that apply aging in place principles is a necessity now more than ever, due to the rising aging population in the United States today. Therefore, it is crucial that interior designers are aware of this issue and strive to design homes that encourage a higher quality of living and life for those with the desire to continue to live in their private residences throughout all stages of life (Lawlor & Thomas, 2008, p. xiv).

Problem

There is a lack of resources to guide the incorporation of universal design and aging in place in private residences. This gives a challenge for providing the specific information and guidelines to new homebuilders and to those who already own a home and plan to stay there. The lack of resources is the main challenge, but there are several more specific sub-problems. There is a lack of codes currently available that are specific to private residences. The Americans with Disabilities Act (ADA) provides the guidelines some designers use as a default design standard, but the legislation does not create guidelines for private residences and may not be the best solution for particular clients or situations (Mitton, & Nystuen,, 2011).

Universal Design

Universal design plays a major role in providing the best design solutions for the widest variety of users and users' needs. The Center for Universal Design (1997) developed seven principles of universal design, which include equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (see Figure 2). Each of the principles serves a main purpose in universal design in order to benefit each user in the best possible way.

Figure 2. Principles of Universal Design

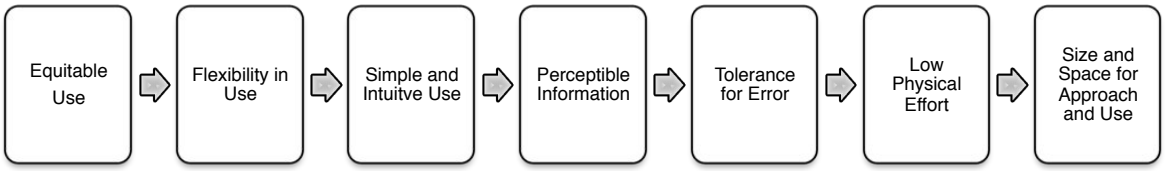


Image by author.

Equitable use focuses on designing for all users without leaving any one user out (Center for Universal Design, 1997). An example of this would be providing automatic doors with sensors at entrances so it is convenient for all users, as when you walk in Wal-Mart or Target.

Being able to adapt to right-handed versus left-handed users or other preferences and abilities of individuals describes what *flexibility in use* aims to do. Providing scissors that are designed for both right-handed and left-handed users is a good example of flexibility in use.

People have a wide range of skills, experience, and knowledge, so it is important to implement designs that are easy to understand and follow, which explains the third principle, *simple and intuitive use*. Those who have been in an airport and have seen the moving sidewalks have witnessed the application of simple and intuitive use.

Some users have different sensory abilities than others; therefore it is important to use multiple ways to communicate essential information. This describes the meaning of the *perceptible information* principle. In a train station one may see signage advising them to stay behind the yellow line when a train is approaching. One may also hear an announcement quite frequently and even notice the yellow line with bumps on it. All of these cues warning people to stay back are good implementations of perceptible information.

The fifth principle, *tolerance and error*, aims to minimize hazards and provide fail safe features (Center for Universal Design, 1997). A good example of tolerance and error that is used probably on a daily basis is the Command+Z shortcut or Undo command on a computer. It allows one to "undo" a mistake without being penalized.

Implementing designs that can be used the most efficiently and comfortably by users and with *minimal physical effort* is another principle of universal design. Touch lamps that operate without a switch exhibit low physical effort.

The last principle of universal design, *size and space for approach and use*, focuses on providing the appropriate size and space for users of all body sizes and mobility needs (Center for Universal Design, 1997). For example, providing wide gates at entrances of theme parks, sporting, or subway stations that accommodate all users.

Aging in Place

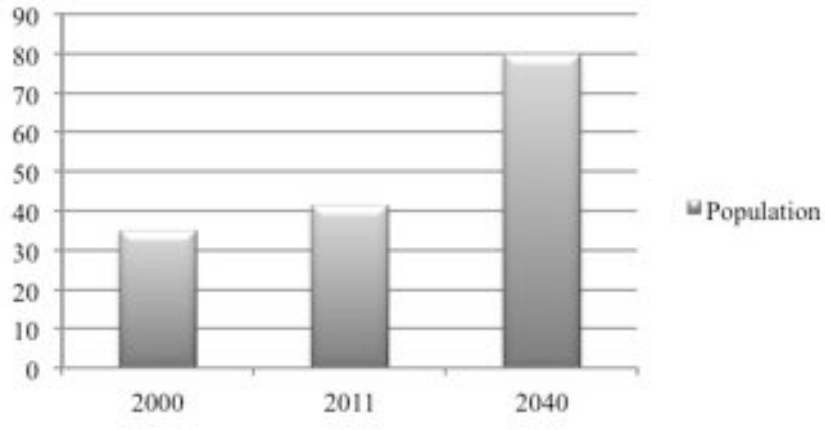
According to AARP (2009), aging in place is " a concept in which individuals continue to live in their long-term homes and communities where they feel safe and comfortable and are able to maintain their independence for as long as possible, regardless of age, income level, or physical ability" (p. 1). More specifically, residential design for aging in place is designing and creating homes that adapt to and meet the needs of those going through the aging process

(Lawlor & Thomas, 2008, p. xiv). Aging in place can positively impact the older population in the United States today. Many times change is difficult or stressful for older adults, therefore staying in the same residence throughout all stages of life can be important. It is important to implement designs for aging in place at the beginning stages of new construction because at some point we will all become part of the elder population or we could develop a disability at any age in life. The goal of aging in place is to design homes for users to maintain their independence throughout all stages of life (Lawlor & Thomas, 2008, p. 1-2).

For example, consider this aging in place scenario. Suzy has lived in the same house since she and her husband, Steve, married. She is now seventy-eight years old and has recently had to begin using a wheelchair and sometimes a walker. The problem she is facing is she cannot fit her wheelchair down hallways without bumping the wall and it will not go through the doorway of the bathroom. Her walker fits down the hallway, but she must turn sideways to get in the bathroom, which is not safe. Her husband is in pretty good health, but with the small clearances in the bathroom and hallway, there is not room for both of them so he cannot help her as readily as desired. The options Suzy and Steve have are to relocate or temporarily move out so renovations can be made to accommodate their current and future needs. They would like to stay in the same house, so they have decided to go to an assisted living area until the renovations are complete. A few months later they moved back in and can now live independently in their home. Suzy can get to and from the bathroom with no problems now and if she needs assistance there is now room for Steve to help as well. This short story shows the importance of designing or retrofitting a home for aging in place. Modifying homes to adapt to needs is usually more of a hassle. Therefore, it is preferable to design homes with aging in place in mind at the beginning stages of new construction (Bell, 2013; Brown, 2012; Blu Homes, n.d.; Wang, n.d.).

Focusing attention on universal design and aging in place is crucial because the aging population in the United States is on the rise. "The aging population (65 and over) increased from 35 million in 2000 to 41.4 million in 2011, which is an 18 percent increase. It is projected to increase to 79.7 million in 2040" (Administration on Aging, 2012, p. 1)(See Figure 3).

Figure 3. Aging Population Growth



Administration on Aging (2012)

The first quarter of the 21st century will see the aging-in-place phenomenon become more prevelant because that is when almost all communities would see increases in the large number of aging baby-boomers (American Society of Interior Designers, n.d.; Frey, 1999). The state of Florida has the largest aging population in the United States (3.4 million as of 2011) and "nearly one in four is above the age of 65" (Ball, n.d., p.30) (See Figure 4). Only three percent of elderly persons moved from 2011 to 2012, showing that most older people stay in the same residence (Administration on Aging, 2012). Over half (57%) of elders lived with their spouse in 2012, about 28 percent lived alone, and about 2 million lived with a grandchild present (Administration on Aging, 2012). According to Farber, Shrinkle, Lynott, Fox-Grage, & Harrell (2011), "nearly 90 percent of people over the age of 65 want to stay in their home for as long as possible, and 80

percent believe their current residence is where they will always live" (p.1). A main issue for the older population is that if they want to age in place, their homes must be accommodating.

Figure 4. Florida Aging Population

Ball (n.d., p.30)

More than 50,000 residents retire to Florida every year (Ball, n.d.). Florida strives to help the aging in many ways through numerous assistance programs set up through the state and federal government. These programs include food programs, services for those with memory disorders, home repair and modifications, home health aid, emergency alert response, and transportation to name a few (Beach, 2008). One major program Florida developed is the Elder Friendly Communities Program to raise awareness of the importance of considering the needs of older residents as part of the planning process (Ball, n.d.). An Elder Friendly Community creates an environment that evokes positive aging, encourages self care, and encourages elders to participate in a variety of activities, which all enhance an elder's independence (Ball, n.d.). This reflects the main goal of aging in place. Florida continues to make strides toward helping the senior citizens of their state, recognizing the important role seniors play in their economy, society, and demographic changes of the state. However, with Florida's rising aging population, there is still a need for guidelines specific to residential design to facilitate aging in place.

Groups such as AARP and MetLife provide many resources for the aging population. These groups are instrumental in providing necessary information and guidance to the elders, so for the aging population residential aging in place guidelines could benefit elders even more. AARP "is a collection of diverse individuals and ideas working as one to influence positive change and improve the lives of those 50 and over" (AARP, 2013, para. 1). AARP is united with one common motto: "To serve, not to be served." (AARP, 2013, para. 6). It is clear that AARP strives to help those with many different lifestyles, cultures, and backgrounds to experience the best quality of life possible. AARP already provides resources pertaining to aging in place recommendations, but still no specific guidelines with the focus of the design of private residences.

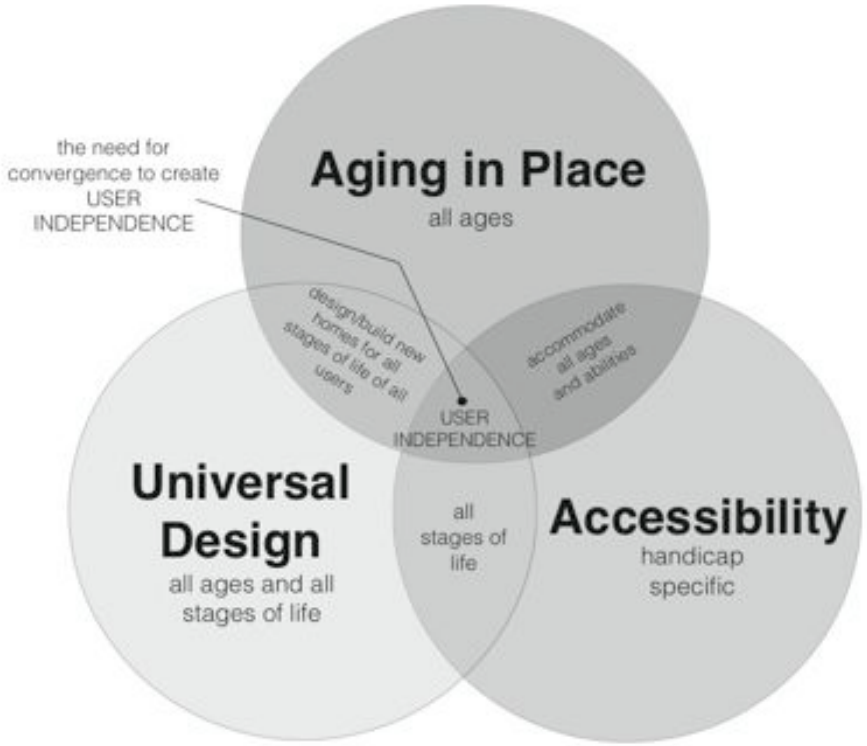
The MetLife Foundation "is dedicated to advancing financial inclusion, helping to build a secure future for individuals and communities around the world" (MetLife foundation, 2013, p. 2). They also provide reports and research to help guide and inform the aging population. This study on residential aging in place could provide AARP and MetLife with more specific guidelines for the aging population with respect to the designs of private homes and changing lifestyles throughout the aging process.

The only code for residential aging in place for the state of Florida is modeled from the ADA guidelines. This code states that "all new single-family houses, duplexes, triplexes, condominiums, and townhouses shall provide at least one bathroom, located with maximum possible privacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch clear opening" (Residential Facilities, 2012, sec. 233.3.6). Other workbooks and guides give simple recommendations and modifications, but they are not specific or based on a code. Many of the guides and workbooks are very general and usually refer back to ADA guidelines,

which lead to another issue. ADA is targeted to a broad population, but is not specific to private homes. Often times the design of private homes require special features designed for specific reasons for a particular client (Mitton & Nystuen, 2011). Client needs vary from project to project; again showing these ADA guidelines may not necessarily be the best choice. With these gaps, there are several things that need to be done. There is a need to provide access to existing information and to develop new information. These two needs could be addressed in one study as will be described in the next section.

Interior designers understand people's behavior and environmental factors, design for the overall quality of life of the users, and design for the health, safety and welfare of the public (NCIDQ, 2012a; NCIDQ, 2012c; Martin & Guerin, 2005, 2010), essential factors when designing for aging in place and universal design. Aging in place incorporates all ages with the intention of individuals living in their private homes through all stages of life, while maintaining independence for as long as possible (AARP, 2009; Lawlor & Thomas, 2008). Universal design also incorporates all ages, as well as those of all abilities and stages of life (Center for Universal Design, 1997). Accessibility connects with both aging in place and universal design, but is handicap specific (Lawlor & Thomas, 2008; Mitton & Nystuen, 2011). Overall user independence is at the core of these three topics (aging in place, universal design and accessibility) (see Figure 5), which are examined and discussed throughout this study.

Figure 5. User Independence



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Chapter 3

Methodology

There were three parts to this research study. The first step was the information-gathering phase. The researcher conducted a codes search and contacted experts in the field to provide their knowledge and give input on developing questions, which will be discussed in detail below. Then, the researcher created a summary chart of the existing data collected. Finally, reference sheets were created using existing guidelines and recommendations, as well as new information developed by the researcher for use in professional practice.

1. Information - gathering

The following paragraphs will discuss the information-gathering process. This phase consists of two phases, a codes search of existing guidelines and recommendations and expert interviews.

1.1 Codes Search for Existing Guidelines and Recommendations

Multiple codes were searched in order to find existing standards and guidelines for universal design and aging in place in private residences. State codes, model codes, professional organizations, peer reviewed articles and textbooks were examined during the codes search. Several levels of codes exist at the state, regional, and local level. State codes are codes applicable only at the state level. The state of Florida is the focus for this study. The International Building Code (IBC, 2012) and ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) were the two model codes examined for applicable codes and recommendations. Model building codes have no legal status until they are adopted or adapted by government regulation (Harmon & Kennon, 2008). IBC is a model building code developed by the International Code Council (ICC), which provides minimum standards to insure the

health, safety, and welfare of the public as they relate to the building construction (Harmon & Kennon, 2008). ADA is "a comprehensive civil rights law that protects individuals with disabilities" (Harmon & Kennon, 2008, p. 28). Publications of professional organizations such as ASID (American Society of Interior Designers), IIDA (International Interior Design Association), NKBA (National Kitchen and Bath Association), AARP, and MetLife were also examined. Several peer reviewed articles and textbooks pertaining to codes, universal design, and aging in place were used throughout the codes search.

1.2 Expert Interviews

A convenience sample was used in contacting experts in the field. Three people were selected from the healthcare field and three from the design field; all were professionals with experience working with senior citizens. This sampling technique selects subjects because they are easiest to recruit thus providing access for the researcher (Castillo, 2009). Convenience sampling is drawn without any underlying probability (Castillo, 2009; Price, 2013). Table 1 below shows the three areas of expertise, with the three experts from each category that were contacted.

Table 1. Experts

Healthcare	Design
• Registered Nurse • Home health/hospice nurse • Occupational Therapist	• Contractor • Interior Designer 1 • Interior Designer 2

The researcher contacted each expert by phone or e-mail first to discuss the purpose of the study and to request permission to use any information provided. Note: IRB is not necessary

in this study because it is not considered human subjects research per Auburn University Institutional Review Board (See Appendix A). Once those asked to be a part of an interview had agreed to do so, the researcher proceeded with gathering the information needed through a series of open-ended questions asked via telephone and e-mail. Responses were recorded in writing by the researcher. Appendix B shows questions that were asked. The experts' input was used in formulating questions and guidelines to be utilized by those who are aging in place. Each expert that was contacted was relevant to this study in different ways. The contractor had first-hand experience in building in the state of Florida, thereby recognizing limitations and concerns for aging in place in private homes. One interior designer specialized in bath design, one area that was examined. The other interior designer had extensive experience in the design field, specializing in residential design. These design experts contributed to this study based on their experience.

The Registered Nurse was selected based on experience working in the medical intensive care unit. The nurse was able to provide insights on designs of hospital rooms and what the main concerns are with implementing universal design in residential spaces. The home health/hospice nurse was able to give advice on what were the key components to incorporate into a private residence for those in the aging process. Occupational therapists help people across the lifespan participate in the things they want and need to do throughout everyday activities, with many clients being those with disabilities or older adults experiencing physical and cognitive changes. Therefore, the occupational therapist was able to provide input about the major activities older persons participate in and the design needs that need to be addressed to allow these older persons to be active and independent in their daily lives.

The information gathered from the experts also contributed to forming the client questionnaire portion of the new reference sheets and guidelines that were developed. The client questionnaire includes questions pertaining to current and future needs, preferences, and specific conditions the user may have that require a specific design (See Appendix D for questions).

2. Analysis

Content analysis of existing codes, standards, and recommendations found through the codes search were summarized in a comparative chart. Content analysis is a qualitative research method that examines the content of a particular body of material to identify themes or patterns (Leedy & Ormrod, 2010). Some examples that were examined are the ADA Guidelines (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), hospital room spatial recommendations and clearances (Winkel, Collins, Juroszek, & Ching, 2006), the National Kitchen and Bath Association (NKBA,2012; Parrott, Beamish, Emmel, & Peterson, 2013), and hospital bathroom requirements (Winkel et al., 2006). The information was organized into four categories applicable to the residential setting: overall travel and hallways, bedrooms, bathrooms, and other (see Appendix C.1). Each category was cross-referenced with the source from the codes search to illustrate how it relates to the seven principles of universal design. For example, if the ADA guidelines give standards for overall travel and hallways that relate to principles one and seven of the universal design principles; these principles were noted. An example of this technique is shown in Appendix C.1. The next step was to synthesize the data summaries as will be described in the next section.

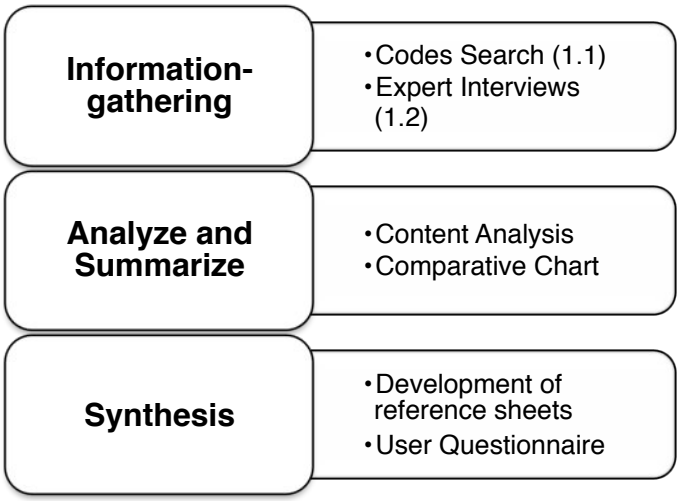
3. Synthesis

The data collected from the experts was matched to the summary chart created from the content analysis of standards and guidelines. The gaps in the existing data were shown, which

resulted in incorporating new knowledge and the development of new guidelines for the reference sheets. The reference sheets combined existing data and filled in the gaps with new information. A client questionnaire was also developed to aid the user and design professionals in identifying residential design features to facilitate the user's aging in place process. The reference sheets were divided into the four categories: overall travel and hallways, bedrooms, bathrooms, and other, and contained the questionnaire and guidelines for the design of residential aging in place for each of those areas. Users are able to answer the questions based on their condition and needs, then designers can go to the reference sheets that provide the best guidelines for their particular need. For example: if the client is in a wheelchair and cannot access the bathroom due to clearances being too narrow, the design professional can go to the reference sheets and find the guidelines that fit the users' situation the best. Some people may need wider clearances to get in the bathroom and some may need a shower they can get in and out of, therefore, the reference sheets will cater to many different user needs in different areas of the home.

Summary of Method

Figure 6. Summary of Method



In summary, this study contained three main parts (See Figure 6), which all led to the development of new guidelines for residential aging in place. The first step was information-gathering, which consisted of a codes search and contacting experts in the field to provide insight in creating a questionnaire. Then, content analysis of the existing guidelines and/or standards was performed and a comparative chart was created. Finally, new guidelines for the four main areas in the home, (overall travel/hallways, bedrooms, bathrooms, and other), were formulated for the new reference sheets. A final reference guide was developed through these three parts containing a user questionnaire and reference sheets with guidelines for each area of the home that was examined in this study.

Chapter 4

Findings and Recommendations

After collecting the data and analyzing the information gathered in the codes search and from the credible experts, some principles of universal design were addressed through recommendation or guidelines from multiple sources while other areas were documented in only one source or none. These universal design principles that did not align with an existing guideline or recommendation were noted. All existing codes, recommendations and guidelines from the literature were collected for data analysis.

