

# Safety vs Aesthetics - Universal Design Solves the Quandary

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**Abstract.** People think about universal design in different ways. Some think that safety in the bathroom has to look institutional and ugly. However, it is possible to design a bathroom that is functional, safe, and healthy with universal design products and features. More importantly, it will be beautiful as well as comfortable. There are ways to achieve this using the actual principles and goals of universal design. The objective is to design bathrooms that are aesthetically pleasing and functional, as well as less hazardous – no matter the size, ability, or age of the user.

**Keywords.** Universal Design, bathrooms, hazards, falls, safety

## Introduction

The statistics of injuries in bathrooms are alarming, with falls causing 81% of the injuries in persons over age 15.<sup>1</sup> We will be looking at applying the Universal Design (UD) principles and goals that will enhance the safety of the differing major elements of the bath through the use of current and functional UD features and products. Different areas of concern regarding poorly designed elements in the bathroom and the hazards they can present are identified and solutions are recommended. All of these suggestions throughout this paper are guidelines that designers can incorporate into the space in accordance with the client's wishes as well as their budget.

## 1. Principles of Universal Design

There are several principles and goals of universal design that have more to do with safety than some of the others: flexibility in use; simple and easy to use; minimizing hazards; requiring low physical effort; size and space for approach and use; body fit; comfort; and wellness.

Flexibility in use has to do with the range of different users. Whether someone is right-handed or left-handed, one will be able to use the sinks no matter

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<sup>1</sup> United States Centers for Disease Control (CDC). Morbidity and Mortality Weekly Report. "Nonfatal Bathroom Injuries Among Persons Aged ≥15 Years --- United States, 2008." June 10, 2011. [http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6022a1.htm?s\\_cid=mm6022a1\\_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6022a1.htm?s_cid=mm6022a1_w). (January 5, 2014).

what, especially with lever handles and single-mount faucets. With simple and easy to use features, everybody can use the space regardless of knowledge or previous experience. Minimizing hazards, such as tripping or slipping perils, should be the priority because the primary objective should be making the client's bathroom safe. Also, the design should require low physical effort, which is more important for those with arthritis in their hands or those who have had a stroke. Using single-mount lever plumbing is easier for those who do not have a lot of strength and for people with a broken arm who have trouble reaching across the sink to a faucet on the other side.<sup>2</sup>

Size and space for approach and use are necessary for people in wheelchairs, on crutches, or push walkers to use a vanity or a toilet in a bathroom. If the user is an oversized person, they want to have enough space to use the bathroom and be able to function well, for instance getting through the walkway of the bathroom without having the vanity and toilet too close to use. Similarly, body fit ensures that all sizes of bodies will be able to function in that space.

If the designer is working with a very short person, they need to think about the reach of their client's arms which is very important to consider when designing the bath environment. They do not want them to be overreaching or stretching and causing problems for their backs and arms. Comfort is a consideration, so it is necessary to make sure that they feel secure in the space. If a user is rushing through their bathroom regimen because they are too cold or hot, this may cause an accident. With wellness, consider potential health risks such as mold and mildew growth. So make sure that areas are well-ventilated with good ventilation systems. Many of these Universal Design principles were formulated by Ron Mace,<sup>3</sup> Ed Steinfeld,<sup>4</sup> and others.

## 2. Potential Bathroom Hazards

The potential for serious accidents in the bathroom is considerable. The United States Centers for Disease Control (CDC) provides statistics available regarding injuries in the home: almost 250,000 people fall in bathrooms every year; falls are the most common cause of traumatic brain injury; and over 60% of injuries occur in or around the tub and shower. These figures are alarming and most people are not aware of the immensity of the problem of accidents occurring in the bathroom.<sup>5</sup>

Falls can become a vicious circle. Unfortunately, the fear of falling is a hard cycle that is difficult to break. People who develop a fear of falling because they have already fallen before, decide that they do not want to do as much anymore. Therefore, they become less physically active, reduce their activities, and do not stay as physically fit which in turn increases their risk of falling.<sup>6</sup> The CDC says that many of the injuries

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<sup>2</sup> North Carolina State University. College of Design. The Center for Universal Design. "Residential Rehabilitation, Remodeling and Universal Design." 2006. [http://www.ncsu.edu/ncsu/design/cud/pubs\\_p/docs/residential\\_remodelinl.pdf](http://www.ncsu.edu/ncsu/design/cud/pubs_p/docs/residential_remodelinl.pdf). (January 4, 2014).

