EXPLORING INCLUSION AND ACCESSIBILITY: 
THE DESIGN PROCESS AS A USER/EXPERT

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ABSTRACT

This is an in-depth study exploring accessibility and inclusion in airport restroom facilities and the design process as a user/expert. Industrial design and several of the design processes including the generic, user-centered, and empathic approaches are discussed, as is the history and definition of the user/expert. Research was conducted by a user/expert who is legally blind to discover areas of opportunity where design could provide solutions to the many problems unearthed. After locating the areas of opportunity, concepts were generated, selected, and eventually refined to provide viable solutions to aid in imparting the most independent travel experience for people who are legally blind/blind. Additionally, the user/expert/designer determined the best manner in which the user/expert can provide information to the design team about their lived experience and material landscape. The results of this research presents a new design process model for future design teams to work together with user/experts to gain new knowledge into the user experience and provide more viable outcomes as design solutions to the user/expert’s specific problems.
To My Family
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CHAPTER 1

INTRODUCTION: ROLE OF THE USER/EXPERT IN INDUSTRIAL DESIGN

1.1 Industrial Design in a Nutshell

If you ask, most people do not know what industrial design is, or for that matter, what an industrial designer does. The Industrial Design Society of America (IDSA) states in their brochure *What is ID?* that:

Industrial Design is the profession that determines the form of a manufactured product shaping it to fit the people who use it and the industrial processes that produce it. Industrial Designers work to make our lives more comfortable, pleasurable, and efficient (2004).

In a nutshell, industrial design produces those objects with which one interacts each day, from the moment an individual wakes up until the moment they go to sleep. Heskett (2002: 2) states that, “[d]esign is one of the basic characteristics of what it is to be human, and an essential determinant of the quality of human life. It affects everyone in every detail of every aspect of what they do throughout each day.” The alarm clock, the coffee grinder, the furniture, the car and many other products purchased to use in the home, office, or elsewhere is researched, conceptualized, evaluated, refined, and finally, produced with the industrial designer behind the wheel. The goal, then, of industrial design is the creation of products according to a standard, which makes the production process seamless, the product more affordable, more appealing, and with better function, all of which benefits the consumer.

Dieter Rams states in the film *Objectified*,

Good design should be innovative. Good design should make a product useful. Good design is aesthetic design. Good design will make a product understandable. Good design is honest. Good design is unobtrusive. Good design is long-lived. Good design is consistent in every detail. Good design is environmentally friendly. Last but not least, good design is as little design as possible (2009).
Products made according to the criteria expounded by Rams stand the test of time: people will remember those products, buy them again and again, and keep them precisely on account of their good design.

1.2 The Industrial Design Process

The industrial design process is an iterative one that constantly evolves; the components of this process are completed repeatedly to ensure that the final product is not only viable but also something that people will purchase, use, and keep. Strickfaden (2006) diagrammed the generic design process (Figure 1.1) in her dissertation. This diagram describes the general procedures used in the design process, beginning with a design brief in which the objectives are clarified. The designer begins by researching several aspects of the brief to gain more insight into current products and delineate which aspects of the products do not function well or need improvement (i.e. materials, size, form). User research is equally important, including surveys, ethnography (observing the user and documenting the observations in the form of images, written notes, or sketches), and personal interviews. Once the designer completes the initial research, the ideation phase begins, which entails the sketching of concepts. Evaluation of the designer’s ideas results in the concept refinement after which the designer decides upon the final product. These components can be repeated a second, and even a third time in order to produce the best product, one that the designer and client believe that consumers will purchase.

Figure 1.1: Generic Industrial Design Process (Strickfaden, 2006).
Over the years, this process has changed, improved, and grown to include different approaches to design such as user-centered and empathic design. In the generic approach the user is traditionally at the end of the process as the consumer. In the user-centered approach the user works with the designer in their process about midway between the concept generation and concept selection. The empathic approach (as illustrated in the diagram in Figure 1.2) brings the user in to the process with the design brief such that both the user and designer design products.