The gaps in these data were identified and investigated, and the findings were organized by space (e.g., overall travel and hallways). The full results of this data collection and analysis are communicated in the following sections and can also be seen in Appendices B.2, B.3 and C. The guide to sources chart (see Appendix C.1) summarily lists all sources and their findings for ease of access; the summary chart can be cross-referenced to locate the more detailed charts in later appendices (see Appendix C).

Overall Travel and Hallways

Overall travel and hallways is discussed in the following sections. The existing guidelines and recommendations found in the literature that was examined, as well as gaps and recommendations from the researcher are presented below.

Existing guidelines and recommendations.

Six of seven principles of universal design were addressed by recommendations and guidelines for overall travel and hallways, as documented in the literature included in this study. Principle four, perceptible information, was the only principle that did not align to the information gathered in this section. There are clear recommendations and guidelines for overall

travel and hallways related to door widths and clearances, hallway widths, lighting, handrails, and ease of access for those using assistive equipment (See Figure 7).

Figure 7. Overall Travel and Hallways - Existing Guidelines and Recommendations

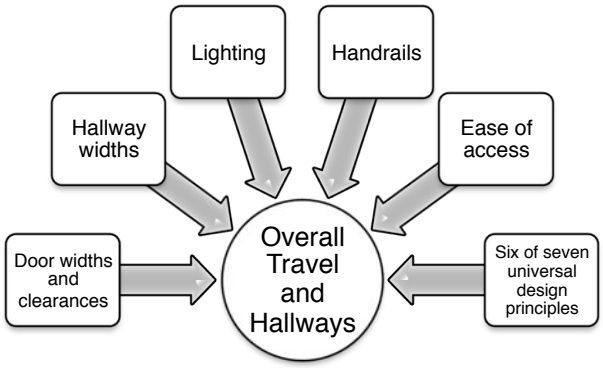


Image by author

From the findings (see Appendix C.2) it was shown that every literature source included in this study (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007; IRC, 2011; Mitton & Nystuen, 2011; Lawlor & Thomas, 2008; Winkel et al., 2006) discussed door widths and clearances and all but one source, healthcare guidelines (Winkel et al., 2006) (See Appendix C.2.b), discussed hallway widths. Universal design principles, equitable use and size and space for approach and use, are both applicable in terms of door and hallway widths and clearances by implementing designs that accommodate users with different abilities and providing sufficient space for all users. Healthcare guidelines (Winkel et al., 2006), the International Residential Code (IRC, 2011), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) (See Appendix C.2.d) all stated that egress doors should be a minimum of 3'-0" (914 mm) wide. The IRC (2011) and textbooks (Mitton & Nystuen, 2011) advise a minimum clear width of 32 inches (813 mm) at doors should be provided.

The IRC (2011) and healthcare guidelines (Winkel et al., 2006) also describe minimum door heights. The IRC states that a minimum clear height of the door opening shall not be less

than 78 inches (1981 mm) and healthcare guidelines (Winkel et al., 2006) advise 6'-8" (2032 mm). The information presented in the appendices, textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008), and the IRC all state that the minimum width for hallways should be no less than 3 feet (914 mm) wide, but some of these sources also suggest a larger width.

Lawlor and Thomas (2008) and the IRC (2011) discuss lighting in the entry and pathways. The IRC requires illumination levels be no less than 1 foot candle (11 lux) at walking surface level. Textbooks Mitton and Nystuen, (2011) and Lawlor and Thomas (2008) reference the need for well designed handrails. Ease of access is referenced by all sources, but specifically by textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) in regard to those using assistive equipment (i.e., wheelchairs, walker, etc.). It is important to note that the hallway width and clearance space is greater in these instances. According to the literature (Mitton & Nystuen, 2011), space for one wheelchair and one person is 48 inches (1219 mm), two wheelchairs is 60 inches (1524 mm). Clear space for a wheelchair is a minimum of 30 x 48 inches (762 by 1219 mm) and a clear turning space of 5 feet (1524 mm) minimum. Lawlor and Thomas (2008) was the only source that advised flush thresholds and level flooring throughout the home.

The researcher concluded that the most well-supported recommendations from the literature were made in regard to door widths and clearances, and hallway widths. Recommendations for lighting, handrails and ease of access regarding those using assistive equipment were also evident. Although flush thresholds and level flooring were only addressed by one source (Lawlor & Thomas, 2008, the relevance of this recommendation will be discussed further.

Six of seven principles of universal design were addressed by these recommendations and guidelines for overall travel and hallways. Principle four, perceptible information, was the only

principle that did not align to the information gathered in this section. The researcher proposes that the principles of universal design are significantly represented by the recommendations for overall travel and hallways, as evidenced in the literature sources included in this study. However, the researcher has also identified some gaps in existing literature that could be filled to improve the applicability of these principles to design practice.

Expert recommendations.

The most commonly discussed topics by experts were floor clearances, doorway widths, ease of access to spaces, handrails, and hallway widths that can allow for walkers, scooters, wheelchairs, etc. to comfortably maneuver up and down the hallway (see Appendix B and Appendix C.2.e). When the experts were interviewed, each suggested that it be standard to implement doors that were at least 3 feet (914 mm) wide and wider hallways. Experts also cited the need for well-designed handrails. The experts suggested that handrails be implemented or at least planned for in new construction or home renovations. Ease of access was referenced in regard to those using assistive equipment. It was noted from the experts that ease of access through spaces was important. Some of the experts had personal experiences that influenced them in making these recommendations. For example, the home health nurse had first-hand experience while recovering from back and knee surgery. She explained that at the beginning of recovering from these surgeries, she had to relocate to a different home that was designed appropriately and was more accessible. She discussed how if a home is not designed appropriately or is not easily adaptable it could hinder the recovery process.

One of the interior designers interviewed had first-hand experience as well. She recently was involved in designing a residence for a family, which included a family member with MS

(multiple sclerosis). With his/her lack of ability to climb stairs and other mobility needs, the design had to consider the overall travel, hallways and entries of the home.

The experts provided useful information and recommendations for overall travel and hallways. Some of the experts had first-hand experiences personally or within their field of expertise. It is important to consider the needs of all users of all ages and abilities when designing the overall travel areas and hallways within private homes.

Gaps and recommendations.

Several gaps were identified through this study. Lighting, handrails and thresholds were referenced in the literature (Lawlor & Thomas, 2008; IRC, 2011; Mitton & Nystuen, 2011) but the guidelines and recommendations in these areas could be better articulated for application to design practice. Lighting, for example, is important when designing for aging in place and is relevant to implementing universal design principles; therefore the researcher suggests the following expert analysis be included in future recommendations and guidelines.

Light and color.

The researcher acknowledges the importance of providing sufficient light levels, especially in pathways. However, an increase in lighting levels may not always correlate to improved environmental conditions when all factors are considered. Increased light levels may result in glare and halos around the light. No matter the age or physical ability of any user, minimizing glare is crucial. Glare can be reduced by selecting appropriate fixtures – with a concealed source or with a shade – and by selecting appropriate flooring materials, (Figueiro, 2008; Brabyn, Haegerstrom-Portrioy, Schneck, & Lott, 2000). Users could also benefit from motion sensor devices in hallways and entrances that activate lighting when movement is detected.

The researcher also recommends the use of natural lighting to be implemented wherever possible to improve physical and emotional health as well as making spaces warm and inviting. Daylight is good for overall health and makes individuals feel good (Lawlor & Thomas, 2008, Lechner, 2009; Newham, Aries, Mancin, & Faye, 2007). One analogy for this is when it is almost spring time, everyone always talks about how they are ready for the sunshine and warm weather or when it is has been cloudy and gloom, people just want to see the sunshine. These are simple examples of how natural daylight is good for the soul.

Color selections can also affect lighting and vision. The researcher recommends avoiding monochromatic color schemes and excessive use of dark materials and finishes. It can be difficult for users to distinguish different planar surfaces – e.g. level changes or floor to wall intersections – when those surfaces have a similar hue, saturation or value (Figueiro, 2008). Hazards can result from miscommunicating the location of planar changes. For example, if there are white floors, white walls, white baseboards and white ceilings, when someone walks down a hallway they could easily trip at corners or level changes where it would be difficult to distinguish the sharp edge in a white-on-white space. The universal design principle of perceptible information would be addressed by including recommendations about colors in future guidelines, such as selecting colors that have contrast and make it easy to distinguish different planar changes and surfaces.

Lighting controls.

The principle of perceptible information would also be supported through improved guidelines related to the placement of light switches in entries and hallways. The researcher suggests that designers consider the needs of all users when placing light switches. Controls, such as switches, should be placed where they can be reached from standing and seated levels,

including access by children and wheelchair users. Two-way switches are recommended, especially in hallways, so that controls can be accessed from multiple locations within a space. For example, hazards can result when the user must walk down a hallway in the dark, feeling his/her way to the switch, to turn on the light. A two-way switch should be placed at both ends of the hallway so the user can access lighting control from either end of the hallway.

The researcher also recommends that users would benefit from being able to easily locate a light switch, even in a dark room. Using a switch that glows or is lit once it is off or when the room is dark would enable users to locate the switch easily. An alternative solution would be to implement remote-controlled or motion sensor fixtures, which might remove the need for switches to be placed within reach. For example, if a user gets up during the night to get a drink and has to walk down the hallway, a motion sensor light could automatically come on. From the user's perspective this means that there is no need to search for the switch in the dark or worry about tripping over something.

Flooring.

The next recommendation for overall travel and hallways is to select the appropriate flooring. As addressed earlier, the floors should be level throughout the home, but especially in the main walkways and entries. A hazard could result if the floor is uneven or thresholds are not flush; users could trip and fall. Eliminate the use of rugs in main travel areas because this can lead to tripping or falling as well (Tinetti, 2003). It is also important to select a flooring material that is durable, slip-resistant, not high in gloss, and low maintenance.

Another gap that needs to be filled is in the area of handrail recommendations and guidelines. Handrails were addressed, but not in detail sufficient for application to design decisions. A user is not likely to anticipate when they may need assistance walking down a

hallway, therefore, it is important to include handrails or grab bars in hallways. If handrails are not added during new construction, the researcher recommends considering the future addition of handrails by reinforcing the walls during new construction. The extra support of reinforced walls can then allow handrails to be added at any later time, as needed. To keep the home aesthetically pleasing, while implementing handrails and grab bars, one can customize the design. They can be designed to resemble chair rail moulding and still provide the support needed. In a residential environment guidelines for handrails are not as strict as those in commercial settings, which explains why handrails in private residences can be designed to be more aesthetically pleasing.

In addition to the recommendations given for door widths and clearances and hallway widths, the researcher also recommends that all doors have lever handles for ease of use by users with a range of mobility and dexterity. Also, the recommendation for a larger hallway does not just benefit someone in a wheelchair or needing mobility assistance. Wider hallways are also beneficial when moving furniture, hauling luggage back and forth, or even for parents when their children are learning to walk and want or need to hold their parent's hand when walking down the hallway. Also, it is important to note that anyone of any age can unexpectedly be put in the situation of needing assistance, such as crutches or a wheelchair; widening hallways as suggested in the guidelines will address this issue.

Summary.

Figure 8 illustrates the various factors imparting overall travel and hallways for aging in place.

Figure 8. Overall Travel and Hallways - Gaps and Recommendations.

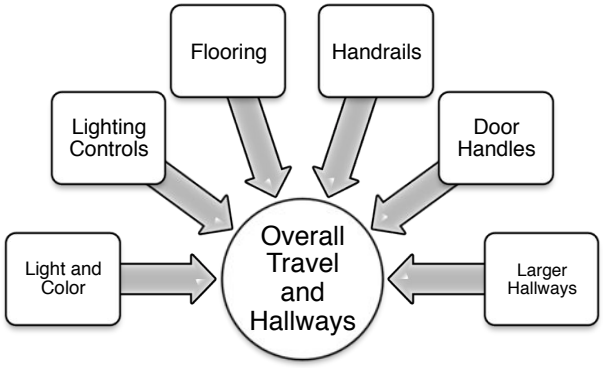


Image by author.

As previously stated, the most well documented guidelines for overall travel and hallways were door widths and clearances and hallway widths. Lighting, handrails, and ease of access regarding those using assistive equipment were also significant. Six of seven of the universal design principles were noted to be aligned to this area of the study. Several gaps were identified in regard to lighting, handrails, and thresholds and the researcher made additional recommendations in regard to these identified gaps. Increasing light levels in major travel areas, selecting appropriate flooring, using larger hallway widths and doorway widths, and applying lever handles were some of the recommendations provided by the researcher. All clients are different and their needs vary as well, so there may be no one-size-fits-all solution. It is important to ask household users about their specific needs, how long they plan to live in the house and what level of independence they desire. These simple programming questions will benefit the designer when creating the best solution for each individual client situation.

Bedrooms

The following sections discuss bedrooms. The existing guidelines and recommendations from the literature (See Figure 9) are presented. Gaps and recommendations developed by the researcher are also discussed.

Figure 9. Bedrooms – Existing Guidelines and Recommendations

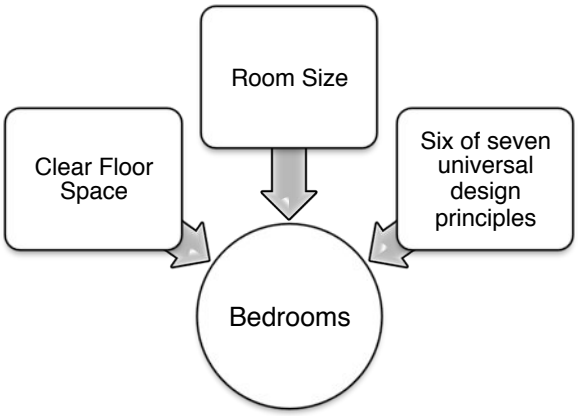


Image by author.

Existing guidelines and recommendations.

As with overall travel and hallways, bedroom guidelines and recommendations aligned to six of seven universal design principles. Again, perceptible information was the only principle not aligned to the existing knowledge in this area. From the findings (see Appendix C.3) it was shown that every source (Department of Justice, 201a, 2010b; Evan Terry Associates, 2007; IRC, 2011; Mitton & Nystuen, 2011; Lawlor & Thomas, 2008; Winkel et al., 2006) discussed providing clear space except for the International Residential Code (IRC, 2011).

Providing clear space aligns with the universal design principle, size and space for approach and use. Most sources (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008; Winkel et al.2006; Kobus, Skaggs, Bobrow, Thomas, Payette, & Chin, 2008) advise to allow 30 to 36 inches (762 to 914 mm) of clear space on both sides of the bed and at the foot of the bed with 36 inches (914 mm) being the minimum clearance for wheelchair users. Mitton and Nystuen (2011) and Lawlor and Thomas (2008) (See Appendix C.3.d) state that major circulation areas require 30 to 36 inches (762 to 914 mm) of clear floor space and minor circulation areas require 24 inches (610 mm) of clear floor space. Allow clear turning space of 5 feet (1524 mm) in diameter

within the room and 60 by 60 inch (1524 by 1524 mm) space to maneuver in the room once furniture is placed. Textbooks (Mitton & Nystuen, 2011; Kobus et al., 2008; Lawlor & Thomas, 2008) also discuss providing clear space to access doors, drawers, and storage areas (closets). Mitton and Nystuen (2011) state to allow 48 by 36 inches (1219 by 914 mm) of clear space to access the closet for wheelchair users and 30 by 48 inches (762 by 1219 mm) adjacent to closet. Textbooks Mitton and Nystuen (2011) and Lawlor and Thomas (2008) also state that 32 inches (813 mm) should be provided for access to closet/storage areas.

The depth of the closet should be at least 2'-10" (864 mm). Bi-fold doors can allow greater clear space at closets or use bypass sliding doors, double pockets doors, or double swing doors. Walk-in closets are the most accessible. Entry to walk-in closets should be 32 inches (813 mm) wide with an interior center aisle of 36 inches (914 mm) wide minimum. It is said to use adjustable mounting heights for shelves and clothes rods or pull-down rods and shelves, which describes both simple and intuitive use and low physical effort universal design principles. The adjustable heights should vary between 30 and 66 inches (762 and 1674 mm) above the floor.

Healthcare guidelines (Winkel et al., 2006), textbooks (Mitton & Nystuen, 2011; Kobus et al., 2008; Lawlor & Thomas, 2008), and the IRC (2011) discuss room size. Healthcare guidelines (Winkel et al., 2006) and the IRC (2011) state that the room shall have not less than 120 square feet (36,576 sq mm) of gross floor area and the IRC suggests no less than 7 feet (2,134 mm) in any horizontal dimension. Textbooks (Mitton & Nystuen, 2011; Kobus, et al., 2008; Lawlor & Thomas, 2008), only suggest that rooms should be sufficiently sized and increased for universal design purposes.

Mitton and Nystuen (2011) and Lawlor and Thomas (2008) discussed entrances and doors within bedrooms. They recommended to provide a minimum clear space of 32 inches (813

mm) and use 36-inch (914 mm) doors, which is the same requirements discussed in overall travel and hallways in the previous section. Lawlor and Thomas (2008) state to specify hallways to and within the master suite at 42 inches (1967 mm) wide. They also suggest the use of low-pile carpet or glare-free flooring materials, extra outlets within bedrooms, consideration of bed heights, and a dedicated toilet and shower for each bedroom. Lawlor and Thomas (2008) suggested placing lighting controls within easy reach by lowering light switches to 42 to 48 inches (1067 to 1219 mm) above finish floor and raising electrical outlets to 18 to 22 inches (457 to 559 mm) above finish floor.

From the information gathered and presented above, the researcher can conclude that the most significant finding was to provide clear floor space around the bed, closet, doors, and within the overall room. These topics were discussed the most in depth in comparison to all other topics addressed. Room size was also significant. Flooring material, outlets, light controls, bed heights, and a dedicated toilet and shower were addressed briefly, but are still important and will be discussed in more detail in the following section.

Expert recommendations.

Experts provided clear recommendations for bedrooms related to ease of access, clear space, flooring and door openings. Other recommendations they mentioned include outlets, bed height, closets with reachable rods and two master suites. See Appendix B to reference the actual interviews and Appendix C.3.e for a list of key points made by experts.

When experts discussed clear space and ease of access, each described allowing an ample amount of space to maneuver within the bedroom and closets without feeling crowded, while also having sufficient space if mobility equipment should have to be used. Experts recommended providing clear space around doors and use 36-inch (914 mm) doors, which is the same

requirement discussed in overall travel and hallways. Experts suggest using wider doorways as standard for ease of access and in case assistive equipment is used. Experts also discussed selecting appropriate flooring materials in bedrooms and some discussed keeping in mind materials that could be a tripping hazard (e.g., rugs). As previously stated, some experts had personal experience that influenced them in making these recommendations.

For example, the registered nurse and home health nurse both had experiences in the field. The registered nurse discussed the importance of homes and especially bedrooms being set up correctly (e.g. enough plugs, location and placement of furniture and bathroom placement in relation to the bedroom). The registered nurse also expressed the importance of asking users what level of independence they expect and what their overall needs within the space are. The home health nurse also addressed the number of plugs in relation to equipment that may need to be used. During the interview she told the story about one of the homes she was working in at the time only had two wall outlets and an overhead lighting fixture with an outlet in it. When she and the other nurses had to plug up an oxygen tank or breathing machine, the cords had to hang from the ceiling or an extension cord was run across the room, which caused even more of a hazard.

It is evident through the information provided from the experts that the design of bedrooms plays a major role in the everyday lives of users. Again, it is important to consider the needs of each user in order to provide the best design solution.

Gaps and recommendations.

There were several gaps identified through the findings, which include eliminating rugs in main travel areas as much as possible, having a master suite at the grade level, providing as much daylighting as possible, selecting appropriate lighting fixtures for a range of needs,

keeping privacy in mind, and planning for placement and number of electrical outlets (See Figure 10).

Figure 10. Bedrooms – Gaps and Recommendations

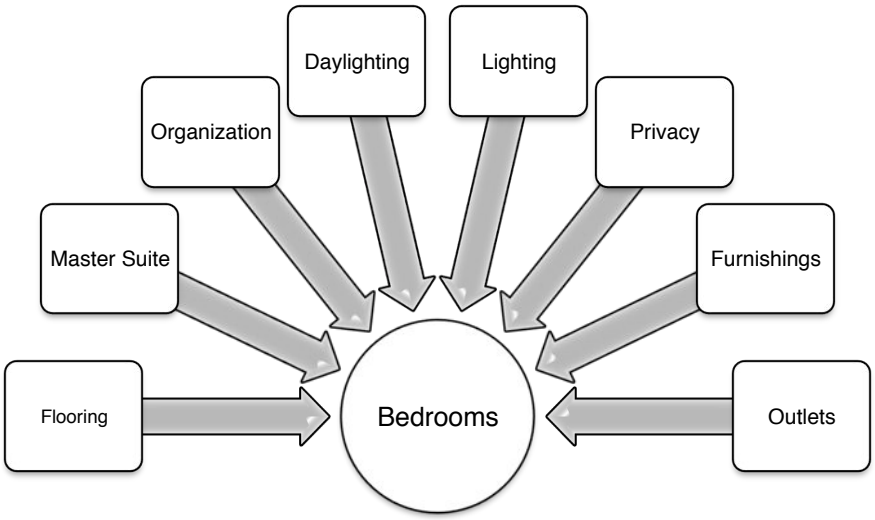


Image by author.