<sup>3</sup> North Carolina State University. College of Design. The Center for Universal Design. "Guide to the Ronald L. Mace Papers, 1974-1998, bulk 1980-1998." 2008. [http://www.ncsu.edu/ncsu/design/cud/about\\_us/usronmace.htm](http://www.ncsu.edu/ncsu/design/cud/about_us/usronmace.htm). (January 5, 2014)

<sup>4</sup> Steinfeld, Edward, Jordana Maisel. Universal Design, Creating Inclusive Environments. Hoboken: John Wiley & Sons, Inc. 2012.

<sup>5</sup> CDC. 2011.

<sup>6</sup> Fall Prevention Center of Excellence. "Basics of Fall Prevention." 2014. <http://stopfalls.org/what-is-fall-prevention/fp-basics/>. (January 7, 2014).

in the bath might be decreased through modifying the environment,<sup>7</sup> and universal design is one of the best ways to make those alterations.

### **3. Client Requirements**

Consider the client's desires as well. They may want a cool, trendy bathroom that has the latest styles and finishes. Others may want a spa look and feel. But they also want good storage and to stay within their budget. So, think about how to fulfill these requirements and wishes for them and which universal design features will fulfill them.

A lot of clients bring photos and drawings from media or magazines. Think about how to utilize and incorporate universal design with those ideas for the client's bathroom so that it will be safe, healthy, functional, and beautiful. Think about alternative features to suggest and utilize other words and phrases that would appeal to your client, such as "Spa Shower" and "Light and Airy". Educate the client about universal design and how it will benefit them and make things more convenient for them. Some of those benefits ensure that the room is easier to use and safer to use. Any guest will be able to function well in the room, no matter their abilities. If a loved one has had hip, knee or foot surgery, is a patient recovering at home, or just wants to age in their home independently, UD features and products will be of great benefit to them. Unfortunately, many people find out too late after a traumatic injury or illness, how much it would have helped to have incorporated Universal Design beforehand.

### **4. Benefits of Universal Design**

Many bathrooms have several features which are characteristic of Universal Design, such as leg room for a seated or a standing user being able to access the vanities which have kneeholes. There can be eye level lighting or a single mount lever faucet on the side so someone does not have to reach across, such as a short person or a person who has had a stroke and is able to use only one side of their body. A child could easily use a step stool to work the faucet levers on the sinks. Also, there are faucets on the market now that are motion activated and will help to keep germs from spreading, as well as assist those with weak hands or child's hands too small to reach the faucet.

Hanging vanities have the advantage of being able to be hung at any height. Position a bench with a handheld shower head within easy reach for the elderly, pregnant women, persons with broken limbs, persons recuperating, or paralyzed persons to easily transfer from a wheelchair (see **Figure 1**). Recessed lights and large windows give plenty of light for those with low or aging vision; also make sure there is a wide enough aisle for all to use.

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<sup>7</sup> CDC. 2011.



**Figure 1. Example of shower with bench and handheld shower**  
*Source: Designs Anew Houston LLC, 2011*

Some vanity areas may have a few shortcomings. The mirrors may not be as low as they should be or the mirrors are too high for a seated user, even a short standing user. The pipes may not be covered to protect against a knee touching a hot pipe. Tilt-able mirrors allow the seated user to adjust the mirror individually. Lighting that is not at head level or eye level, but overhead, can cast stark shadows across the face.