![Diagram of the Empathic Design Process](image)

**Figure 1.2:** The Empathic Design Process by McDonagh, Thomas, Chen, He, Hong, Kim, Zhang, & Peña-Mora (2009).

### 1.3 What does it mean to be a Designer?

There are numerous roles for the designer and they all are quite varied which makes defining what it means to be a designer challenging. A designer can create electronics, kitchen appliances, furniture, services, and even spaces. Heskett (2002) believes that it is not really possible to determine the exact point in human history that design began but he is sure that the hand played an enormous part in the beginning. He states that the hand is a unique
tool on its own and has allowed humans to create the most basic of designs: the ancient ax is an example (2002: 12). As materials changed and human knowledge grew, forms began to evolve and became abstracted according to culture, need, and practical work. Heskett’s theory does not suggest that the designer requires merely the hand alone or even just the hand allied with the senses, but means rather that it is both working together with the mind, “that forms the coordinated trinity of powers by which human beings have asserted ever-greater control over the world.” (2002: 13).

Designers use their ability to think and conceptualize possibilities that could change their world, hopefully for the better. Many throughout history have done just that, from the simple hand tools that early humans devised to assist themselves in growing and hunting food or building homes, to the current machinery made to reduce the time, effort, and labor required to harvest an enormous amount of acreage. These later tools and other technologies were imagined, sketched out, materials decided upon, initial models were made, modified and enhanced, original prototypes made, and, after many additional ideas, modifications, materials, and models were completed, a final product was created. When one casts a historical eye on major innovations such as the telegraph, telephone, the typewriter, the computer, or the steam engine, the airplane, the automobile—even looking at the simple pen or the bicycle—the design is evident. They were ‘designed’ in order to make human communication and transportation easier and faster. They also have evolved since their inception to become sustainable, energy efficient, more affordable, faster, and yes, ‘prettier.’

1.4 Role of User/Expert in Industrial Design

Universal design has been part of the design world since the end of World War II, when people realized that barrier-free environments were needed for the returning veterans.
Ronald Mace, an internationally renowned architect and user of a wheelchair, created the term and its processes (Moore, 2001). Soon after the advent of universal design in architecture, industrial designers began to use these methods and had two distinct groups of users, those without disabilities thought of as the “normal” group, and those users with disabilities, the “special” group (Moore, 2001: 2.3-2.4). At that time, universal design attempted to provide reasonable accommodations for all in the areas of safety, convenience, and comfort. The component that continues to be the most important in universal design is user involvement in the design process (Ringaert, 2001). The “user/expert” the role of a person with special life experiences (e.g., wheelchair user, person who is visually impaired) being trained then involved in the design process first termed by Lifchez and Winslow in “Design for Independent Living: The Environment and Physically Disabled People”, (1979) entering the design arena at the beginning with the designer provides insight into problems not currently addressed by the user alone. The user/expert problem solves on a daily basis enabling the user/expert to adjust products to suit their own needs, allowing for a more independent lived experience.

1.4.1 Brief History of the User/Expert

Ringaert describes the origins of the user/expert with disabilities during the 1970’s with the initiation of the independent living movement as the result of a “grassroots efforts to influence disability policies.” (2001: 6.2) The movement sought to create a method of independence for people with disabilities by relying upon technological and social support. Called interdependence, this refers to people with disabilities doing things in society in the same way those without disabilities do. It is by doing this that people with disabilities learn what they need to know to control their own lives in their community—what does and does
not work for them in their day to day living, what needs to be avoided, what can facilitate in or is an obstacle in their built environment. Daily experience in their day-to-day lives makes them user/experts (Ringaert, 2001).

While the idea of the user/expert dates back to the 1970’s, not much written evidence exists that draws on the experiences of user/experts. Lifchez and Winslow (1979: 18) characterize the user/expert as, “disabled consultants.” In their earliest experiences with the user/expert, a course at the University of California Berkeley in the Department of Architecture was conducted with the diverse population of people with disabilities in planning accessible spaces and environments. This created an eye-opening experience for not only the instructors but also the “disabled consultants,” in that they were often looking at their environments for the first time and from both physical and emotional viewpoints. The designers found themselves stepping outside their comfort zone, needing to understand the whole person, the “disabled consultants,” and the resultant interactions with others, as well as within the “consultants” environment. This course resulted in the “disabled consultants” or user/experts gaining the understanding that they wanted independence, while the instructors thereafter viewed at the Berkeley campus in a completely different light (Lifchez & Winslow, 1979).