Flooring.

Flooring may not have been sufficiently addressed. While textbooks (Lawlor & Thomas, 2008) suggest low-pile carpet, it is important to keep in mind how easily assistive equipment can maneuver over specific pile heights and floor material transitions. In fact it may be best to eliminate loose rugs as much as possible. Rugs can be a trip hazard for any user, but especially for elders (Tinetti, 2003). As people age their stability decreases and clumsiness increases. If rugs are used, make sure they are secured to the floor and use visually appropriate contrast in value, hue or saturation between the rug and the underlying flooring material.

Master suite.

It is recommended by the researcher that it become standard for the master suite to be located at the grade (ground) level. The master suite is a major living space that should be useable through all stages of life. In a multi-story house in which it is desirable to have all

bedrooms on an upper level, it may be possible to design for two master suites. Consider a scenario in which the client's current bedroom is upstairs. If the client has knee replacement surgery, how will he/she recover comfortably? The client will not be allowed to go up and down stairs for a while, so he/she would not be able to get to any of the upstairs bedrooms. The lack of privacy, comfortable sleeping space and access to master suite amenities may inhibit the healing process. This demonstrates one scenario in which it is important to design for a master suite at grade level.

Further, a design with two master suites is not only beneficial for personal use, but also can be a more functional design for guests. From the client's perspective, one never knows when an elderly family member may require personal care and have to move in with the client. If there are two master bedrooms in the house, both can provide personal space in this new and unexpected arrangement.

Organization.

Another recommendation is to provide clean, uncluttered sleeping spaces with amenities to allow for ease of access for users with limited mobility. Clean and uncluttered space decreases the risk of tripping or running into furniture within the bedroom. Providing a sitting area within a bedroom would be beneficial as well, and can be adapted to the changing needs of a user over time. From the client's perspective, if the client or the spouse were to become ill and need assistance around the clock, the sitting space could be converted to provide family or other caregivers with personal space within the master suite.

Daylighting.

The author suggest that providing as much daylighting as possible is always encouraged and is good for overall health. It is better for users' vision as opposed to artificial lighting.

Daylighting with a view also allows those with limited access to the outdoors to be able to see outside. Although the sources reviewed for this study did not indicate the importance of natural daylighting, design literature does, in fact, document the importance of daylighting within living environments (Newham et al., 2007; Lechner, 2009). Providing views of the outdoors and nature aids in the healing process (Rea, Figueiro, & Bullough, 2002; Oyama, 2004; Han & Ishida, 2004), so if someone is not able to actually be outdoors, this allows them to feel as if they are a part of the outside world.

The author suggests that fenestration can be controlled with automatic or electronically controlled window treatments. As addressed in the overall travel and hallways section, light switches or mechanisms that are easy to see and access are also important in bedrooms. Easy to use controls for daylighting, light switches and fans may support independence through all stages of life.

Lighting.

Lighting fixture selection is also important. Many different tasks occur in a bedroom – sleep, read, relax, dress – so lighting decisions in this area must support a wide range of needs.

The researcher recommends that task lighting be provided on both sides of the bed and that the switches be easily accessible. Overhead lighting within the room should be provided and should be at an increased light level from task lighting by the bed, but should not result in glare. As with overall travel and hallways, provide bedroom switches that light up at night or lights that can be controlled by a handheld device.

Privacy.

Another recommendation is to consider privacy when locating and planning bedrooms. It is important to design bedrooms such that visitors who are in the living room or at the front door

cannot see directly into the room. Privacy is also important to remember with street front rooms. From the client's perspective, if there was a new baby in the household and someone came over to bring dinner for the night, the client would not want the bedroom to be the first things the visitor sees when he/she comes in the front door. Although a client's needs may change over time, an expectation of privacy in the bedroom may be a concern across the whole span of a client's life.

Furnishings.

When specifying bedside tables as well as other furniture for the bedroom, be sure to select those that fit the needs of the client. Tables that are 20 inches (508 mm) high can mean less bending and seat heights 18 to 20 inches high (457 to 508 mm) make it easier to get in and out of chairs.

Outlets.

The researcher makes additional recommendations for the location and placement of outlets, beyond what was addressed in the literature sources used in this study. It is important to plan for the location and number of outlets necessary in each space prior to construction. This is especially important in bedrooms, which can become the main living space during certain times in a client's life. Hazards can result from improper placement of outlets as well as from having an insufficient number of outlets.

For example, if a user becomes ill and has to have a breathing machine or other types of equipment hooked up he/she will need additional outlets. If there are not enough outlets near the bed, an extension cord may be connected in order for the equipment to be in reach of the user. This forms an obstacle that people have to walk over constantly and may become a tripping hazard or a life-threatening hazard if critical equipment gets accidentally unplugged. However,

when outlets are placed correctly and the number of outlets is sufficient for the space, there is less potential for hazard and inconvenience. Even users without specialized equipment may need additional outlets for everyday items such as lamps, cell phones, computers, TVs, DVD players and alarm clocks.

Summary.

The most well-documented guidelines and recommendations identified were related to clear floor space within the room and specifically around the bed, closet and doors (Department of Justice, 201a, 2010b; Evan Terry Associates, 2007; IRC, 2011; Mitton & Nystuen, 2011; Lawlor & Thomas, 2008; Winkel et al., 2006; Kobus et al., 2008; IRC, 2011). Six of the seven universal design principles were significant criteria for consideration for bedrooms as well. Gaps and recommendations included eliminating rugs in main travel areas as much as possible, having a master suite at the grade level, providing as much daylighting as possible, selecting appropriate lighting fixtures for a range of needs, keeping privacy in mind, and planning for placement and number of electrical outlets. As previously stated, client needs may vary and there may be no one-size-fits-all solution. Ask each household user about his/her specific needs, how long he/she plans to live in the house and what level of independence he/she desires to support the best solution for his/her individual situation.

Bathrooms

Bathrooms are discussed in the following sections. Existing guidelines and recommendations from the literature are discussed. Also, gaps and recommendations presented by the author are discussed.

Existing guidelines and recommendations.

Bathroom guidelines and recommendations aligned to all seven universal design principles. As noted in the findings (see Appendix C.4), not every principle aligned to every source but most sources engaged all of the universal design principles. Healthcare guidelines (Winkel et al., 2006) aligned to six of seven, but did not align with the perceptible information principle. The 2010 Florida Building Code, Residential (ICC, 2011) and the 2012 Florida Accessibility Code for Building Construction (Residential Facilities, 2012) were the only sources to which none of the universal design principles could be clearly aligned.

The most significant findings for bathrooms related to clear space, bathtub and shower dimensions, toilet placement, grab bars and control placement. Flooring material in shower and bathtubs, mirror placement and dimensions, storage, shelving and accessories recommendations were also well-documented (See Figure 11).

Figure 11. Bathrooms – Existing Guidelines and Recommendations

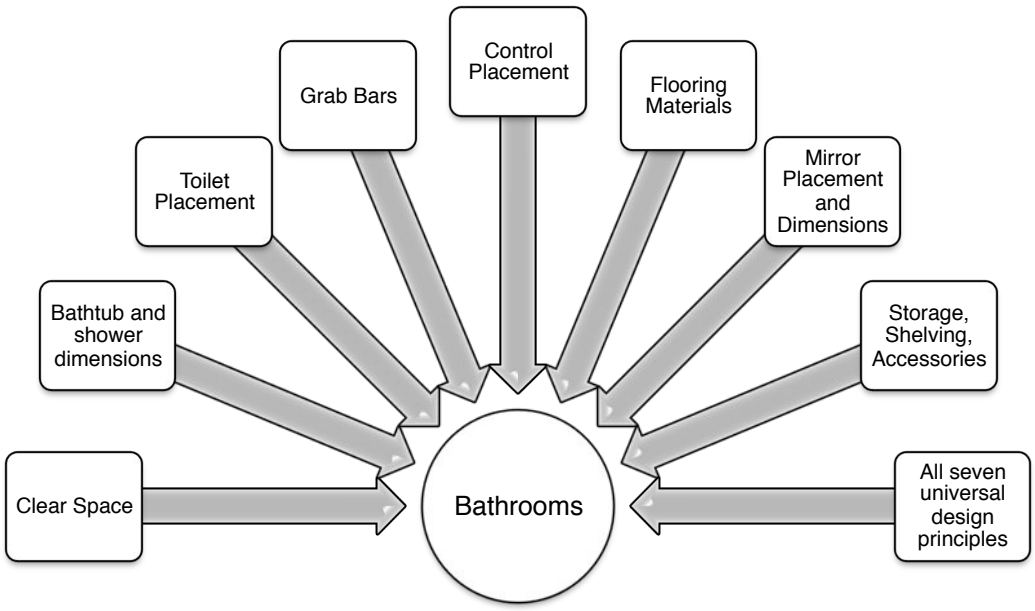


Image by author.

All sources addressed recommendations related to clear space (see Appendix C.4). Clear space around doors, and at lavatories, sinks, vanities, bathtubs, showers and toilets were all discussed, which aligns with universal design principles equitable use and size and space for approach and use. Clear space around doors was described by the ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), healthcare guidelines (Winkel et al., 2006), the NKBA (NKBA, 2012; Parrott et al., 2013), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) (See Appendix C.4.g), the 2010 Florida Building Code, Residential (ICC, 2011) and 2012 Florida Accessibility Code for Building Construction (Residential Facilities, 2012). The ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) states that doors shall not swing into the clear floor space or clearance for any fixture unless it is in a private room where a clear space of 30 by 48 inches (762 by 1219 mm) minimum is provided within the room beyond the arc of the door swing.

Healthcare guidelines (Winkel et al., 2006) state that clear space of 30 by 48 inches (762 by 1219 mm) is to be provided if the door swings into the room, clear of the door swing. The door shall have 32 inches (813 mm) minimum of clear width. The NKBA (2012) also states the clear opening of a doorway should be at least 32 inches (813 mm), 2'-10" (864 mm) door minimum. A more accessible clear opening should be at least 34 inches (864 mm), 3'-0" (914 mm) door minimum. Textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) discuss doorway openings as well. They suggest the doorway opening to be at least 32 inches (813 mm) as well and should be unobstructed.

Mitton and Nystuen (2011) and Lawlor and Thomas (2008) state that a 3-foot (914 mm) door, when the door swings out, allows the turning radius to exist free of the door or a 32-inch (813 mm) pocket door is also useful. Doorways that are 34 to 36 inches (864 to 914 mm) wide

permit better access. The door should open out to the hall rather than into the bathroom. The 2010 Florida Building Code, Residential (ICC, 2011) and the 2012 Florida Accessibility Code for Building Construction (Residential Facilities, 2012) state the toilet rooms shall have a clear opening of not less than 29 inches (737 mm) at door.

Providing clear space at lavatories, sinks, vanities, bathtubs, showers and toilets were discussed by ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), the IRC (2011), NKBA (2012), Parrott et al. (2013), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008). ADA (Department of Justice, 2010a, 2010b) states that a 30 by 48 inch (762 by 1219 mm) minimum clear floor space, positioned for a forward approach and knee and toe clearance should be provided. Clearance in front of the bathtub shall extend the length of the bathtub and shall be 30 inches (762 mm) wide minimum. Different types of shower compartments exist with different clearances depending on the type of approach (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007).

The IRC (2011) states that there shall be a clearance of not less than 21 inches (533 mm) in front of a water closet, lavatory, or bidet to any wall, fixture, or door. The NKBA (2012) and Parrott et al. (2013) recommend planning a clear floor space of at least 30 inches (762 mm) from the front edge of all fixtures to any opposite bath fixture, wall, or obstacle. Plan a minimum clear floor space of 30 by 48 inches (762 by 1219 mm) centered at each fixture plus space for maneuvering including approach and turning for a person using a wheelchair. The minimum size of knee space is 36 inches (914 mm) wide by 27 inches (686 mm) high by 8 inches (203 mm), increasing to 17 inches (432 mm) deep in toe space. Mitton and Nystuen (2011) and Lawlor and Thomas (2008) also state that a clear space should be provided measuring 30 by 48 inches (762 by 1219mm) in front of sinks, the bathtub, and the toilet.

Wheelchair accessible showers require a clear space of 30 by 48 inches (762 by 1219 mm) adjacent to the shower entry for approach and transfer. Wheelchair accessible vanity design requires a clear area under the sink that is a minimum of 27 inches (686 mm) above the floor; 29 inches (737 mm) is recommended for most adults along with 30 inches (762 mm) of clear approach space. Accessible toilets, bidets, and sink fixtures require clearance and placement; various models require 3 to 9 inches (76 to 227 mm) of clearance between the fixture and the wall. Toilets should be at minimum 18 inches (457 mm) from the vanity-cabinets, bathtubs, or sidewalls (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007; Mitton & Nysteun, 2011; Lawlor & Thomas, 2008; NKBA, 2012; Parrott et al., 2013; IRC, 2011).

ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), the NKBA (2012), Parrott et al. (2013), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) provided information regarding the placement of mirrors. ADA (Department of Justice, 2010a, 2010b) suggested that mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1016 mm) maximum above the finish floor or ground. Mirrors not above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (889 mm) maximum above the finish floor or ground. For those in a wheelchair, the top edge of the mirror should be 74 inches (1880 mm) minimum from the floor or ground. The NKBA (2012) and Parrott et al. (2013) suggest placing mirrors above or nearing the lavatory at a height that takes the user's eye height into consideration. Plan for a full-height mirror to provide reflection at eye level, regardless of user's height or stature. Mitton and Nystuen, (2011) state that 40 inches (1016 mm) should be the maximum mirror height, when the mirror is not tilted; however, many wheelchair users prefer tilted mirrors and mounting guidelines are not indicated for titled mirrors.

The placement of toilets was discussed by all sources except the 2010 Florida Building Code, Residential (ICC, 2011) and the 2012 Florida Accessibility Code for Building Construction (Residential Facilities, 2012). ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) recommend the centerline of the water closet shall be 16 inches (406 mm) minimum to 18 inches (457 mm) maximum from the sidewall or 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the sidewall in accessible toilet rooms. The toilet shall be arranged for left-hand or right-hand approach. The seat height shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum measured to the top of the seat. In residential dwelling units, the height is permitted to be 15 inches (381 mm) minimum and 19 inches (483 mm) maximum above the finish floor, measured to the top of the seat (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007).

The IRC (2011) states that a water closet, lavatory, or bidet should not be set closer than 15 inches (381 mm) from its center to any side wall or vanity. The NKBA (2012) and Parrott et al. (2013) recommend the distance from the centerline of the toilet and or bidet to any bath fixture, wall, or other obstacle be at least 18 inches (457 mm). They also suggest considering the user height and ability when determining the toilet height. If a separate toilet compartment is used, the size should be at least 36 by 66 inches (914 by 1676 mm) with a swing-out or pocket door. To maximize access, provide privacy in the toileting area without using a separate compartment.

Textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) and experts discussed grab bars as well. Implementing grab bars is one example that describes the universal design principle tolerance for error. Grab bars in residential dwelling units shall not be required to be installed in toilet or bathrooms provided that reinforcement has been installed in the walls and

located so as to permit the installation of grab bars when needed. Mitton and Nystuen (2011) and Lawlor and Thomas (2008) suggest to use 36 inch (914 mm) and 42 inch (1067 mm) grab bars mounted 33 to 36 inches (914 by 1676 mm) above the floor. They also suggest higher toilet seat heights, i.e. 18-inch (457 mm) optimum seat height.

Sinks and lavatories were also addressed when examining bathrooms. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), the NKBA (2012); and Parrott et al., (2013) and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) provide recommendations for sinks and lavatories. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) recommends that lavatories and sinks shall be installed with the front of the higher side of the rim or counter surface 34 inches (864 mm) maximum above the finish floor. Hand-operated metering faucets shall remain open for 10 seconds minimum and faucets shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist, which describes the universal design principle of low physical effort.

The NKBA (2012) and Parrott et al. (2013) suggest placement dimensions for different types of lavatories. Single-lavatory placement should be at least 20 inches (508 mm) from the centerline of the lavatory to the sidewall. For double-lavatory placement, the distance between the centerlines of the two lavatories should be at least 36 inches (914 mm). The minimum distance between the edges of two freestanding or wall-hung lavatories is 4 inches. The height for a lavatory varies between 32 and 43 inches (813 and 1092 mm) depending on the needs of the user. Lavatory controls should be within the user's reach and operable with minimal effort. The NKBA also suggests specifying clipped or round corners rather sharp edges on all counters.

Mitton and Nystuen (2011) and Lawlor and Thomas (2008) also suggest information for sinks and lavatories. They state that wall-mounted sinks are ideal for use by those in wheelchairs,

as they allow for chair clearance directly under the sink, easing access to the sink bowl, faucet, and controls, which aligns with universal design principle equitable use. Wall-hung lavatories should be 18 by 22 inches (457 by 559 mm). If mounted in a cabinet or countertop, the sink bowl should be mounted as close to the front edge of the counter as possible. Single-lever or paddle faucet handles are suggested to be the best choice for bathroom use. This recommendation describes flexibility in use, tolerance for error, and simple and intuitive use. It is important for the design to consider the selection of lavatory faucets when designing bathrooms for use by individuals with disabilities, the elderly, and small children.

Vanity cabinet height should be based on the size and height of the most frequent user. A taller toe kick, 9 inches (229 mm) with a 6-inch (152 mm) setback from the face edge of the cabinet is recommended (Lawlor & Thomas, 2008). Up to 1 foot (305 mm) of the 4 feet (1219 mm) required for forward approach can extend under a lavatory with clear access to knee space. Removable doors or doors that pocket back into the vanity cabinet can be functional options as well in order to provide knee space. Select low maintenance countertops for bathroom lavatories.

ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), the NKBA (2012), Parrott et al. (2013), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) all discuss bathtubs. Clearances for bathtubs were discussed previously. All sources suggested providing a seat in bathtubs for better accessibility. Grab bars inside bathtubs were addressed by all sources as well. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) states that grab bars are not required to be installed in bathtubs in residential dwelling units provided that reinforcement has been installed in the walls and located properly to permit installation later.

The NKBA (2012) and Parrott et al. (2013) also recommend that the tub walls should be reinforced at the time of construction to facilitate installation of grab bars later. Placement of grab bars should be planned to facilitate access to and maneuvering within the tub area. When grab bars are used, they should be placed at 33 to 36 inches above the floor, must be 1.5 to 2 inches (38 to 51 mm) in diameter, and extend 1.5 inches (38 mm) from the wall. Grab bars should be placed according to the needs and height of the user. Mitton and Nystuen (2011) and Lawlor and Thomas (2008) also suggest structural reinforcement for grab bars. They recommend that if grab bars are required, they should be provided on both ends of the tub and two bars of different heights are required along the side of the tub.

ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), NKBA (2012), Parrott et al. (2013), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) all have suggestions for controls within bathtubs. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) suggests that controls should be located on an end wall, between the bathtub rim and grab bar, and between the open side of the bathtub and centerline of the width of the bathtub. They should be operable with one hand and should not require tight grasping, pinching, or twisting of the wrist as stated before.

According to the NKBA (2012) and Parrott et al. (2013) tub controls should be accessible from both sides and outside the tub and be located between the rim of the bathtub and 33 inches (838 mm) above the floor. Controls should be offset toward the room and have an easy grasp, as with lever or loop handles. Hot and cold should be identified with red and blue indicators. Mitton and Nystuen (2011) and Lawlor and Thomas (2008) recommend that controls should be placed where users can reach them and should be mounted near the entry side of the head wall,

describing the universal design principle perceptible information. Pressure-balanced valves and hot water limiters should be used and water shutoff valves should be accessible.

The NKBA (2012), Parrott et al. (2013), and ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) suggest providing a handheld shower spray unit and it must have an on/off control. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) recommends the bathtub shower spray units shall deliver water that is 120°F (49°C) maximum. ADA discusses enclosures for bathtubs and states that they shall not obstruct controls, faucets, shower and spray unit, or obstruct transfer from wheelchairs onto the bathtub seat and into bathtubs. They also suggest that enclosures shall not have tracks installed on the rim of the open face of the bathtub. The NKBA (NKBA, 2012; Parrott et al., 2013) suggests the wall around the tub should be covered in a waterproof material extending at least 3 inches (76 mm) above the showerhead rough-in. They also suggest that steps not be placed outside of the tub and slip-resistant surfaces should be used for the tub bottoms.

Bathtubs were discussed above, but showers were also addressed. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), the IRC (2011), NKBA (2012), Parrott et al. (2013), and Mitton and Nystuen (2011) and Lawlor and Thomas (2008) all provide suggestions in regard to showers. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) discusses different types of showers. Transfer type shower compartments shall be 36 by 36 inches (914 by 914 mm) inside dimension with a 36-inch (914 mm) wide minimum entry on the face of the shower. A standard roll-in shower shall be 30 inches (762 mm) wide minimum by 60 inches (1524 mm) deep minimum inside dimensions with a 60- inch (1524 mm) wide minimum entry on the face of the shower. Lastly, alternate roll-in showers shall be 36

inches (914 mm) wide by 60 inches (1524 mm) deep minimum inside dimension with a 36-inch (914 mm) minimum entry.