Showers are an area where a majority of accidents happen. Good lighting helps to be able to see what one is doing, lessening chances of falling, slipping and dropping items. Not having a trip hazard at the shower threshold is beneficial so that a wheelchair or walker user or even an elder would not worry about entering the shower. A bench is advantageous for those who are weak, transferring from a wheelchair, have a broken leg, had a hip replacement or a foot operation. A handheld shower head at a low enough level for a seated user not to be forced to stand to reach it, is necessary for cleansing while seated and stable. It also decreases the chance of falling off the bench while reaching for it. The shampoo niche close at hand is helpful so that they do not have to reach down to the floor or near the overhead shower to get what they need. The open space under the seat allows them to push to a standing position more easily, lessening the chance of losing their balance.

According to the CDC, the bathtub is directly responsible for over 40% of all bathroom injuries.<sup>8</sup> Therefore, it is very important that the tub area be as safe as possible. Tubs should have a wide rim on which to sit and lift the legs over and into the tub. Some tubs also have a handheld shower for ease of cleansing and a contoured tub bottom to fit the curve of the reclining body. The wide rim also makes it easier to transfer from a wheelchair. Look at the shapes of the new detached shaped tubs. A

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<sup>8</sup> CDC. 2011.

short person would struggle to lift a leg high enough over the lip without losing their balance. The sliver of a rim gives no space to sit and pivot. They are sleek, but are they safe? Another safety concern is positioning a tub on a platform with steps leading up (see **Figure 2**). This tub area is potentially hazardous, especially when wet.



**Figure 2.** Example of bathtub with potential fall hazard  
*Source: Designs Anew Houston LLC, 2013*

A new trend in baths is a glass enclosure for both the shower and tub together in the same wet area. Many of these showers now have no place to sit and the tub is the new popular style, with the super thin rim. Some of these baths have step-downs at the tub and would be an easy place to slip, stumble and fall.

A grab bar is helpful near a bench and also near enough for a standing user to grab if falling. Grab bars are often thought of as only for the elderly or infirm. Anyone can slip and fall in a shower or tub; decorative grab bars fit in seamlessly with the other plumbing (see **Figures 1 and 3**). There are slide bars that also serve as grab bars available. Grab bars can double as towel bars, soap dishes, toilet paper holders; they can go around shower temperature controls. Nowadays they are aesthetically pleasing and functional at the same time.

Great UD bathrooms have open spaces and plenty of room in which to maneuver. One way to create more turning space is to have no delineated shower enclosure area and the whole bath floor becomes a total wet room. Small tile in the shower floor area is much less slippery because of the grout. The shower opening should be wide enough for a wheelchair to enter. The bathtub in a small secondary bathroom can be converted to a curbless shower with the whole room becoming a wet

room for a tripless entry (see **Figure 3**). The temperature control lever is near the entry to the shower instead of under the showerhead, so that one will not be struck with frigid water. There are many styles of grab bars that are not institutional, but blend in aesthetically with the other plumbing fittings.



**Figure 3.** Example of hall bath with curbless shower  
*Source: Designs Anew Houston LLC, 2013*

Comfort height toilets stand between 17"-19" high, about the same height as a chair or wheelchair. This makes it much easier for transfer from a mobility aid or for an elder with little thigh strength to use. There are toilets that have a motion-activated lid and seat, integrated air dryer, deodorizer, and heated seat, making it convenient and secure for persons with arthritis, broken limbs, neurological disorders, or weak limbs. Wall-hung toilets can be positioned at the desired height for the user. These toilets help to forestall falls from inaccurately aimed seating. Creating a space next to the toilet for easy transfer can be easily incorporated into the overall plan (see **Figure 4**).



**Figure 4.** Example of toilet with ample space for transfer  
*Source: Designs Anew Houston LLC, 2012*

Indoor air quality is of great importance for health and well-being, especially in the bathroom where there is so much moisture. A heat/vent/light fixture helps to take excessive moisture out of the air which can cause mold growth, adds more light to the space and adds heat to a cold room in winter months.

When a moisture sensor switch senses rising condensation levels, it automatically turns on the fan and keeps it on until the condensation is no longer a problem and the room dries. Mold can also cause costly damage to your home. An electric towel dryer will help dry your towels rapidly so mold will not grow as quickly in warmer climates.