Seats and grab bars shall be provided in showers or at least planned for at new construction. The suggestions for controls in showers are the same as for bathtubs. According to the IRC (2011), showers shall have not less than 900 square inches (22,860 sq mm) of interior cross-sectional area and shall not be less than 30 inches (762 mm) minimum. The height of showers should not be less than 70 inches (1778 mm) above the shower drain outlet. The hinged door should open outward. The access and egress opening shall have a clear and unobstructed finished width of not less than 22 inches (559 mm).

The NKBA (2012) and Parrott et al. (2013) also discussed different types of showers and provided measurements for each. The interior shower size should be at least 36 by 36 inches (914 by 914 mm). They suggest planning for either a transfer or roll-in shower. Roll-in shower entries should be 32 inches (813 mm) for a 60-inch (1524 mm) deep shower and 36 inches (914 mm) wide for a 42-inch (1067 mm) deep shower to allow turning space. It is suggested to plan for a seat within the shower that is 17 to 19 inches (432 to 483 mm) above the shower floor and 15 inches (381 mm) deep or to fit the parameters of the space and the needs of the user. Walls should be reinforced at the time of construction to allow for installation of grab bars if and when needed.

Suggestions for controls of showers are the same as for bathtubs, except it is suggested that the controls to be located between 38 and 48 inches (965 and 1219 mm) above the floor depending on the user's height. Also minimizing thresholds at the shower entry to no more than ½ inch (13 mm) is suggested. The wall around the shower pan should be covered in a waterproof

material extending at least 3 inches (76 mm) above the showerhead rough-in and use a slip-resistant surface in the shower bottom.

Textbook sources (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) discuss different sizes of showers as well, which aligns with equitable use universal design principle. They suggest that a 3-foot by 3-foot (914 by 914 mm) shower can help users maintain balance and allows them to catch themselves should they fall. A 5-foot by 5-foot (1524 by 1524 mm) shower allows for a wheelchair to roll directly into the stall and there should be at least 60 inches (1524 mm) in all directions. The minimum depth of a curbless shower should be 30 inches (762 mm), but a more generous minimum depth of 36 inches (914 mm) is recommended. There should be 42 to 48 inches (1067 to 1219 mm) in depth for someone in a wheelchair to enter the shower and retain complete range of motion of bathing and accessing the water controls.

Again controls should be placed where the user can reach them and be able to turn them before getting into the shower Mitton & Nystuen, 2011; Lawlor & Thomas, 2008). Controls should be placed 15 to 48 inches (381 to 1219 mm) above finish floor. Pressure-balanced valves and hot water limiters should be used as well. Showerheads and curtain rods should be mounted at 72 inches (1829 mm) above the finish floor, but will vary based on the individual height of the user. Grab bars should be installed when needed. If a grab bar is needed, a vertical grab bar height is 18 inches (457 mm) minimum and should be located 4 inches (102 mm) maximum from the side of the shower. If a shower door is used, the door swing must be considered. It is important to keep a level threshold at the shower entry and a change in texture and pattern of the flooring material will provide a visual cue where the shower pan begins and main floor ends.

ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007), the NKBA (2012), Parrott et al. (2013), and textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008)

discussed recommendations for storage, shelving, and accessories in bathrooms, which all align with the universal design principle, size and space for approach and use. ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) recommends that shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above finish floor. The NKBA (2012) and Parrott et al. (2013) suggest to provide storage of frequently used items and accessories between 15 and 48 inches (381 and 1219 mm) above finish floor. Toilet paper holders should be located 8 to 12 inches (203 to 305 mm) in front of the edge of the toilet bowl, centered at 26 inches (660 mm) above the floor. Textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) recommend that soap, towels, and other related items shall be installed within seated reach and within 15 to 48 inches (381 to 1219 mm) above the floor.

The NKBA (2012) and Parrott et al. (2013) were the only sources to provide recommendations for lighting, ventilation, and heat in bathrooms. NKBA (2012) suggests that, in addition to general lighting, task lighting should be provided for each functional area in the bathroom. Task lighting at a vanity should be beside the mirror and at eye level, with the lamp not visible to the eye. Lighting controls should be between 15 and 48 inches (381 and 1219 mm) above finish floor and operable with a closed fist and with minimal effort. A mechanical exhaust system, vented to the outside, was suggested for each enclosed area in the bathroom. Ventilation controls should be placed 15 to 48 inches (381 and 1219 mm) above finish floor as well and should also be operable with minimal effort, be easy to read, and produce little noise pollution. The NKBA (2012) also suggests a supplemental heat source, such as a heat lamp, a toe kick heater or floor heat, be considered.

From the information gathered and presented in the above paragraphs, the researcher can conclude that the most significant topics discussed were clear space, bathtub and shower

dimensions, toilet placement, grab bars, and control placement. Flooring materials in showers and bathtubs, mirror placement and dimensions, storage, shelving and accessories recommendations, were also significant. Lighting, ventilation, and heat were only discussed by one source, but are still important when designing bathrooms, especially lighting.

Expert recommendations.

The most commonly addressed topics by experts (see Appendix B and C.4.h) in relation to bathrooms were to provide a handicap accessible bathroom, provide seats in showers, higher toilet seats, grab bars. They also discussed the location of fixtures and components within the bathroom.

Experts discussed being able to maneuver comfortably within bathrooms, which aligns with providing clear space. They suggested utilizing grab bars where and when necessary (e.g. in showers, bathtubs, and around toilets). The contractor and one interior designer addressed reinforcing walls at new construction to provide the appropriate support for grab bars if and when they are needed. Showers and bathtubs were both discussed. Experts suggested that they each be accessible by all users when used in private homes by providing seats and/or grab bars. Several experts suggested higher toilet seats and to implement this in new construction. Again, the experts provided these recommendations based on their experiences in the field or their own personal experiences.

One of the interior designers discussed her experiences within professional practice of bath design. She discussed incorporating design for all ages. She suggested implementing various heights for vanities and countertops to include design that fit both adults and children. One important recommendation was to program each client in order to meet his or her needs and expectations.

The contractor had both personal and professional experience. His parents are at the age now where they need modifications in their home to accommodate their needs. He has now made those modifications for them, but discussed the importance of implementing designs at new construction to plan ahead for the future, rather than having to remodel later. He also has customers who are beginning to request changes to their living environments to accommodate their needs.

These examples give clear evidence that there is a need for designing for aging in place in private residences and that implementing designs at new construction is beneficial for the user. It is important to remember that there is no one-size-fits-all solution, as mentioned previously by the researcher as well as by the occupational therapist. However, actions can be taken in the beginning stages of construction so users can have the opportunity to age in place.

Gaps and recommendations.

There were several gaps identified in the literature sources related to the bathroom area, which include flooring materials, lighting, shower and bathtubs relationships, and toilet compartments (See Figure 12).

Figure 12. Bathrooms – Gaps and Recommendations

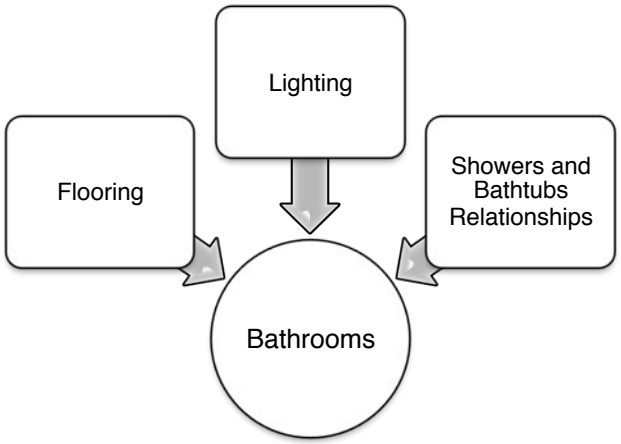


Image by author.

Flooring.

Although guidelines were given for flooring in showers and bathtubs, recommendations were not provided for the overall main floor material. The researcher suggests that it is important to use slip resistant flooring materials in showers and bathtubs as stated previously, but it is also crucial to select appropriate flooring throughout the entire bathroom. The researcher suggests that the entire bathroom area be finished with a low maintenance, durable, slip resistant flooring that does not have a high gloss finish, which will helps reduce glare. Bathrooms are some of the moistest areas in the home; be sure that flooring materials are sealed or naturally impervious to moisture penetration.

Lighting.

The researcher suggests expanding on the lighting guidelines provided by the NKBA (2012) and Parrott et al. (2013) by recommending that different types of lighting be used within bathrooms: ambient, task, and accent or decorative lighting. Task lighting can provide lighting for daily tasks such as putting on makeup, shaving and drying hair. One example of functional task lighting would be to wall mount a light fixture on either side of a mirror. Additional lighting can be recessed in the ceiling of the shower and bathtub area. The researcher recommends the use of lamp dimmers so the light levels can be adjusted for a variety of users and scenarios. For example, from the client's perspective, in the morning when he/she is getting ready, bright light may be desired, but when the client wants to relax and soak in the tub at the end of a long day, he/she may want the lights to be dim and soft. Dimmers can also be useful for low-level illumination in the middle of the night.

Lighting plays a major role in everyday tasks in all spaces and should not be under designed in the bathroom space. The bathroom may be the location in which medicines are

measured, injections are administered, or health care conditions are monitored. Light levels as well as light color should be considered. Implementing both warm and cool light can be beneficial. Cool light may be used in areas of the bathroom where these tasks just mentioned take place. Cool light is brighter and cleaner and gives off a blue or white hue. Warm light can be used for the overall room area and is more intimate and gives off a yellowish hue (Lechner, 2009).

Shower and bathtub relationships.

One gap is evidenced in the need for integrating related information in the existing guidelines. For example, showers and bathtubs were addressed in separate recommendations, but were not discussed in specific relation to one another. One recommendation when designing bathrooms is to provide both a shower and bathtub to accommodate users of all ages and abilities. When designing showers, it is recommended to install one with a seat built in, so a seat does not have to be added later. Seating in showers and bathtubs is usually associated with accessibility for those with disabilities or who are aging; however, users of all ages and abilities can benefit from a shower seat.

From the client's perspective, when one has to shave his/her legs, it may be preferable to sit down or to prop the leg up. Also, pregnant women may have a more difficult time bending once they are further along in their pregnancy. Designing showers with seats already installed provides these and other users with everyday assistance as needed. If a toilet is separated from the main bathroom by a compartment or room then that room should be accessible as well. In this case, additional guidelines or recommendations may be borrowed from commercial bathroom guidelines that address public toilet stalls. If a separate toilet room is not used, but visual privacy is desirable, the researcher recommends designing a partition between the toilet

and the main area of the bathroom. This still provides privacy and a separate space without using an actual door, which allows for more usable clear floor space.

Summary.

The most significant findings for bathrooms related to clear space, bathtub and shower dimensions, toilet placement, grab bars, and control placement. Flooring material in shower and bathtubs, mirror placement and dimensions, storage, shelving and accessories recommendations were also significant. All of the universal design principles aligned to the guidelines for bathrooms. Identified gaps include flooring materials, lighting, shower and bathtub relationships, and toilet compartments.

The researcher also made several recommendations for bathrooms, including to select a flooring material within the entire bathroom that is slip-resistant and does not produce a glare, provide different types of lighting, provide both a shower and bathtub in bathrooms, and if a toilet compartment is used within a bathroom, that it should be accessible as well.

Other

Over the course of this study, some recommendations applied to every category – overall travel and hallways, bedrooms, and bathrooms – or were valuable and relevant but not specific to a category (see Appendix 5.A, 5.G, and 5.H). ADA (Department of Justice, 2010a, 2010b; Evan Terry Associates, 2007) provides recommendations for elevators in private residences and reach dimensions throughout the entire residence. Due to cost, most private residences do not have elevators at the time of new construction; usually elevators are installed if a user has a mobile disability or if the user is elderly. One way to allow for the addition of an elevator is to design levels so that closets of an appropriate size are positioned on top of each other on the different levels. In this way the closets can then become an elevator shaft, if needed. ADA (Department of

Justice, 2010a, 2010b; Evan Terry Associates, 2007) also provides recommended dimensions for reaching for those who may be in a wheelchair or other mobility assistive equipment. These suggestions can be applied in multiple areas of the home, including bathrooms, kitchens, storage spaces and laundry.

The most commonly suggested topics by experts include sensory factors, incorporate all ages, reinforce all walls in new construction, design depends on the needs of the client, and ease of access. All of these topics were applied throughout the above sections (overall travel and hallways, bedrooms, and bathrooms). Textbooks (Mitton & Nystuen, 2011; Lawlor & Thomas, 2008) mention appropriate flooring material throughout spaces, appropriate lighting, table and seat heights, and rounded corners on furniture. All of these topics were applied and discussed above as well.

Chapter 5

Conclusions

This chapter provides a summary and implications from the findings in chapter four, as well as suggestions for future research. The information is organized into two sections, summary and implications and future research. The summary and implications section identifies results of the study that may be useful to practitioners and users. The future research section will discuss areas of the study that can be expanded on in the future.

Summary and Implications

Through the information-gathering phase, a codes search of existing guidelines and recommendations and interviews with credible experts were performed. The codes search allowed the researcher to examine what recommendations and guidelines already exist. These findings were further enhanced through interviews with experts. Each expert that was interviewed was able to give useful recommendations or note areas of concern in private residences in regard to aging in place. Content analysis of the existing codes, standards, and recommendations were summarized in a comparative chart. The information was organized into four categories: overall travel and hallways, bedrooms, bathrooms, and other. From the comparative chart, keywords and phrases were identified and listed. Reference sheets were then created to note what each source recommended and which universal design principles were aligned with that area. The summary chart and reference sheets gave a clear understanding of what information exists and what gaps needed to be filled. The researcher then gave recommendations and guidelines for areas that needed new or more knowledge.

The most well documented guidelines for overall travel and hallways were door widths and clearances and hallway widths. Lighting, handrails, and ease of access regarding those using

assistive equipment were also significant. Six of seven of the universal design principles were noted to be aligned to this area of the study. Several gaps were identified in regard to lighting, handrails, and thresholds and the researcher made additional recommendations in regard to these identified gaps. Increasing light levels in major travel areas, selecting appropriate flooring, using larger hallway widths and doorway widths, and applying lever handles were some of the recommendations provided by the researcher.

In regard to bedrooms, the most well-documented guidelines and recommendations related to clear floor space within the room and specifically around the bed, closet and doors. Gaps and recommendations included eliminating rugs in main travel areas as much as possible, having a master suite at the grade level, providing as much daylighting as possible, selecting appropriate lighting fixtures for a range of needs, keeping privacy in mind, and planning for placement and number of electrical outlets.

The most significant findings for bathrooms related to clear space, bathtub and shower dimensions, toilet placement, grab bars, and control placement. Flooring material in shower and bathtubs, mirror placement and dimensions, storage, shelving and accessories recommendations were also significant. All of the universal design principles aligned to the guidelines for bathrooms. Identified gaps include flooring materials, lighting, shower and bathtubs relationships, and toilet compartments. The research also made several recommendations for bathrooms, including to select a flooring material within the entire bathroom that is slip-resistant and does not produce a glare, provide different types of lighting, provide both a shower and bathtub in bathrooms, and if a toilet compartment is used within a bathroom, that it should be accessible as well.

All clients are different and their needs vary as well, so there may be no one-size-fits-all solution. It is important to ask household users about their specific needs, how long they plan to live in the house and what level of independence they desire. These simple programming questions will benefit the designer when creating the best solution for each individual client situation. As stated previously, designing and creating spaces for the overall health, safety, and welfare of each user is the main goal for interior designers; therefore, understanding each clients' needs is crucial when designing for those who want to age in place. By implementing the recommendations and guidelines presented in this study, users will have the opportunity to age in place.

The findings of this study suggest that there is a need for more, and more clearly articulated, guidelines for residential aging in place and universal design, which validates the overall goal of this research. The researcher recommends that designers incorporate these expanded guidelines and recommendations at the time of new construction. Further, the researcher has provided questionnaires that may assist in uncovering client needs and expectations related to aging in place (see Appendix D).

From the information gathered and presented in this study, the researcher plans to develop a booklet for interior designers, builders, contractors, professional organizations, and government agencies to serve as a reference and guide when designing for aging in place. The booklet will include a questionnaire to determine client needs, as well as the recommendations and guidelines for different areas in the home. The booklet will essentially be an easy pocket-guide during the programming and design development phases of new construction projects and renovations.

Conclusion

Interior design is of major importance; it impacts, influences and affects our world and lives in many different aspects. According to NCIDQ (2012a), interior design is "the art and science of understanding people's behavior to create functional spaces within a building" (para. 2). The main goal for interior designers is to create spaces, lend knowledge, and take responsibility for critical features that protect the health, safety, and welfare of the public (NCIDQ, 2012c).

With the aging population on the rise in the United States, universal design and aging in place are crucial. The Administration on Aging (2012) states that the aging population will nearly double in the next 25 years, estimated to reach 79.7 million by 2040. The biggest challenge facing the design community is the lack of resources to incorporate universal design and aging in place in private residences. There are resources that provide recommendations for aging in place, but no specific guidelines with the focus of the design of private residences.

The purpose of this study was to examine the seven principles of universal design (equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use) represented in existing literature. The researcher paired the few existing guidelines from codes and model codes with design recommendations from credible resources such as professional organizations, peer review literature, and textbooks to create a summary of existing guidelines and recommendations. Gaps in existing knowledge were noted and new knowledge was added through the creation of proposed new guidelines that have been organized into reference sheets. These reference sheets are intended to provide interior designers, builders, and the client with the information needed to

design homes that fit the specific needs of clients planning to age in place within their private residence.

Future Research

This study exhibits several limitations in relation to sampling and methodology. The first limitation is the sample size and limiting the study to only the state of Florida. A larger number of credible experts and other states ultimately need to be taken into consideration. Only one state was chosen for the study, therefore, limiting its generalizability to other states. However, this study can be a starting point for creating guidelines for other states as well. A convenience sample was used to contact experts in the field. Three experts from the healthcare field and three experts from the design field were contacted. The use of a convenience sample is a limitation in itself because of lack of ability to generalize the results for the entire population. This results in a low external validity and sampling bias. Using content analysis can result in limitations as well. For example; content analysis describes what is there, but does not answer 'why', therefore, it is a purely descriptive method and causal relationships cannot be proven. Also, the analysis is limited by the availability of materials and it is a time-consuming method of research.

There are several areas for future research that could reach beyond the limitations of the study at hand. The first opportunity would be to expand the range of literature sources used in this study. Those sources that were not included in the study at hand could provide additional guidelines and recommendations for the residential environment. Further, by expanding upon the range of literature surveyed it might be possible to adapt non-residential guidelines and recommendations to the needs of the residential designer and client. Second, this study is concerned only with overall travel and hallways, bedrooms, and bathrooms. Future studies could expand on this work by repeating the method on additional areas of the residential environment

such as the kitchens, living areas, stairways and homes as a whole and in relation to the site. A third area for future study would be to address the same areas of the home using a different method. Interviews of credible experts and content analysis were used to gather information in the study at hand. The experts were able to provide first-hand knowledge in their field of expertise, which was beneficial to this study. The content analysis method was able to show what knowledge exists and what additional guidelines and recommendations needed to be addressed. Future research could conduct a post-occupancy evaluation (POE) through behavior observations to document daily activities performed in different areas of the home. The researcher recommends observations be conducted of a range of homes, from those that are minimally accessible to those that are advertised or certified to be universally designed. Also, user surveys could assist in correlating observations to the client's reported levels of satisfaction with the designed space. One final area for future research would be to examine the cost difference in retrofitting a home to meet aging in place needs versus designing and planning for the lifespan of the client at the time of new construction.

The study at hand suggests that there is a need for more, and more clearly articulated, guidelines for residential aging in place and universal design. Any of the above addressed future research areas could further support designers in implementing successful design strategies for residential aging in place.

References Cited

AARP. (2009). *Home and community glossary: Understanding the terminology you need to assess your home and community.* Retrieved on September 11, 2013, from http://www.aarp.org/relationships/caregiving/info-12-2009/women_glossary_home_community_terms.html

AARP (2013). *Who we are.* Retrieved on September 30, 2013 from www.aarp.org/about-aarp/info-2011/who-we-are.html

Administration on Aging (aoa). (2012). *A profile of older Americans: 2012*. Retrieved on September 10, 2013, from www.aoa.gov/AoARoot/Aging_Statistics/Profile/2012/docs/2012profile.pdf

American Society of Interior Designers. (n.d.). *Aging in place: Aging and the impact of interior design.* Retrieved on September 28,2013 from www.asid.org/sites/default/files/aging_in_place1.pdf

Ball, M. S. (n.d.). *Aging in place: A toolkit for local governments.* Retrieved on September 24, 2013 from www.aarp.org/content/dam/aarp/livable-communities/plan/planning/aging-in-place-a-toolkit-for-local-governments-aarp.pdf

Beach, E.D. (2008). *The Florida state plan on aging 2009-2011: Keeping the promise.* Retrieved on September 11, 2013 from www.nasuad.org/sites/nasuad/files/hcbs/files/215/10723/FL_State_Plan.pdf

Bell, M. (2013). *Building vs. renovating: Our tips to help you decide.* Retrieved on October 26, 2013 from http://www.realestate.com.au/blog/building-vs-renovating-our-tips-to-help-you-decide/

Blu Homes (n.d.). *Renovate or rebuild.* Retrieved on October 12, 2013 from http://www.bluhomes.com/infographics/renovate-or-rebuild/

Brabyn, J. A., Haegerstrom-Portrioy, G., Schneck, M. E., & Lott, L. A. (2000). Visual impairments in elderly people under everyday viewing conditions. *Journal of Visual Impairments and Blindness, 94*(12), 741-755

Brown, R. (2012). *Renovate old home or tear it down?.* Retrieved on October 4, 2013 from http://www.washingtontimes.com/news/2012/oct/25/cover-story-renovate-old-home-or-tear-it-down/?page=all

Castillo, J. J. (2009). *Convenience sampling.* Retrieved on October 2, 2013 from explorable.com/convenience-sampling

Center for Universal Design. (1997). *The principles of universal design, Version 2.0*. Raleigh, NC: North Carolina State University. Retrieved on September 8, 2013, from http://ncsu.edu/www/ncsu/design/sod5/cud/pubs_p/docs/poster.pdf

Department of Justice (2010a). *2010 ADA standards for accessible design.* Retrieved on August 28, 2013 from http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Department of Justice (2010b). *Americans with disabilities act (ADA) standards.* Retrieved on August 28, 2013 from http://www.access-board.gov/attachments/article/1474/ADAstandards.pdf

Evan Terry Associates (2007). *Pocket guide to the ADA.* (3rd ed.). Hoboken, New Jersey: John Wiley & Sons

Farber, N., Shrinkle, D., Lynott, J., Fox-Grage, W., & Harrell, R. (2011). *Aging in place: A survey of livability policies and practices.* Retrieved on September 3, 2013 from http://assets.aarp.org/rgcenter/ppi/liv-com/aging-in-place-2011-full.pdf

Figueiro, M. G. (2008). A proposed 24 hour lighting scheme for older adults. *Lighting Research and Technology, 40*(2), 153-160

Frey, W. H. (1999). 'New sun belt' metros and suburbs are magnets for retirees. *Population Today, 27* (9), 1-3. Retrieved on September 30, 2013 from www.frey-demographer.org/briefs/B-1999-2_NewSunBeltMetros&Suburbs.pdf

Han, S. & Ishida, T. (2004). A practical method of harmonizing daylight and artificial light in interior space. *Journal of Light and Visual Environment, 28*(3), 18-24

Harmon, S. K. & Kennon, K. E. (2008). *The code guidebook for interiors.* (4th ed). Hoboken, New Jersey: John Wiley & Sons.

International Building Code (IBC). (2012). *2012 International building code.* USA: International Code Council, Inc.

International Code Council (ICC). (2011). *2010 Florida building code, residential.* USA: International Code Council, Inc.

International Residential Code (IRC). (2011). *International residential code for one- and two-family dwellings.* USA: International Code Council, Inc.

Kobus, R. L., Skaggs, R. L., Bobrow, M., Thomas, J., Payette, T. M., & Chin, S. P. (2008). *Building type basic for healthcare facilities.* (2nd ed). Hoboken, New Jersey: John Wiley & Sons

Lawlor, D. & Thomas, M. A. (2008). *Residential design for aging in place.* Hoboken, New Jersey: John Wiley & Sons.

Lechner, N. (2009). *Heating, cooling, lighting: Sustainable design methods for architects*. (3rd ed.). Hoboken, New Jersey: John Wiley & Sons.

Leedy, P. D. & Ormrod, J. E. (2010). *Practical research.* (9th ed). Upper Saddle River, New Jersey: Pearson Education, Inc.

Martin, C. S. & Guerin, D. A. (2005). *The interior design profession's body of knowledge.* Retrieved on October 8, 2013 from www.idbook.orf/PDFs/IDBOK_2005.pdf

Martin, C. S. & Guerin, D. A. (2010). *The interior design profession's body of knowledge and its relationship to people's health, safety, and welfare.* Retrieved on October 8, 2013 from www.idbook.org/PDFs/IDBOK_2010.pdf

MetLife Foundation. (2013). *MetLife Foundation.* Retrieved on September 30, 2013 from http://www.metlife.com/assets/cao/foundation/MissionOverview.pdf

Mitton, M. & Nystuen, C. (2011). *Residential interior design: A guide to planning spaces.* (2nd ed). Hoboken, New Jersey: John Wiley & Sons.

NCIDQ. (2012a). *Definition of interior design.* Retrieved on October 4, 2013 from www.ncidq.org/AboutUs/AboutInteriorDesign/DefinitionofInteriorDesign.aspx

NCIDQ. (2012b). *Differences between interior design and decorating.* Retrieved on October 4, 2013 from www.ncidq.org/AboutUs/AboutInteriorDesign/DifferencesBetweenInteriorDesignDecorating.aspx

NCIDQ. (2012c). *How interior designers protect the public.* Retrieved on October 4, 2013 from www.ncidq.org/AboutUs/AboutInteriorDesign/HowInteriorDesignersProtectthePublic.aspx

Newham, G. R., Aries, M. B. C., Mancin, S., & Faye, G. (2007). Individual control of electric lighting in a daylit space. *Lighting Research and Technology, 40*(1), 25-41

NKBA. (2012). *Kitchen and bathroom: Planning guidelines with access standards.* Hoboken, New Jersey: John Wiley & Sons

Nussbaumer, L. L. (2012). *Inclusive design: A universal need.* New York, New York: Fairchild Books.

Oyama, Y. (2004). Psychological effect of daylighting on behavior. *Journal of Light and Visual Environment, 28*(1), 70-71

Parrott, K., Beamish, J., Emmel, J., & Peterson, M.J. (2013). *Bath planning: Guidelines, codes, standards* (2nd ed.). Hoboken, New Jersey: John Wiley & Sons

Price, M. (2013). *Convenience samples: what they are, and what they should (and should not) be used for.* Retrieved on October 2, 2013 from http://hrdag.org/convenience-samples-what-they-are/

Rea, M. S., Figueiro, M. G., & Bullough, J. D. (2002). Circadian photobiology: An emerging framework for lighting practice and research. *Lighting Research and Technology, 34*(3), 177-187

Residential Facilities. (2012). *2012 Florida Accessibility Code for Building Construction.* Retrieved on September 14, 2013 from www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/2012_Florida_Accessibility_Code_Final%20.pdf

Scott, R. (2012). *State plan on aging 2013-2016.* Retrieved on October 10, 2013 from elderaffaris.state.fl.us/does/StatePlan/2013_2016StatePlan.pdf

Tinetti, M. E. (2003) Preventing falls in elderly persons. *The New England Journal of Medicine, 348*(1), 42-47

Wang, A. (n.d.) *Residential remodeling vs. building a new home.* Retrieved on October 14, 2013 from http://budgeting.thenest.com/residential-remodeling-vs-building-new-home-21947.html

Winkel, S. R., Collins, D. S., Juroszek, S. P., & Ching, F. D. K. (2006). *Building codes illustrated for healthcare facilities.* Hoboken, New Jersey: John Wiley & Sons

Appendix A

IRB Correspondence

From: IRB Administration
Sent: Wednesday, September 25, 2013 10:43 AM
To: Lindsay Tan
Subject: RE: Use of experts in thesis research

Dear Dr. Tan,

The IRB's opinion is that this would not be considered to be human subjects research. The processes described do not require IRB review.

Best wishes,
Susan

Susan Anderson, M.S., CIM
IRB Administrator
Office of Research Compliance
115 Ramsay Hall, basement
Auburn University, AL 36849
IRBadmin@auburn.edu *(for questions/info)*
IRBsubmit@auburn.edu *(for protocol submissions)*
334-844-5966
fax 334-844-4391

"Soli Deo gloria!" – J.S. Bach

From: Lindsay Tan
Sent: Tuesday, September 24, 2013 9:14 AM
To: IRB Administration
Cc: Margaret Albritton
Subject: Use of experts in thesis research

Good morning,

One of our graduate students is interested in contacting experts in the field as part of her thesis research. These experts would be asked to provide their input on formulating her questions and the specifics of her method. It is possible that their input may be cited in her thesis work, but these are not "interviews" per se and they are not the focus of the research. Does she need to go through IRB prior to contacting these experts in the field?

Thank you in advance for your time and assistance!

-LT

Lindsay Tan, MFA, IDEC, EDAC, NCIDQ
Assistant Professor of Interior Design

Appendix B

Interview

B.1. Interview Questions

Questions for credible experts.
1. What is your professional background?

2. Do you think design for aging in place is important and why?

3. Do you have personal or professional experience with aging needs? If yes, please explain.

4. What are some things you think should be addressed in designing for aging in place?

B.2. Completed interviews

Title: Registered Nurse

1. What is your professional background?

Registered Nurse (~ 1 ½ years)
Currently travel nurse (California); ICU
Licensed in AL, CA, FL
Works in ICU
Graduated with BS from AUM in May 2012

2. Do you think design for aging in place is important and why?

Yes, end of life care. Sees aging first hand. Needs to be set up correctly for when nurse comes in. If not set up correctly, they will end up in hospital anyway. (i.e. enough plugs, location and placement of furniture and bathroom, etc)

3. Do you have personal or professional experience with aging needs? If yes, please explain.

Yes, see it first hand every day

4. What are some things you think should be addressed in designing for aging in place?

- Sensory (eye sight, feeling, hearing)
- easy access to equipment, personal items, near bed
- walker, scooter can get in hallways, turn easy
- flooring (carpet vs. hardwood, no rugs!)
- handicap bathroom
- bathroom near bedroom
- spacing, handrails
- depends on client
- design based on client
- level of independence

B.2. – continued

Title: Home Health Nurse

1. What is your professional background?

Home health director
Nursing home
Hospice
Marketing
Doctors' office
Dialysis

2. Do you think design for aging in place is important and why?

Yes; first-hand experience with back surgery and knee surgery. Difficult recovering if home is not designed appropriately or is not easily adaptable.

3. Do you have personal or professional experience with aging needs? If yes, please explain.

Yes, first hand experience with back and knee surgery

4. What are some things you think should be addressed in designing for aging in place?

- equipment need to be able to hook up; outlets!
- bathroom attached to bedroom
- showers (grade level)
- higher counter tops (not crouching)
- higher toilet @ beginning
- bed heights
- doorways
- steps (alternate way enter home and in)

B.2. – continued

Title: Occupational Therapist

1. What is your professional background?

I am an occupational therapist/public administrator. I currently work as an OT educator.

2. Do you think design for aging in place is important and why?

Yes, I believe that design for aging in place is important. I believe that at any age, the environment plays a critical role in productive living/occupational engagement. Aging is a continuum and environmental needs should be addressed across that spectrum (birth to death).

3. Do you have personal or professional experience with aging needs? If yes, please explain.

My experience with aging needs includes earning the CAPS designation through the NAHB. I have also had an opportunity to serve on my local Rebuilding Together Board of Directors. As a clinician, I have had the opportunity to perform home evaluations in my patients' homes prior to their discharge. The goal was to identify barriers/obstacles (natural and built) that would have prevented them from going to a safe home environment.

4. What are some things you think should be addressed in designing for aging in place?

It all depends on the individual. Every person is different--and so are their needs. It's not a one size fits all type of endeavor. Access is so much more than meeting regulations/ordinances/law (e.g. - ADA); it's much more personal.

B.2. – continued

Title: Contractor

1. What is your professional background?

Working in the construction industry for 28 years. Became a registered residential contractor in 1994. Became certified general contractor in 2002. Have been doing business at Armbruster construction Inc. for 18 years. Performing work such as residential homebuilding, residential and light commercial renovation and remodeling.

2. Do you think design for aging in place is important and why?

Design for aging in place is very important. Needs such as security, safety, ease-of-use, and comfortable living are often overlooked. A great number of the adult population are reaching the age to where it is necessary to accommodate them with their basic "special-needs". Most homes are not built or designed for wheelchair and walker use or limited mobility. Builders only meet the minimum standards and usually to no rhyme it reason.

3. Do you have personal or professional experience with aging needs? If yes, please explain.

I have both personal and professional experience in these areas. Both of my parents are reaching the age to where they are in need of modifications to their home which I have met to meet their needs. Also customers of mine are beginning to request changes to their living environments to accommodate their needs. Things such as door swings, door openings, grab bars, hand rails, curb heights and floor clearances need to be considered. Customers are also interested in simplifying on their own such as vinyl and brick and also low maintenance landscaping.

4. What are some things you think should be addressed in designing for aging in place?

Items mentioned above. As insignificant as it may seem I strongly believe that blocking in walls should be standardized and required for areas such as bathroom's and stairwells.

Additional information provided: References Florida Building Code, ADA, and NAHB

B.2. – continued

Title: Interior Designer 1

1. What is your professional background?

Contractor
NKBA (cabinet manufacturer)
Free lance kitchen and bath designer for 10 years

2. Do you think design for aging in place is important and why?

Yes, because the aging population is rising
Families are moving in together (different generations)

3. Do you have personal or professional experience with aging needs? If yes, please explain.

Yes, in professional practice over past 5 years redesign kitchen and bath for aging parents (tub removed, toilets, higher lavatories). Children need to reach vanities (varied heights).
At new construction reinforce all walls for grab bars, program client.
Even a broken arm= aging in place

4. What are some things you think should be addressed in designing for aging in place?

- how long plan to live there
- reinforce walls
- 3' doors as standard
- entryway aesthetically appealing
- slip resistance for all ages
- incorporate all ages
- 2 master (up and down)
- physical needs
- open space (clear open space
- bath and bed on 1st floor)
- faucets (easy to use for all)
- seats in shower
- sight
- handicap height toilets

B.2. - continued

Title: Interior Designer 2

1. What is your professional background?

My professional background is a Bach of Science in Interior Design from BYU-I (2001), followed by experience with architects and designers in the commercial sector of the industry. In 2010, I completed my NCIDQ exam. In 2008, I started teaching interior design in Lethbridge College, a two-year interior design diploma program.

2. Do you think design for aging in place is important and why?

Enables clients to stay in their homes and workplaces as they age. This is important given the high cost of real estate and the stresses/discomforts to move and adapt to a new environment.

3. Do you have personal or professional experience with aging needs? If yes, please explain.

Yes, most recently (spring/summer 2013) designed a residence for a mid forty year old who had MS. The idea was to create an environment with flexibility and with all needs on one level of the home given his change of mobility and lack of ability to climb stairs. Although I did not design the floor plan, concerns were raised with the high number of stairs to enter the home. Although, the main level of the home was well thought out, the client will struggle to enter the home if mechanical assistance is ever required.

4. What are some things you think should be addressed in designing for aging in place?

- overall ease of entry and movement throughout the space
- materiality that provides low transitions, value contrasts, low maintenance
- ease of ability to use handles, knobs, switches
- ease of access to the spaces - bathrooms that can be adapted
- hallway widths that allow for mechanical assisted movement
- doorway widths are at least 32" clear - closets with reachable rods
- lever door handles and faucets - grab bars in shower
- pull/knobs with minimal effort to open items - seats in shower
- toggle switches - raised toilet seats
- smooth transitions between different flooring materials

B.3 Summary of Interviews

	Overall Travel/Hallways	Bedroom	Bathroom	Other
Registered Nurse	-walker, scooter can get in hallways, turn easy - flooring - handrails	- easy access to equipment, personal items, near bed - no rugs -spacing	- handicap bathroom - bathroom near bedroom	- sensory (eye sight, feeling, hearing) - depends on client - design based on client - needs to be set up correctly when nurse coming in (i.e. enough plugs, location and placement of furniture and bathroom, etc.) - need to ask what level of independence are they looking for and what they expect
Home Health Nurse	- doorways	- equipment needs to be able to hook up; outlets? - bed heights	- bathroom attached to bedroom - showers (grade level) - higher countertops (not crouching) higher toilet @ beginning	- difficult recovering if home is not designed appropriately or is not easily adaptable - steps (alternate was to enter home and within home)
Occupational Therapist/ CAPS				- home evaluations - all depends on the individual - not a one size fits all type of endeavor -access is so much more that meeting regulations/ ordinances/laws (e.g.- ADA); it's much more personal

B.3 - continued

	Overall Travel/Hallways	Bedroom	Bathroom	Other
Contractor	- door swings - door openings - hand rails - floor clearances	- floor clearances - door sings - door openings	- grab bars - blocking in walls should be standardized and required for areas such as bathrooms	- blocking in walls should be standardized and required for areas such as bathrooms and stairwells - curb heights - accommodate their needs - most homes are not built or designed for wheelchair and walker use or limited mobility; builders only meet minimum standards and usually to no rhyme or reason
Interior Designer 1	- reinforce walls - 3' doors as standard - entryway aesthetically appealing - open space (clear open space)	- reinforce walls - 2 masters (up and down) - bedroom on 1st floor	- reinforce walls - slip resistance for all ages - bathroom on 1st floor - faucets (easy to use for all) - seats in shower - handicap height toilets	- how long plan to live there - physical needs - incorporate all ages - sight - children need to reach varities (varied heights) - at new construction reinforce all walls for grab bars, etc. - program client

B.3 – continued

	Overall Travel/Hallways	Bedroom	Bathroom	Other
Interior Designer 2	- overall ease of access to the spaces - hallway widths that allow for mechanical assisted movement - smooth transitions between different flooring materials - door widths	- closets with reachable rods - doorway widths	- door widths - lever faucets - bathrooms that can be adapted for assisted toilet grab bars, raised seats, seat in showers, grab bars in shower	- lever door handles - pull/knobs with minimal effort to open items - toggle switches - smooth transitions between different flooring materials - materiality that provides low transitions, value contrasts, low maintenance - ease of ability to use handles, knobs, switches - environment with flexibility and with all needs on one level of the home given change of mobility and lack of ability to climb stairs - entry into the home
Summary	- floor clearances - doorway widths - ease of access to spaces - handrails - hallway widths that allow for walkers, scooters, wheelchairs, etc.	- reinforce walls - ease of access - flooring - door openings	- handicap bathroom - seats in shower - higher toilets - grab bars - location	- sensory - design depends on needs of client - incorporate all ages - reinforce walls - ease of use

Appendix C

Survey of Existing Guidelines

C.1 Guide to Sources

	Overall Travel/ Hallways	Bedroom	Bathroom	Other
ADA	Appendix C.2.a	Appendix C.3.a	Appendix C.4.a	Appendix C.5.a
Healthcare Guidelines	Appendix C.2.b	Appendix C.3.b	Appendix C.4.b	
Florida Building Code 2010, Residential			Appendix C.4.c	
2012 Florida Accessibility Code for Building Construction			Appendix C.4.d	
International Residential Code	Appendix C.2.c	Appendix C.3.c	Appendix C.4.e	
NKBA			Appendix C.4.f	
Textbooks	Appendix C.2.d	Appendix C.3.d	Appendix C.4.g	Appendix C.5.b
MetLife	Provides resources to help secure the future for individuals and communities. Provide resources such as home assessments and other reports/literature.			
AARP	Provides multiple online resources for the aging population. Provide resources such as home assessments, home modification articles and other report/literature.			
Experts	Appendix C.2.e	Appendix C.3.e	Appendix C.4.h	Appendix C.5.c

***** *Note.* The citation for each source can be found in the appendices.

C.2 Overall Travel/ Hallways

C.2.a
ADA

This information was drawn from the following sources:

Department of Justice (2010a). *2010 ADA standards for accessible design.* Retrieved on August 28, 2013 from http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Department of Justice (2010b). *Americans with disabilities act (ADA) standards.* Retrieved on August 28, 2013 from http://www.access-board.gov/attachments/article/1474/ADAstandards.pdf

- 403 Walking Surfaces
    - 403.5 Clearances
        - Walking surfaces shall provide clearances complying with 403.5
        - 403.5.1 Clear Width
            - Except as provided in 403.5.2 and 403.5.3, the clear width of walking surfaces shall be 36 inches (915mm) minimum.
        - 403.5.2 Clear Width at Turn
            - Where the accessible route makes a 180 degree turn around an element which is less than 48 inches (1120mm) wide, clear width shall be 42 inches (1065mm) minimum leaving the turn.
                - Exception: Where the clear width at the turn is 60 inches (1525mm) minimum compliance with 403.5.2 shall not be required.

        - 403.5.3 Passing Spaces
            - An accessible route with a clear width less than 60 inches (1524mm) shall provide passing spaces at intervals 200 feet (61m) maximum. Passing spaces shall be either: a space 60 inches (1525mm) minimum by 60 inches (1525mm) minimum; or an intersection of two walking surfaces providing a T-shaped space complying with 304.3.2 where the base and arms of the T-shaped space extend 48 inches (1220mm) minimum beyond the intersection.
- 404 Doors, Doorways, and Gates
    - 404.2 Manual Doors, Doorways, and Manual Gates
        - Manual doors and doorways and manual gates intended for user passage shall comply with 404.2
            - 404.2.3 Clear Width
                - Door openings shall provide a clear width of 32 inches (815mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610mm) deep shall provide a clear opening width of 36 inches (915mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (865mm) above the finish floor or ground. Projections into the clear opening width between

34 inches (865mm) and 80 inches (2030mm) above the finish floor or ground shall not exceed 4 inches (100mm).

- Exceptions: 1. In alteration, a projection of 5/8 inch (16mm) maximum into the required clear width shall be permitted for the latch side stop. 2. Door closers and door stops shall be permitted to be 78 inches (1980mm) minimum above the finish floor or ground.