Letting in the natural daylight makes it easier to do all of the daily ablutions of cleansing and grooming. Having layered lighting (that is, natural, artificial, ambient, task and decorative) gives the necessary amount of light for each task, especially for those with low vision. People like to have natural daylight come in; humans have an inherent need to be around nature, known as biophilia.<sup>9</sup> So having lots of window area is a plus. Germs and mold like to grow in darkness, so light also helps to keep them at bay.

Glare also is a problem for older eyes from all of the shiny marble surfaces on a shower surround, floor, vanity, wainscoting or wall. A tile step down from the shower in a shiny finish can be hard to see and becomes a trip hazard.

Smaller tiles that do not have a high gloss, shiny or slick surface work best for flooring, even outside of the shower flooring. The grout also helps to make the floors

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<sup>9</sup> Wilson, Edward D. *Biophilia*. Cambridge: Harvard University Press. 1984.

safer from slipping and falling. Highly polished natural stone can be very dangerous when water splashes out from the shower or tub. If a natural stone tile is desired, the floor tile should be honed or a rougher finish for a more secure footing.

A shiny, slick marble or granite floor presents a major potential for slipping and falling. The United States Skid Resistance Scale or Coefficient of Friction, is used to determine the degree of slippage on a tiled surface. While assessing different tile surfaces, wet and dry conditions along with the speed of the subject are monitored. Using a tile with a COF of .60 or greater that meets or exceeds general safety and health regulations will cut down on the slipping accidents that happen in the bathroom.

Storage functions best at point of use, right where it is needed and accessible. A pull-out under the sink makes the area easier to reach stored items. Replacing a linen closet with a tall cabinet with pull-outs gives much more storage space that is easily seen and accessed. A pull-out step in the toe kick at the vanity is perfect for small children to reach the sink without climbing on the toilet or on the top of the vanity to reach the faucet. The more drawers, the better for easy access.

## **5. Universal Design Demographics**

As the needs of your clients and their friends and families change and evolve, UD helps to make people feel better about themselves, less isolated, more independent, and more in control of their health and well-being.

Be thinking when designing: can this bathroom be used safely by the 15.2 million wheelchair/mobility aid users; the 4 million persons who have had strokes now able to use only one side; the 6.6 million visually impaired or those with aging eyes; or the almost 40 million arthritic persons, according to the CDC?<sup>10</sup>

Think of those other demographics who will benefit from a safer environment around water: short or tall persons; young or elder persons; broken bone victims; persons with back, knee or hip problems; elders with little arm strength; pregnant women; or multi-generational households of a child, adult, and grandparent.

The CDC shows that 35.7% of adults and 17% of children 2-19 years of age are obese.<sup>11</sup> Are the bath plumbing fixtures, grab bars, and other surfaces safe for increased amounts of weight and pressure? The 2010 United States Census reports that there are now over 4.3 million multi-generational homes, representing a 15% increase over the last census.<sup>12</sup> These statistics show that many millions of people will benefit from safe, convenient, and beautiful Universal Design features and products in their bathrooms.

## **Conclusion**

Remember that throughout the lifetime of a client they might encounter any of the conditions or phases of life listed above. So suggest alternative UD features and

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<sup>10</sup> Media Relations. Fact Sheet. May 13, 2004. <http://www.cdc.gov/media/pressrel/fs040513.htm>. (January 7, 2014).

<sup>11</sup> CDC. Overweight and Obesity. April 27, 2012. [www.cdc.gov/obesity/data/facts.html](http://www.cdc.gov/obesity/data/facts.html). (January 5, 2014).

<sup>12</sup> CDC. 2010 Census Briefs. Multigenerational Households: 2009–2011 American Community Survey Briefs. October 2012. <http://www.census.gov/prod/2012pubs/acsbr11-03.pdf>. (January 5, 2014).



products that will be usable by them, their family, visiting relatives or friends that might be in one of these stages.

Unexpected things happen; UD helps to prepare the bathroom's user for traumatic changes, aging in place, and all of the ever-changing chapters of life. The client will enjoy their bathroom knowing that it has been designed to offer a safe, efficient, functional space that is gorgeous, up-to-date and never institutional looking.

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