- 404.2.4 Maneuvering Clearances
  - This section discusses the different directions to approach a door and the clearances that should be allowed for each approach.
- 404.2.7 Door and Gate Hardware
  - Handles, pulls, latches, locks and other operable parts on doors and gates shall be 34 inches (865mm) minimum and 48 inches (1220mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.
    - Exceptions: 1. Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles, and similar existing doors or grilles that are designed

with locks that are activated only at the top or bottom rail. 2. Access gates in barrier walls and fences protecting pools, spas, and hot tubs shall be permitted to have operable parts of the release of latch on self-latching devices at 54 inches (1370mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener, or integral combination lock.

- 302 Floor or Ground Surfaces
    - 302.1 General
        - Floor and ground surfaces shall be stable, firm and slip resistant and shall comply with 302.
    - 302.2 Carpet
        - Carpet or carpet tile shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. Carpet or carpet tile shall have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. Pile height shall be ½ inch (13mm) maximum. Exposed edges of carpet shall be fastened to floor surfaces and shall have trim on the entire length of the exposed edge. Carpet edge trim shall comply with 303.
- 303 Changes in Level
    - 303.1 General

        - Where changes in level are permitted in floor or ground surfaces, they shall comply with 303
    - 303.2 Vertical
        - Changes in level of ¼ inch (6.4mm) high maximum shall be permitted to be vertical
    - 303.3 Beveled
        - Changes in level between ¼ inch (6.4mm) high minimum and ½ inch (13mm) high maximum shall be beveled with a slope not steeper than 1:2
- 304 Turning Space
    - 304.1 General
        - Turning space shall comply with 304
    - 304.2 Floor or Ground Surfaces
        - Floor or ground surfaces of a turning space shall comply with 302. Changes in level are not permitted.
    - 304.3 Size
        - Turning space shall comply with 304.3.1 or 304.3.2
            - 304.3.1 Circular Space
                - The turning space shall be a space of 60 inches (1525mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with 306
            - 304.3.2 T-shaped Space
                - The turning space shall be a T-shaped space within a 60 inch (1525mm) square minimum with arms and base 36

inches (915mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610mm) minimum. The space shall be permitted to include knee and toe clearance complying with 306 only at the end of either the base or arm.

- 304.4 Door Swing
  - Doors shall be permitted to swing into turning spaces.

- 305 Clear Floor or Ground Space
  - 305.1 General
    - Clear floor or ground space shall comply with 305
  - 305.2 Floor or Ground Surfaces
    - Floor or ground surfaces of a clear floor or ground space shall comply with 302. Changes in level are not permitted.
  - 305.3 Size
    - The clear floor or ground space shall be 30 inches (760mm) minimum by 48 inches (1220mm) minimum
  - 305.4 Knee and Toe Clearance
    - Unless otherwise specified, clear floor or ground space shall be permitted to include knee and toe clearance complying with 306
  - 305.5 Position
    - Unless otherwise specified, clear floor or ground space shall be positioned for either forward or parallel approach to an element

- 306 Knee and Toe Clearance
    - 306.1 General
        - Where space beneath an element is included as part of clear floor or ground space or turning space, the space shall comply with 306. Additional space shall not be prohibited beneath an element but shall not be considered as part of the clear floor or ground space or turning space
    - 306.2 Toe Clearance
        - 306.2.1 General
            - Space under an element between the finish floor or ground and 9 inches (230mm) above the finish floor or ground shall be considered toe clearance and shall comply with 306.2
        - 306.2.2 Maximum Depth
            - Toe clearance shall extend 25 inches (635mm) maximum under an element
        - 306.2.3 Minimum Required Depth
            - Where toe clearance is required at an element as part of a clear floor space, the toe clearance shall extend 17 inches (430mm) minimum under the element
        - 306.2.4 Additional Clearance
            - Space extending greater than 6 inches (150mm) beyond the available knee clearance at 9 inches (230mm) above the finish floor or ground shall not be considered toe clearance
        - 306.2.5 Width

        - Toe clearance shall be 30 inches (760mm) wide minimum
    - 306.3 Knee Clearance
        - 306.3.1 General
            - Space under an element between 9 inches (230mm) and 27 inches (685mm) above the finish floor or ground shall be considered knee clearance and shall comply with 306.3
        - 306.3.2 Maximum Depth
            - Knee Clearance shall extend 25 inches (635mm) maximum under an element at 9 inches (230mm) above the finish floor or ground
        - 306.3.3 Minimum Required Depth
            - Where knee clearance is required under an element as part of a clear floor space, the knee clearance shall be 11 inches (280mm) deep minimum at 9 inches (230mm) above the finish floor or ground, and 8 inches (205mm) deep minimum at 27 inches (685mm) above the finish floor or ground
        - 306.3.4 Clearance Reduction
            - Between 9 inches (230mm) and 27 inches (685mm) above the finish floor or ground, the knee clearance shall be permitted to reduce at a rate of 1 inch (25mm) in depth for each 6 inches (150mm) in height
        - 306.3.5 Width
            - Knee clearance shall be 30 inches (760mm) wide minimum
- 505 Handrails

- 505.4 Height
    - Top of gripping surfaces of handrails shall be 34 inches (865mm) minimum and 38 inches (965mm) maximum vertically above walking surfaces, stair nosing, and ramp surfaces. Handrails shall be at a consistent height above walking surfaces, stair nosings, and ramp surfaces
        - Advisory: A maximum height of 28 inches (710mm) measured to the top of the gripping surface from the ramp surface or stair nosing is recommended for handrails designed for children. Sufficient vertical clearance between upper and lower handrails, 9 inches (230mm) minimum, should be provided to help prevent entrapment
- 505.5 Clearance
    - Clearance between handrail gripping surfaces and adjacent surfaces shall be 1 ½ inches (38mm) minimum

*All universal design principles apply to these ADA guidelines.

C.2 continued

C.2.b
Healthcare Guidelines

This information was drawn from the following source:

Winkel, S. R., Collins, D. S., Juroszek, S. P. & Ching, F. D. K. (2006). *Building codes illustrated for healthcare facilities.* Hoboken, New Jersey: John Wiley & Sons

- Section 1006.2
    - Requires that the illumination level of a means of egress be not less than 1 foot candle (11 lux) at the walking surface level
- Egress doors should always be 3'-0" x 6'-8" (914 x 2032mm) doors to provide the required minimum opening clearances. Maximum individual door width for swinging egress doors is 48 inches.

C.2 continued

C.2.c
International Residential Code

This information was drawn from the following source:

International Residential Code (IRC). (2011). *International residential code for one- and two-family dwellings.* UDA: International Code Council, Inc.

A. Section R311- Means of Egress

A.1. R311.2- Egress door

A.1.1. At least one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged and shall provide a minimum clear width of 32 inches (813mm) when measured between the face of the door and the stop, with the door open 90 degrees (1.57rad). The minimum clear height of the door opening shall not be less than 78 inches (1981MM) in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. Egress door shall be readily operable from inside the dwelling unit without the use of a key or special knowledge of effort.

A.2. R311.6- Hallways

A.2.1. The minimum width of a hallway shall be not less than 3 feet (914mm).

* Principles of universal design not addressed include:

2. Flexibility in Use
4. Perceptible Information

C.2 continued

C.2.d
Textbooks

This information was drawn from the following source:

Mitton, M. & Nystuen, C. (2011). *Residential interior design: A guide to planning spaces.* (2nd ed). Hoboken, New Jersey: John Wiley & Sons.

- 32 inches (813mm) clear space at doors- for swinging doors, use doors with a minimum width of 36 inches (914mm)
- Hallways and or paths of travel must be a minimum of 36 inches (914mm) wide
- As necessary, for wheelchair users, provide clear turning space (5 feet [1524mm] minimum diameter) or room for T-shaped turn
- Stairs are problematic for wheelchair users and others with mobility limitations, requiring that ramps or elevators be provided in place of stairs
- Well-designed handrails are required in areas of vertical circulation
- Required space for one wheelchair and one ambulatory person 48 inches (1219mm)
- Required space for two wheelchairs 60 inches (1524mm)
- Clear space for wheelchair must be provided in areas where the user must access items such as closets, plumbing fixtures, and other items for daily use; this clear space should be a minimum of 30 by 48 inches (762 by 1219mm)

This information was drawn from the following source:

Lawlor, D. & Thomas, M. A. (2008). *Residential design for aging in place.* Hoboken, New Jersey: John Wiley & Sons

- Entry should be large enough for those of various ages and abilities to maneuver easily
- Entry door should be as wide as possible with at least 18 inches of clear floor space on the pull side of the door

- Entry floor should be level and without thick, high-pile area rugs
- Wide doorways and flush thresholds should be included throughout the home as well as at entrance and long hallways
- Hallway that has a 42-48 inch minimum width allows space for a caregiver to provide assistance if need be and is spacious
- Provide adequate lighting in entry and pathways
- Use pocket doors when possible (don't create a barrier)
- Specify hallways at minimum 42 inches wide

* All universal design principles apply

C.2 continued

C.2.e
Experts Recommendations

- Floor clearances
- Doorway widths
- Ease of access to spaces
- Handrails
- Hallway widths that allow for walkers, scooters, wheelchairs, etc.

* Principles of universal design not addressed include:

4. Perceptible Information

C.3 Bedrooms

C.3.a
ADA

This information was drawn from the following sources:

Department of Justice (2010a). *2010 ADA standards for accessible design.* Retrieved on August 28, 2013 from http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Department of Justice (2010b). *Americans with disabilities act (ADA) standards.* Retrieved on August 28, 2013 from http://www.access-board.gov/attachments/article/1474/ADAstandards.pdf

- 807.2.3 Beds
    - Where beds are provided, clear floor space complying with 305 shall be provided on at least one side of the bed. The clear floor space shall be positioned for parallel approach to the side of the bed

C.3 continued

C.3.b
Healthcare Guidelines

This information was drawn from the following source:

Winkel, S. R., Collins, D. S., Juroszek, S. P. & Ching, F. D. K. (2006). *Building codes illustrated for healthcare facilities.* Hoboken, New Jersey: John Wiley & Sons

- Inpatient treatment room 240 gross square feet
- Outpatient areas 100 gross square feet
- Sleeping areas 120 gross square feet
- 36" (914mm) minimum clear space on both sides of bed and at foot of bed

* Principles of universal design not addressed include:

4. Perceptible Information

C.3 continued

C.3.c
International Residential Code

This information was drawn from the following source:

International Residential Code (IRC). (2011). *International residential code for one- and two-family dwellings.* USA: International Code Council, Inc.

A. Section R304- Minimum Room Areas

A.1. R304.1- Minimum area

A.1.1. Every dwelling unit shall have at least one habitable room that shall have not less than 120 sq ft (11m^2) of gross floor area,

A.2. R304.3- Minimum dimensions

A.2.1. Habitable rooms shall not be less than 7 feet (2134mm) in any horizontal dimension.

* Principles of universal design not addressed include:

4. Perceptible Information

C.3 continued

C.3.d
Textbooks

This information was drawn from the following source:

Mitton, M. & Nystuen, C. (2011). *Residential interior design: A guide to planning spaces.* (2nd ed). Hoboken, New Jersey: John Wiley & Sons.

- Provide a minimum clear space of 32 inches (813mm) at doors- use 36-inch (914mm) doors to accomplish this
- Provide a minimum clear circulation space of 32 inches (813mm) for access to bed and closet/storage
- Provide a clear turning space (5 feet [1524mm] in diameter) or room for a T-shaped-turn conveniently located within the room
- Provide clear space to access doors (clear area on latch side of door)
- Provide clear space to access drawers and other storage areas
- Adjust mounting heights of clothing rods and shelves
- Major circulation occurs at the entrance and most traveled areas; major circulation areas require 30 to 36 inches (762 to 914mm) of clear floor space
- Minor circulation areas- those less traveled- are most comfortable designed at 24 inches (610mm). However, they can function at 22 inches (559mm) and can be tightly sized at 18 inches (457mm)
- The areas required to make the bed is a minimum of 18 inches (457mm) and is more comfortably designed at 24 inches (610mm)
- Major circulation areas require 36 inches (914mm) for wheelchairs

- For wheelchair users, all circulation space is best kept at 36 inches (914mm) or more, with 32 inches (813mm) the minimum required for wheelchairs
- A clearance of 36 inches (914mm) around beds is required for wheelchairs, with a clear space 48 by 36 inches next to the closet
- 8-9 foot (2743-2438mm) ceiling height for closets
- Provide a clear space (for wheelchair users) 30 by 48 inches (762 by 1219mm) adjacent to closet for parallel access
- Bifold doors can allow for greater clear space at closet
- Pull-down rods are accessible through the use of a wand; pull-down shelves are also available
- 2'-10" (864mm) deep closet more beneficial
- walk-in closets more accessible

This information was drawn from the following source:

Kobus, R. L., Skaggs, R. L., Bobrow, M., Thomas, J., Payette, T. M., & Chin, S. P. (2008). *Building type basic for healthcare facilities.* (2nd ed). Hoboken, New Jersey: John Wiley & Sons

- Increased room sizes are necessary for universal and other patient rooms to accommodate greater space needs for equipment, family support, separate staff sinks and increased utilities
- Rooms should be sufficiently sized
- Each room should contain a dedicated toilet and shower
- Each room should have storage space

This information was drawn from the following source:

Lawlor, D. & Thomas, M. A. (2008). *Residential design for aging in place.* Hoboken, New Jersey: John Wiley & Sons

- Clear floor space
- Specify hallways to and in master suite at 42 inches wide
- Minimum doorway allowances into and within the suite should be minimum of 32 inches wide
- Allow 36 inches of clear space on either side of the bed
- 60 by 60 inch space to maneuver with the room once furniture is placed
- Walk-in closets that are at least 32 inches wide, center aisle is a minimum of 36 inches wide and storage systems within are easy to reach and adjusted for specific needs of the client
- Closet rods that have an adjustable height of 30 to 66 inches above floor
- Non-walk-in closets, consider bypass sliding doors, double pocket doors, double swing doors, or bi-fold doors
- Windowsills at 30 inches above finished floor
- Specify extra outlets
- Place lighting controls within easy reach of the bed
- Low-pile carpet or glare-free flooring material
- Consider the combined height of mattress, box springs and bed frame
- Height adjustable beds
- Specify lower light switches (42 to 48 inches AFF) and higher electrical outlets (18 to 22 inches AFF)
- Use lighting controls

* All universal design principles apply

C.3 continued

C.3.e
Expert Recommendations

- Reinforce walls
- Ease of access
- Flooring
- Door openings

* Principles of universal design not addressed include:

4. Perceptible Information

C.4 Bathrooms

C.4.a
ADA

This information was drawn from the following sources:

Department of Justice (2010a). *2010 ADA standards for accessible design.* Retrieved on August 28, 2013 from http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Department of Justice (2010b). *Americans with disabilities act (ADA) standards.* Retrieved on August 28, 2013 from http://www.access-board.gov/attachments/article/1474/ADAstandards.pdf

- 603 Toilet and Bathing Rooms
    - 603.1 General
        - Toilet and bathing rooms shall comply with 603
    - 603.2 Clearances
        - Clearances shall comply with 603.2
            - 603.2.1 Turning Space
                - Turning space complying with 304 shall be provided within the room
            - 603.2.2 Overlap
                - Required clear floor spaces, clearance at fixtures, and turning space shall be permitted to overlap
            - 603.2.3 Door Swing

- Door shall not swing into the clear floor space or clearance required for any fixture. Doors shall be permitted to swing into the required turning space.
    - Exceptions: 1. Doors to a toilet room or bathing room for a single occupant accessed only through a private office and not for common use or public use shall be permitted to swing into the clear floor space or clearance provided the swing of the door can be reversed to comply with 603.2.3, 2. Where the toilet room or bathing room is for individual use and clear floor space complying with 305.3 is provided within the room beyond the arc of the door swing, doors shall be permitted to swing into the clear floor space or clearance required for any fixture

- 603.3 Mirrors
    - Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1015mm) maximum above the finish floor or ground. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (890mm) maximum above the finish floor or ground
        - Advisory: A single full-length mirror can accommodate a greater number of people, including children. In order for mirrors to be

usable by people who are ambulatory and people who use wheelchairs, the top edge of mirrors should be 74 inches (1880mm) minimum from the floor or ground.

- 603.4 Coat Hooks and Shelves
  - Coat hooks shall be located within one of the reach ranges specified in 308. Shelves shall be located 40 inches (1015mm) minimum and 48 inches (1220mm) maximum above the finish floor.

- 604 Water Closets and Toilet Compartments
  - 604.1 General
    - Water closets and toilet compartments shall comply with 604.2 through 604.8.
      - Exception: Water closets and toilet compartments for children's use shall be permitted to comply with 604.9
  - 604.2 Location
    - The water closet shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 16 inches (405mm) minimum to 18 inches (455mm) maximum from the sidewall or partition, except that the water closet shall be 17 inches (430mm) minimum and 19 inches (485mm) maximum from the sidewall or partition in the ambulatory accessible toilet compartment specified in 604.8.2. Water closets shall be arranged for a left-hand or right-hand approach
  - 604.3 Clearance

- Clearances around water closets and in toilet compartments shall comply with 604.3
    - 604.3.1 Size
    - Clearance around a water closet shall be 60 inches (1525mm) minimum measured perpendicular from the side wall and 56 inches (1420mm) minimum measured perpendicular from the rear wall

- 604.4 Seats
    - The seat height of a water closet above the finish floor shall be 17 inches (430mm) minimum and 19 inches (485mm) maximum measured to the top of the seat. Seats shall not be sprung to return to a lifted position
        - Exceptions: 1. A water closet in a toilet room for a single occupant accessed only through a private office and not for common use or public use shall not be required to comply with 604.4., 2. In residential dwelling units, the height of water closets shall be permitted to be 15 inches (380mm) minimum and 19 inches (485mm) maximum above the finish floor measured to the top of the seat
- 604.5 Grab Bars
    - Grab bars for water closets shall comply with 609. Grab bars shall be provided on the sidewall closest to the water closet and on the rear wall.
        - Exceptions: 2. In residential dwelling units, grab bars shall not be required to be installed in toilet or bathrooms provided that

reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with 604.5

- Advisory: Reinforcement must be sufficient to permit the installation of rear and side wall grab bars that fully meet all accessibility requirements including, but not limited to, required length, installation height, and structural strength

- 604.5.1 Side Wall
  - The sidewall grab bar shall be 42 inches (1065mm) long minimum, located 12 inches (305mm) maximum from the rear wall and extending 54 inches (1370mm) minimum from the rear wall.
- 604.5.2 Rear Wall
  - The rear wall grab bar shall be 36 inches (915mm) long minimum and extend from the centerline of the water closet 12 inches (305mm) minimum on one side and 24 inches (610mm) minimum on the other side

- 604.8 Toilet Compartments
  - Discusses dimensions for wheelchair accessible toilet compartments. These can be referenced and applied in a home if the bathroom contains a single toilet room within the bathroom.

- 606 Lavatories and Sinks
  - 606.1 General
    - Lavatories and sinks shall comply with 606
  - 606.2 Clear Floor Space

- A clear floor space complying with 305, positioned for a forward approach, and knee and toe clearance complying with 306 shall be provided
    - Exceptions: 3. In residential dwelling units, cabinetry shall be permitted under lavatories and kitchen sinks provided that all of the following conditions are met: a) the cabinetry can be removed without removal or replacement of the fixture, b) the finish floor extends under the cabinetry, and c) the walls behind and surrounding the cabinetry are finished 4. A knee clearance of 24 inches (610mm) minimum above the finish floor or ground shall be permitted at lavatories and sinks used primarily by children 6 through 12 years where the rim or counter surface is 31 inches (785mm) maximum above the finish floor or ground 5. A parallel approach complying with 305 shall be permitted to lavatories and sinks used primarily by children 5 years and younger

- 606.3 Height
    - Lavatories and sinks shall be installed with the front of the higher of the rim or counter surface 34 inches (865mm) maximum above the finish floor or ground
        - Exceptions: 2. In residential dwelling units kitchens, sinks that are adjustable to variable heights, 29 inches (735mm) minimum and 36 inches (915mm) maximum, shall be permitted where rough-in

plumbing permits connections of supply and drain pipes for sinks mounted at the height of 29 inches (735mm)

- 606.4 Faucets
  - Controls for faucets shall comply with 309. Hand-operated metering faucets shall remain open for 10 seconds minimum
- 607 Bathtubs
  - 607.1 General
    - Bathtubs shall comply with 607
  - 607.2 Clearance
    - Clearance in front of the bathtubs shall extend the length of the bathtub and shall be 30 inches (760mm) wide minimum. A lavatory complying with 606 shall be permitted at the control end of the clearance. Where a permanent seat is provided at the head end of the bathtub, the clearance shall extend 12 inches (305mm) minimum beyond the wall at the head end of the bathtub.
  - 607.3 Seat
    - A permanent seat at the head end of the bathtub or a removable in-tub seat shall be provided. Seats shall comply with 610.
  - 607.4 Grab Bars
    - Grab bars for bathtubs shall comply with 609 and shall be provided in accordance with 607.4.1 and 607.4.2
      - Exceptions: 2. In residential dwelling units, grab bars shall not be required to be installed in bathtubs located in bathing

facilities provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with 607.4

- 607.4.1 Bathtubs with Permanent Seats
  - For bathtubs with permanent seats, grab bars shall be provided in accordance with 607.4.1
  - 607.4.1.1 Back Wall
    - Two grab bars shall be installed on the back wall, one located in accordance with 609.4 and the other 8 inches minimum (205mm) and 10 inches (255mm) maximum above the rim of the bathtub. Each grab bar shall be installed 15 inches (380mm) maximum from the head end wall and 12 inches (305mm) maximum from the control end wall
  - 607.4.1.2 Control End Wall
    - A grab bar 24 inches (610mm) long minimum shall be installed on the control end wall at the front of the bathtub
- 607.4.2 Bathtubs without Permanent Seats
  - For bathtubs without permanent seats, grab bars shall comply with 607.4.2
  - 607.4.2.1 Back Wall

        - Two grab bars shall be installed on the back wall, one located in accordance with 609.4 and other located 8 inches (205mm) minimum and 10 inches (255mm) maximum and shall be installed 24 inches (610mm) maximum from the head end wall and 12 inches (305mm) maximum from the control end wall
    - 607.4.2.2 Control End Wall
        - A grab bar 24 inches (610mm) long minimum shall be installed on the control end wall at the front edge of the bathtub
    - 607.4.2.3 Head End Wall
        - A grab bar 12 inches (305mm) long minimum shall be installed on the head end wall at the front edge of the bathtub
- 607.5 Controls
    - Controls, other than drain stoppers, shall be located on an end wall. Controls shall be between the bathtub rim and grab bar, and between the open side of the bathtub and the centerline of the width of the bathtub. Controls shall comply with 309.4
- 607.6 Shower Spray Unit and Water

- A shower spray unit with a hose of 59 inches (1500mm) long minimum that can be used both as a fixed-position shower head and as a hand-held shower shall be provided. The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars. Bathtub shower spray units shall deliver water that is 120°F (49°C) maximum
- 607.7 Bathtub Enclosures
    - Enclosures for bathtubs shall not obstruct controls, faucets, shower and spray units or obstruct transfer from wheelchairs onto bathtub seats or into bathtubs. Enclosures on bathtubs shall not have tracks installed on the rim of the open face of the bathtub.

- 608 Shower Compartments
    - This section discusses shower compartments and accessible shower compartments (roll-in shower compartments). These guidelines can be referenced and used in residential bathrooms for those who may need an accessible shower.
- 609 Grab Bars
    - This section discusses guidelines for grab bar placement and installation.
- 610 Seats

- Different types of seats for bathing units exist. There are guidelines for each of these, but most have been discussed in previous sections.

* All universal design principles apply

C.4 continued

C.4.b
Healthcare Guidelines

This information was drawn from the following source:

Winkel, S. R., Collins, D. S., Juroszek, S. P. & Ching, F. D. K. (2006). *Building codes illustrated for healthcare facilities.* Hoboken, New Jersey: John Wiley & Sons

- A clear space of 30" by 48" (762 by 1219mm) is to be provided if the door swings into the room, clear of the door swing
- Door shall be 32" minimum clear width
- 60" (1524mm) clear dimension

* Principles of universal design not addressed include:

4. Perceptible Information

C.4 continued

C.4.c
2010 Florida Building Code, Residential

This information was drawn from the following source:

International Code Council (ICC). (2011). *2010 Florida building code, residential*. USA: International Code Council, Inc.

A. Section R320 Accessibility

A.1. R320.1 Shall be in accordance with the provisions of the Florida Building Code, Accessibility

A.1.1. R320.1.1

- All new single-family houses, duplexes, triplexes, condominiums and townhouses shall provide at least one bathroom, located with maximum possible privacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch (737mm) clear opening. However, if only a toilet room is provided at grade level, such toilet rooms shall have a clear opening of not less than 29 inches (737mm).

* Principles of universal design not addressed include:

1. Equitable Use
2. Flexibility in Use
3. Simple and Intuitive Use
4. Perceptible Information
5. Tolerance for Error
6. Low Physical Effort
7. Size and Space for Approach and Use

C.4 continued

C.4.d
2012 Florida Accessibility Code for Building Construction

This information was drawn from the following source:

Residential Facilities. (2012). *2012 Florida Accessibility Code for Building Construction.* Retrieved on September 14, 2013 from www.floridabuilding.org/fbc/committees/accessibility/aac/Changes_to_Law/2012_Florida_Accessibility_Code_Final%20.pdf

A. 233.3.6

A.1. All new single-family houses, duplexes, triplexes, condominiums and townhouses shall provide at least one bathroom, located with maximum possible privacy, where bathrooms are provided on habitable grade levels, with a door that has a 29-inch clear opening. However, if only a toilet room is provided at grade level, such toilet room shall have a clear opening of at least 29 inches.

* Principles of universal design not addressed include:

1. Equitable Use
2. Flexibility in Use
3. Simple and Intuitive Use
4. Perceptible Information
5. Tolerance for Error
6. Low Physical Effort
7. Size and Space for Approach and Use

C.4 continued

C.4.e
International Residential Code

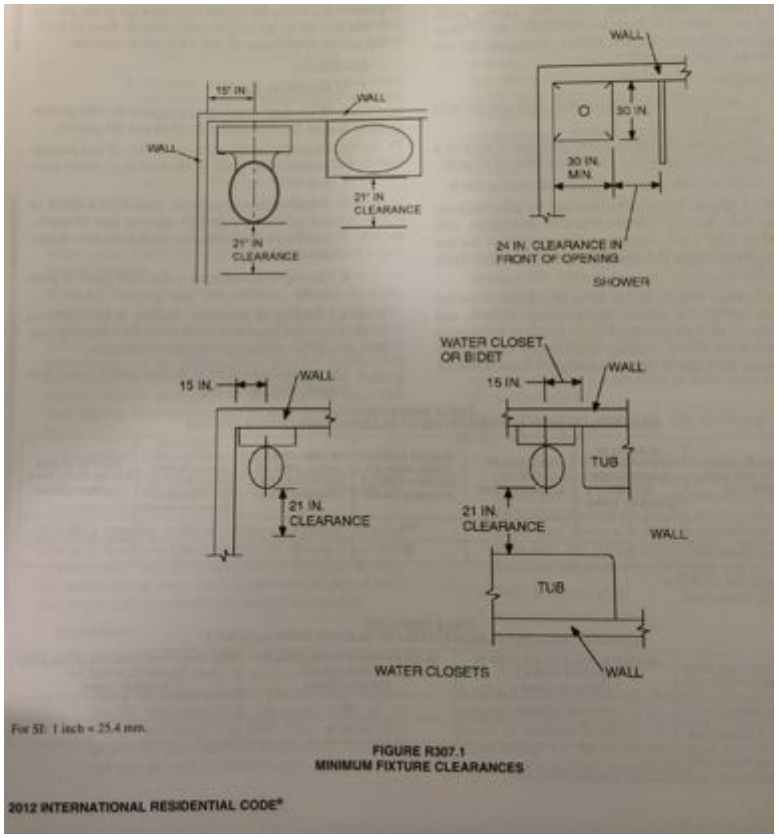
This information was drawn from the following source:

International Residential Code (IRC). (2011). *International residential code for one- and two-family dwelling.* USA: International Code Council, Inc.

A. Section R307- Toilet, Bath and Shower Spaces

A.1. R307.1- Space Required

A.1.1. Fixtures shall be spaced in accordance with Figure R307.1 and in accordance with the requirements of Section P2705.1



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B. Section R306- Sanitation

B.1. R306.1- Toilet facilities

- Every dwelling unit shall be provided with a water closet, lavatory and a bathtub or shower

C. Section P2705- Installation

C.1. P2705.1- General

- The installation of fixtures shall conform with the following:
  - Floor-outlet or floor-mounted fixtures shall be secured to the drainage connection and to the floor, where so designed, by screws, bolts, washers, nuts and similar fasteners of copper, brass or other corrosion-resistant material
  - Wall-hung fixtures shall be rigidly supported so that strain is not transmitted to the plumbing system
  - Where fixtures come in contact with walls and floors, that contact area shall be water tight
  - Plumbing fixtures shall be usable
  - Water closets, lavatories and bidets. A water closet, lavatory or bidet shall not be set closer than 15 inches (381mm) from its center to any side wall, partition, or vanity or closer than 30 inches (762mm) center-to-center between adjacent fixtures. There shall be a clearance of not less than 21 inches (533mm) in front of a water closet, lavatory, or bidet to any wall, fixture or door
  - The location of piping, fixtures or equipment shall not interfere with the operation of windows or doors

- In flood hazard area as established by Table R301.2(1), plumbing fixtures shall be located or installed in accordance with Section R322.1.7
- Integral fixture-fitting mounting surfaces on manufactured plumbing fixtures or plumbing fixtures constructed on site, shall meet the design requirements of ASME A112.12.2/CSA B45.1 or ASME A112.19.3/ CSA B45.1

D. Section P2708- Showers

D.1. P2708.1- General

- Shower compartments shall have not less than 900 square inches ($0.6m^2$) of interior cross-sectional area. Shower compartments shall be not less than 30 inches (762mm) in minimum dimension measured from the finished interior dimension of the shower compartment, exclusive of fixture valves, shower heads, soap dishes, and safe grab bars or rails. The minimum required area and dimension shall be measured from the finished interior dimension at a height equal to the top of threshold and at a point tangent to its centerline and shall be continued to a height of not less than 70 inches (1778mm) above the shower drain outlet. Hinged shower doors shall open outward. The wall area above built-in tubs having installed shower heads and in shower compartments shall be constructed in accordance with Section R702.4. Such walls shall form a water-tight joint with each other and with either the tub, receptor or shower floor
  - Exceptions
    - Fold-down seats shall be permitted in the shower, provided the required 900-square-inch ($0.6m^2$) dimension is maintained when the seat is in the folded-up position

- Shower compartments having not less than 25 inches (635mm) in minimum dimension measured from the finished interior dimension of the compartment provided that the shower compartment has a cross-sectional area of not less than 1,300 square inches ($0.838m^2$)
- P27081.1 Access
    - The shower compartment access and egress opening shall have a clear and unobstructed finished width of not less than 22 inches (559mm)

* All universal design principles apply

C.4 continued

C.4.f
NKBA Recommendations

This information was drawn from the following source:

NKBA (2012). *Kitchen and bathroom: Planning guidelines with access standards.* Hoboken, New Jersey: John Wiley & Sons

1) Door/Entry

- The clear opening of a doorway should be at least 32" (813mm). This would require a minimum 2'10" (864mm) door.
- If the existing structure precludes changing the opening, then a minimum 2'0" (610mm) door is allowable.
    - Access Standard:
        - The clear opening of a doorway should be at least 34" (864mm). This would require a minimum 3'0" (914mm) door.

2) Door Interference

- Access Standard
    - The door area should include clear floor space for maneuvering, which varies according to the type of door and the direction of approach.

3) Clear Space

- Plan a clear floor space of at least 30" (762mm) from the front edge of all fixtures (e.g., lavatory, toilet, bidet, tub, and shower) to any opposite bath fixture, wall or obstacle.
    - Access Standard

- Plan a minimum clear floor space of 30” x 48” (762mm x 1219mm) centered at each fixture, plus space for maneuvering including approach and turning for a person using a wheelchair.
- Plan a knee space at the lavatory or work space to allow for a front approach for a seated user. Recommended minimum size of a knee space is 36” wide x 27” high x 8” deep (914mm x 686mm x 203mm), increasing to 17” (432mm) deep in the toe space, which extends 9” (229mm) from the floor. Insulation for exposed pipes should be provided.
- Consider the user’s method of transfer to the toilet to plan a clear space to fit the user’s needs.

4) Single-Lavatory Placement

- The distance from the centerline of the lavatory to the sidewall/tall obstacle should be at least 20” (508mm).
- The minimum distance between a wall and the edge of a freestanding or wall-hung lavatory is 4” (102mm).

5) Double-Lavatory Placement

- The distance between the centerlines of two lavatories should be at least 36 (914mm). The minimum distance between the edges of two freestanding or wall-hung lavatories is 4” (102mm).

6) Lavatory/ Vanity Height

- The height for a lavatory varies between 32” and 43” (813mm and 1092mm) to fit the user.
    - Access Standard

        - Lavatory controls should be within the user's reach and operable with minimal effort

7) Counter

- Specify clipped or round corners rather than sharp edges on all counter.

8) Shower Size

- The interior shower size is at least 36" x 36" (914mm x 914mm).
    - Access Standard
        - Plan either a transfer or a roll-in shower.
        - Roll-in shower entries: For a 60" (1524mm) deep shower, a 32" (813mm) wide entry is adequate. For a 42" (1067mm) deep shower, the entry must be at least 36" (914mm) wide to allow for turning space.

9) Tub/ Shower Controls

- The shower controls should be accessible from both inside and outside the shower spray and be located between 38" and 48" (965mm and 1219mm) above the floor depending on user's height.
- The tub controls should be accessible from both inside and outside the tub and be located between the rim of the bathtub and 33" (838mm) above the floor.
    - Access Standard
        - Controls should be offset toward the room and easy to grasp, as with lever or loop handles.
        - Hot and cold should be identified with red and blue indicators.
        - Provide a handheld spray at a height accessible to the user.

10) Shower/ Tub Seat

- Plan a seat within the shower that is 17”-19” (432mm x 483mm) above the shower floor and 15” (381mm) deep.
    - Access Standard
        - Plan a seat in the shower and/ or bathtub to fit the parameters of the space and the needs of the user.

11) Tub/Shower Surround

- The wall area above a tub or shower pan should be covered in a waterproof material extending at least 3” (76mm) above the showerhead rough in.

12) Grab Bars

- Plan grab bars to facilitate access to and maneuvering within the tub and shower areas.
- Tub and shower walls should be prepared (reinforced) at time of construction to allow for installation of grab bars to support a static load of 250 lbs (113kg).
- Grab bars should be placed at 33” to 36” (838mm to 914mm) above the floor.
- Grab bars must be 1 ¼” to 2” (32mm to 60mm) in diameter and extend 1 ½” (38mm) from the wall.
    - Access Standard
        - Walls throughout the bathroom should be prepared (reinforced) at time of construction to allow for installation of grab bars to support minimum of 250 lbs. (113kg) of force in any direction.
        - Grab bars should be placed according to the needs and height of the user, particularly near the tub/shower and the toilet.

13) Glazing

- Access Standard

- Consider line of sight of user when planning height of bottom of glazing.

14) Tub/Shower Door

- Access Standard
  - Minimize thresholds at the shower entry to no more than ½" (13mm).

15) Steps

- Steps should not be placed outside of tub.
- If steps are used, grab bar/ handrail is mandatory.

16) Flooring

- Slip-resistant surfaces should be specified for the general bath flooring, shower floors, and tub/shower bottoms.

17) Equipment Access

- Access Standard
  - Equipment controls should be placed between 15" and 48" (381mm and 1219mm) above the finished floor.

18) Toilet/Bidet Placement

- The distance from the centerline of toilet and/or bidet to any bath fixture, wall or other obstacle should be at least 18" (457mm).
  - Access Standard
    - Consider user height and ability when determining toilet height.

19) Toilet Compartment

- The size for a separate toilet compartment should be at least 36" x 66" (914mm x 1676mm) with a swing-out or pocket door.
  - Access Standard

        - To maximize access, provide privacy in the toileting area without using a separate compartment.

20) Storage

- Provide adequate, accessible storage for toiletries, bath linens, grooming, and general bathroom supplies at point of use.
    - Access Standard
        - Provide storage of frequently used items between 15” and 48” (381mm and 1219mm) above the finished floor.

21) Accessories

- Place a mirror above or near the lavatory at a height that takes the user’s eye height into consideration.
- The toilet paper holder should be located 8” to 12” (203mm to 305mm) in front of the edge of the toilet bowl, centered at 26” (660mm) above the floor.
- Additional accessories, such as towel holders and soap dishes, should be conveniently located near all bath fixtures.
    - Access Standards
        - Plan a full-height mirror to provide reflection at eye level, regardless of the user’s height or stature.
        - Accessories should be placed between 15” and 48” (381mm and 1219mm) above the floor, and operable with a closed fist and with minimal effort.

22) Electrical Receptacles

- All GFCI receptacles should be located at electrical appliance points of use.

23) Lighting

- In addition to general lighting, task lighting should be provided for each functional area in the bathroom (e.g., grooming, showering).
    - Access Standard
        - Task lighting at the vanity should be beside the mirror and at eye level, with the lamp not visible to the eye.
        - Lighting controls should be between 15" and 48" (381mm and 1219mm) above the floor and operable with a closed fist and with minimal effort.

24) Ventilation

- Plan a mechanical exhaust system, vented to the outside, for each enclosed area.
    - Access Standard
        - Ventilation controls should be placed 15" to 48" (381mm to 1219mm) above the floor, operable with minimal effort, easy to read, and with minimal noise pollution.

25) Heat

- A supplemental heat source (e.g., heat lamp, toe kick heater, or floor heat) should be considered.

* Principles of universal design not addressed include:

4. Perceptible Information

C.4 continued

C.4.g
Textbooks

This information was drawn from the following source:

Mitton, M. & Nystuen, C. (2011). *Residential interior design: A guide to planning spaces.* (2nd ed). Hoboken, New Jersey: John Wiley & Sons.

- Wall-mounted sinks are ideal for use by those in wheelchairs, as they allow for chair clearance directly under the sink, easing access to the sink bowl, faucet, and controls
- Single-lever faucet handles are the best choice for bathroom use
- Designers must consider the selection of lavatory faucets when designing bathrooms for use by individuals with disabilities, the elderly, and small children
- Bathtub accessibility is highly dependent on the specific needs of the individual client
- Assess current and future needs of client
- Bathtubs can be accessible if they have a seat, structural reinforcement for grab bars, controls mounted near the entry side of head wall, 30-in by 60-in (762 by 1524mm) minimum clear floor space, hand-held shower spray
- Grab bars (if required) should be provided at both ends of the tub, and two bars (of different heights) are required along the side of the tub
- 3’ by 3’ shower can help users maintain balance and allows them to catch themselves should they fall; requires a folding seat
- 5’ by 5’ shower allows for a wheelchair to roll directly into the stall; can have a shower seat
- Shower controls should be placed where user can reach them and turn before they get in shower

- Pressure-balanced valves and hot water limiters
- Grab bars in showers
- Water shutoff valves should be accessible
- If a shower has a door, the door swing must be considered
- Showerheads and curtain rods are often mounted at 72 inches (1829mm) A.F.F., although mounting heights will vary based on individual needs
- Wheelchair-accessible showers require a clear space of 30 by 48 inches (762 by 1219mm) adjacent to the shower entry for approach and transfer as well as for grab bars
- Up to 1 foot (305mm) of the 4 feet (1219mm) required for forward approach can extend under a lavatory with clear access to knee space
- Vertical grab bar height is 18 inches (457mm) minimum; bar should be located 4 (102mm) inches maximum from side of shower
- Sink bowl mounted as close to front edge as possible
- Wheelchair-accessible vanity design requires a clear area under the sink that is a minimum of 27 inches (686mm) above the floor; 29 inches (737mm) is recommended for most adults along with 30 inches (762mm) of clear approach space
- 40 inches (1016mm) is the maximum mirror height, when mirror is not tilted (tilted mirrors are preferred by many wheelchair users)
- Controls and outlets should be 15 to 48 inches (381 to 1219mm) above the floor
- Soap, towels, and other related items should be installed within seated reach and within 15 to 48 inches (381 to 1219mm) above the floor

- Wheelchair-accessible toilet, bidet, and sink fixtures require clearance and placement; various models require 3 to 9 inches (76 to 229mm) of clearance between fixture and wall
- Creating an accessible half-bath makes home visitable; doorways that provide an opening of at least 32 inches (813mm) and clear turning area (5 foot diameter [1524mm]) within the room must be provided
- A 3-foot (914mm) door, when door swings out, allows the turning radius to exist free of door or a 32-inch (813mm) pocket door
- Wall-hung lavatory, 18 by 22 inches (457 by 559mm) in half bath
- 36-inch (914mm) and 42-inch (1067mm) grab bars mounted 33 to 36 inches (838 to 914mm) above floor in half bath
- Clear space measuring 30 by 48 inches (762 by 1219mm) in front of sink [half bath]
- Clearance of 30 by 48 inches (762 by 1219mm) in front of toilet (parallel access) [half bath]

This information was drawn from the following source:

Lawlor, D. & Thomas, M. A. (2008). *Residential design for aging in place.* Hoboken, New Jersey: John Wiley & Sons

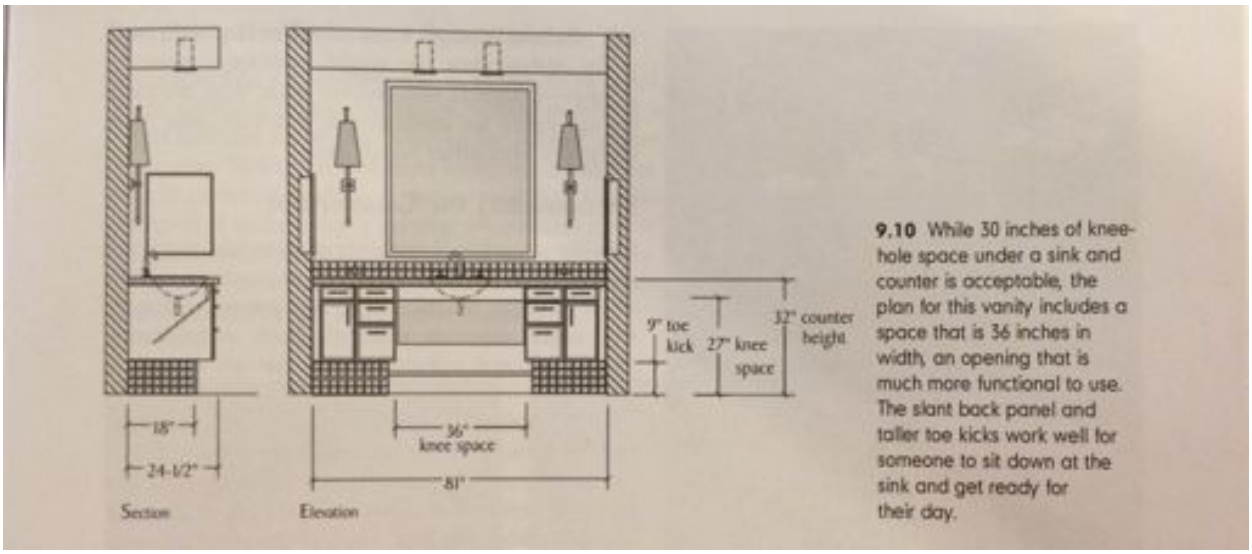
- Allow plenty of room for the door to swing out fully 90 degrees or more for someone to exit easily from shower
- Make entrances to the bathroom a minimum of 32” of clear unobstructed space between the doorjambs, but when space allows, make the doorways and openings as wide as possible, which will result in open clear space around vanity
- Doorways that are 34 to 36 inches wide permit better access
- Hinge door to open out toward the hall rather than into bathroom

- 5-ft turning radius for wheelchair (if needed)
- Bathroom door thresholds should not exceed one-quarter inch in height unless the threshold between the bathroom and adjacent room is beveled to blend the varying heights
- Taller toe kick (9 inches with a 6-inch setback from the face edge of the cabinet)
- Vanity cabinet height should be based on the size and height of the most frequent user
- Removable doors or doors that pocket back into vanity cabinet
- Select low maintenance countertops
- Install toward front of cabinet
- Lever or paddle handle controls
- Toilets should be at minimum 18 inches from vanity cabinets, bathtubs, or sidewalls
- Level threshold at shower entry, change in texture and patterns in the flooring material will provide a visual clue where the shower pan begins and the main floor ends
- Tubs should have seats as well
- Minimum depth of a curb-less shower to be 30 inches, more generous minimum depth of 36 inches is recommended; 42-48 inches in depth allows for someone in a wheelchair to enter shower and retain complete range of motion for bathing and accessing the water controls
- At least 60 inches in all directions for roll-in shower
- Choose appropriate material

* All universal design principles apply

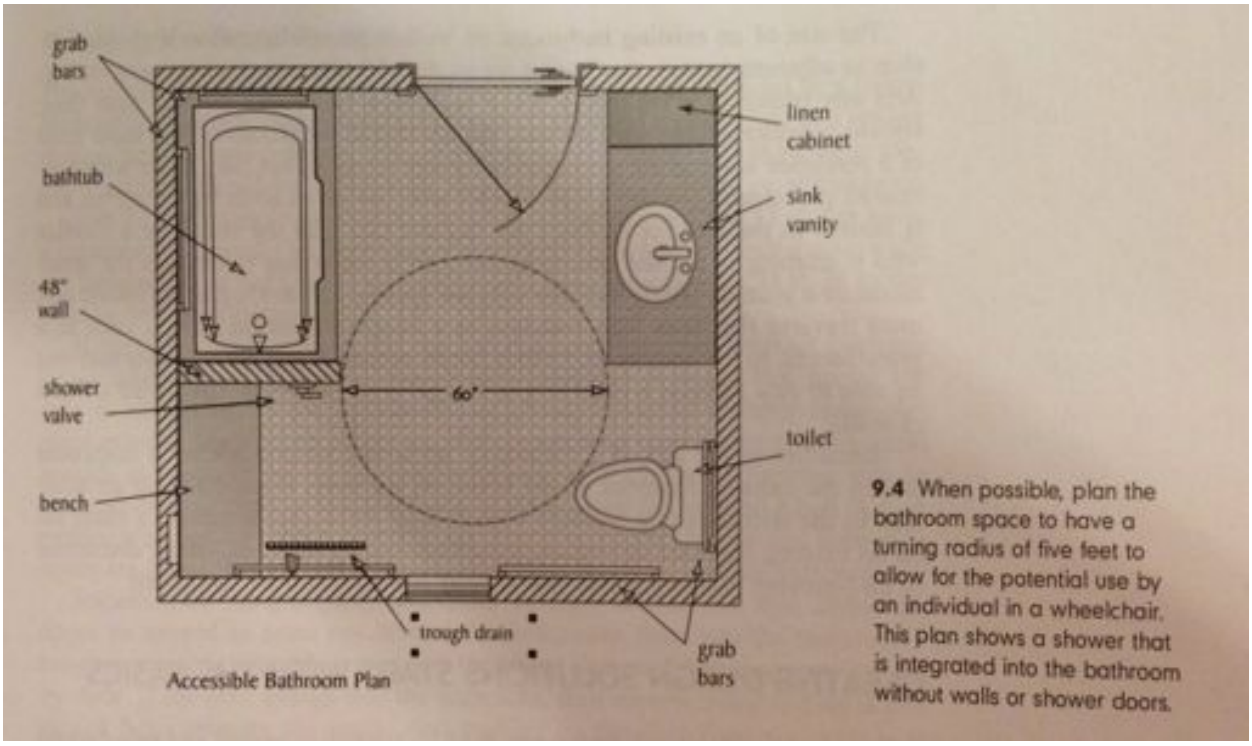
This information was drawn from the following source:

Lawlor, D. & Thomas, M. A. (2008). *Residential design for aging in place.* Hoboken, New Jersey: John Wiley & Sons



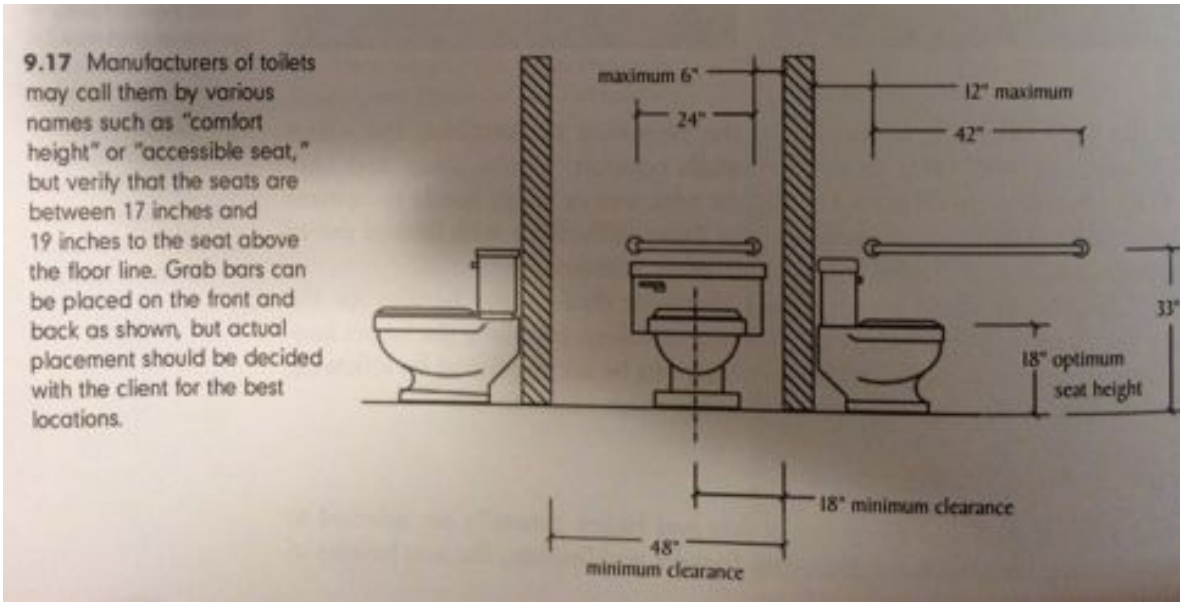
9.10 While 30 inches of knee-hole space under a sink and counter is acceptable, the plan for this vanity includes a space that is 36 inches in width, an opening that is much more functional to use. The slant back panel and taller toe kicks work well for someone to sit down at the sink and get ready for their day.

p. 135



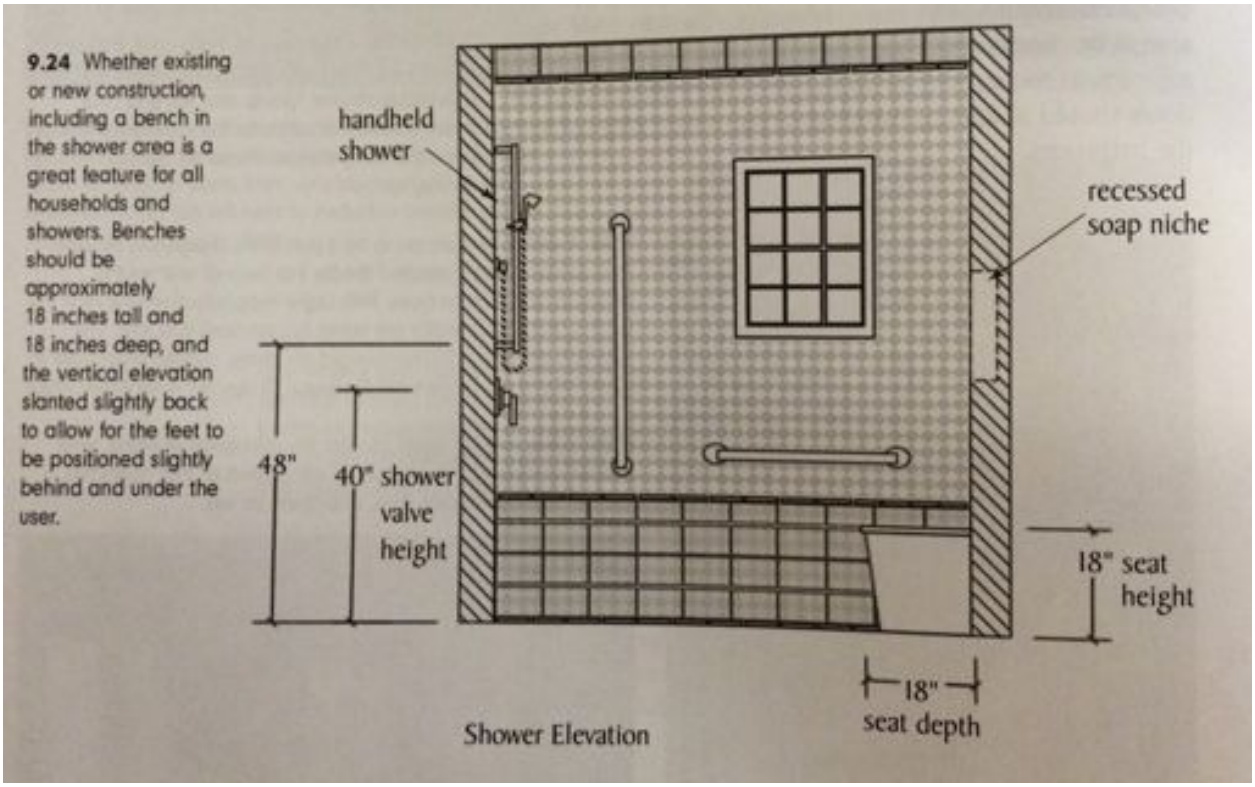
9.4 When possible, plan the bathroom space to have a turning radius of five feet to allow for the potential use by an individual in a wheelchair. This plan shows a shower that is integrated into the bathroom without walls or shower doors.

p. 131



9.17 Manufacturers of toilets may call them by various names such as "comfort height" or "accessible seat," but verify that the seats are between 17 inches and 19 inches to the seat above the floor line. Grab bars can be placed on the front and back as shown, but actual placement should be decided with the client for the best locations.

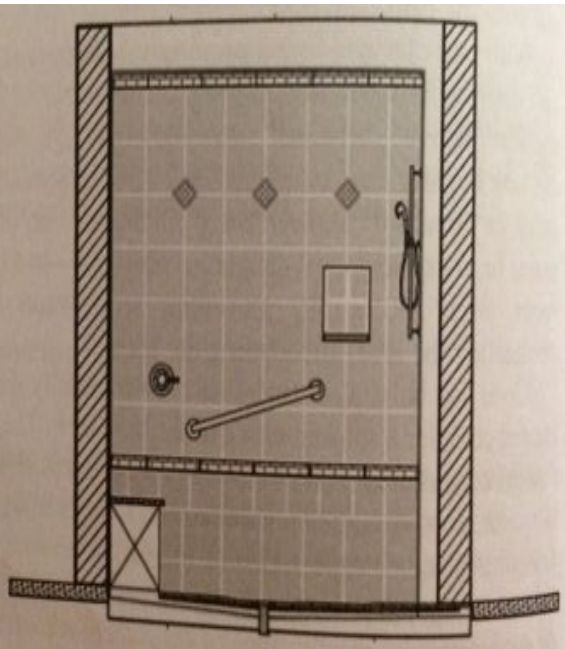
p. 138



9.24 Whether existing or new construction, including a bench in the shower area is a great feature for all households and showers. Benches should be approximately 18 inches tall and 18 inches deep, and the vertical elevation slanted slightly back to allow for the feet to be positioned slightly behind and under the user.

p. 142

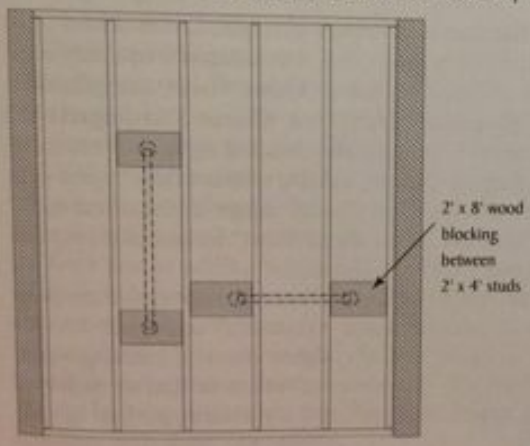
9.26 To ensure proper drainage of the water in a curbless shower, the shower floor should have a slope toward the drain 1/4 inch to 3/8 inch for every foot of floor. Ideally, position and locate the drain at the point farthest from the entry area, even if it is located near an interior corner of the floor.



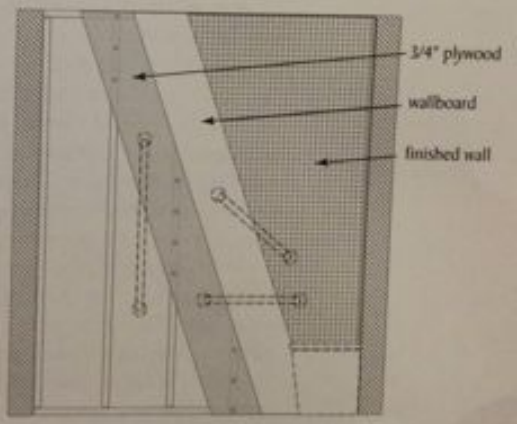
Curbless Shower Elevation with Floor Drain

p. 144

9.27 and 9.28 Figuring out the framing location where the grab bars should be placed should be the preference and desire of the client so plan ahead and know where to place plywood or wood blocking during the framing stages of the project. A better solution and one that gives more flexibility is to frame the entire walls of the shower. With plywood covering the entire walls behind the tile or stone face, placement can be made anywhere and at any time.



Shower Walls with Blocking for Grab Bars



Shower Wall with Plywood Backing on All Walls

p. 145

C.4 continued

C.4.h
Expert Recommendations

- Handicap bathroom
- Seats in shower
- Higher toilets as standard
- Grab bars
- Location

* Principles of universal design not addressed:

4. Perceptible Information

C.5 Other

C.5.a
ADA

This information was drawn from the following sources:

Department of Justice (2010a). *2010 ADA standards for accessible design.* Retrieved on August 28, 2013 from http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf

Department of Justice (2010b). *Americans with disabilities act (ADA) standards.* Retrieved on August 28, 2013 from http://www.access-board.gov/attachments/article/1474/ADAstandards.pdf

- 409 Private Residence Elevators
    - 409.1
        - Private residence elevators that are provided within a residential dwelling unit required to provide mobility features complying with 809.2 through 809.4 shall comply with 409 and with ASME A17.1. Elevator operation shall be automatic
    - 409.4 Elevator Cars
        - Private residence elevator cars shall comply with 409.4
            - 409.4.1 Inside Dimensions of Elevator Cars
                - Elevator cars shall provide a clear floor space of 36 inches (915mm) minimum by 48 inches (1220mm) minimum and shall comply with 305.
            - 409.4.2 Floor Surfaces

        - Floor surfaces in elevator shall comply with 302 and 303
    - 409.4.3 Platform to Hoistway Clearance
        - The clearance between the car platform and the edge of any landing sill shall be 1 ½ inch (38mm) maximum
    - 409.4.4 Leveling
        - Each car shall automatically stop at a floor landing within tolerance of ½ inch (13mm) under rated loading zone loading conditions
    - 409.4.5 Illumination Levels
        - Elevator car illumination shall comply with 407.4.5
    - 409.4.6 Car Controls
        - Elevator car control buttons shall comply with 409.4.6, 309.3, 309.4 and shall be raised or flush
            - 409.4.6.1 Size
                - Control buttons shall be ¾ inch (19mm) minimum in their smallest dimension
            - 409.4.6.2 Location
                - Control panels shall be on a side wall, 12 inches (305mm) minimum from any adjacent wall
- 308 Reach Ranges
    - 308.1 General
        - Reach ranges shall comply with 308

        - Advisory: Children's Reach Ranges (Forward or Side Reach)
            - Maximum of 36 inches (915mm) for ages 3 and 4, 40 inches (1015mm) for ages 5 through 8, and 44 inches (1120mm) for ages 9 through 12; Minimum of 20 inches (510mm) for ages 3 and 4, 18 inches (455mm) for ages 5 through 8, and 16 inches (405mm) for ages 9 through 12
    - 308.2 Forward Reach
        - 308.2.1 Unobstructed
            - Where a forward reach is unobstructed, the high forward reach shall be 48 inches (1220mm) maximum and the low forward reach shall be 15 inches (380mm) minimum above the finish floor or ground.
        - 308.2.2 Obstructed High Reach
            - Where a high forward reach is over an obstruction, the clear floor space shall extend beneath the element for a distance not less than the required reach depth over the obstruction. The high forward reach shall be 48 inches (1220mm) maximum where the reach depth is 20 inches (510mm) maximum. Where the reach depth exceeds 20 inches (510mm), the high forward reach shall be 44 inches (1120mm) maximum and the reach depth shall be 25 inches (635mm) maximum.
    - 308.3 Side Reach
        - 308.3.1 Unobstructed

- Where a clear floor or ground space allows a parallel approach to an element and the side reach is unobstructed, the high side reach shall be 48 inches (1220mm) maximum and the low side reach shall be 15 inches (380mm) minimum above the finish floor or ground

- 308.3.2 Obstructed High Reach
  - Where a clear floor or ground space allows a parallel approach to an element and the high side reach is over an obstruction, the height of the obstruction shall be 34 inches (865mm) maximum and the depth of the obstruction shall be 24 inches (610mm) maximum. The high side reach shall be 48 inches (1220mm) maximum for a reach depth of 10 inches (225mm) maximum. Where the reach depth exceeds 10 inches (225mm), the high side reach shall be 46 inches (1170mm) maximum for a reach depth of 24 inches (610mm) maximum.
    - Exceptions: 1. The top of washing machines and clothes dryers shall be permitted to be 36 inches (915mm) maximum above the finish floor.

* All universal design principles apply

C.5 continued

C.5.b
Textbooks

This information was drawn from the following source:

Lawlor, D. & Thomas, M. A. (2008). *Residential design for aging in place.* Hoboken, New Jersey: John Wiley & Sons

- Select appropriate floor materials
- Select appropriate lighting
- A table that is 20 inches high can mean less bending
- Slightly rounded furniture corners
- Seat heights 18-20 inches to make it easier to get in and out of

* All universal design principles apply

C.5 continued

C.5.c
Expert Recommendations

- Sensory
- Design depends on needs of client
- Incorporate all ages
- Reinforce walls
- Ease of use

* All universal design principles apply

Appendix D

Client Questionnaire

1. Please list and describe your physical accommodations and abilities:

2. Check any of the listed equipment you currently use to assist you with mobility and daily activities:

__ Cane

__ Walker

__ Wheelchair

__ Commode

__ Grab rails in the bathroom

__ Hospital bed

__ Shower seat

__ Other (specify): _____

3. Which of the following activities do you need help with?

__ Bathing

__ Toileting

__ Walking/mobility outdoors

__ Housekeeping

__ Transferring (to and from areas of living)

__ Walking/mobility indoors

__ Going up and down stairs

Please check yes or no for the following:

4. Are hallways wide enough to navigate with a wheelchair or other mobility device?

___ Yes ___ No

5. Are rooms (bathroom, bedroom, kitchen) big enough to navigate?

___ Yes ___ No

6. Are doorways wide enough to get through?

___ Yes ___ No

7. Are steps the only way to in and out of the home?

___ Yes ___ No

8. Do you have steps inside the home that you would need to use?

___ Yes ___ No

9. Are counters, drawers, and cabinets at a level where you can access them?

___ Yes ___ No