Ostroff (1997) comments that, “A user/expert can be anyone who has developed natural experience in dealing with the challenges of our built environment.” This includes people with disabilities, parents with children, the elderly, and anyone that appropriately fit a situation of which the designer(s) have no experience. It is by working with these user/experts that Ostroff believes the designer can learn greatly, especially by encountering those with limited capabilities and very specific needs with which the designer is unfamiliar.
Ringaert (2001) discusses distinct approaches to user/expert involvement, working with disability specific groups such as a local association for people with cerebral palsy, disability-generic groups such as independent living groups, and committees that are constructed at the municipal level which include individuals from a variety of user groups. One of the problems associated with these approaches is that, in many cases, the individuals represent only one dimension and do not have expertise in all access or universal design issues. The solution to this, from Ringaert’s perspective, is to provide “broad-based training in universal design to persons with disabilities” (2002: 6.3) who were considered to be user/experts in their own disability-specific issues. This would then allow these user/experts to provide consultation services to designers, architects, contractors, and others on universal design issues and could provide a means by which the user/experts could earn an income.

1.4.2 Importance of User/Expert on a Team

The role of the designer has changed over time and there are many people in Industrial Design who excel at different things. The design thinker is useful throughout the production process, from beginning to end. There are great model makers, great sketchers, and excellent materials experts. A good design team is made up of people who are knowledgeable about some areas more than others but work well together because they all have a shared language, one that is design-based. The design team and its use of this shared language brings about the creation of products, services, and experiences that work well, perform a specific task, and are aesthetically pleasing.

Incorporating the user/expert into a design team assists the designer in expanding their empathic horizon—connected naturally to the lifetime of the individual—as well as informs the design process. The designer’s observation of the user/expert in the role of user,
can lead to insights into authentic human behavior (McDonagh, Strickfaden, Thomas, 2011: 860-862) and then presents possibilities for product concepts that fit the needs of the user/expert rather than products that the designer may think would work for the user/expert but actually do not work at all or would be better suited to another task.

1.4.3 Implications of User/Expert on Industrial Design Practice

When the user/expert is included in the design process, the designer can see how the user/expert modifies their environment, space, or product to work for them: the authentic human behavior of the user/expert can result in viable product solutions. When the user/expert is also the designer, the implications for the industrial design practice shifts. No longer is the user/expert just someone to be observed or one to evaluate the final product. The user/expert can have a significant impact on the design concept itself. The user/expert, can, through experience with or research into the specific area of need (i.e. those required in the design brief from the client), provide insight into what does and does not work, ask questions that most designers may not imagine or consider, sketch design concepts, identify possible modifications, and work in the same iterative manner that many designers use daily, in order to provide more viable solutions to the client’s needs.

Knowledge gained by user/experts in the daily, lived experience is, in fact, essential to the designer. Strickfaden and Devlieger (2011) discuss various types of design including co-design being a way to work intimately with the user/expert. Engaging with non-designers to create more inclusive designs are suggested as necessary. Strickfaden and Devlieger state that inclusive or empathic design solutions do not happen only by the atypical approaches such as conversation with the non-designer, but by going beyond the conversational stories
or ethnography to techné which is described as the engagement of daily life experiences. The best explanation of techné is:

Techné is considered to be the knowledge that is enacted in daily life, is naturally occurring, involves genuine human expertise and is bound to necessity and something practical. Techné is connected to embodiment, which is defined as experiences and performances that are contained within the memory of peoples’ bodies. Further to this, physical and emotional attributes and characteristics are aspects of embodiment. The ability to empathize with others is connected to basic human emotions. It is techné and embodiment that bridge people’s emotions towards the creation of empathy (Strickfaden and Devlieger, 2011: 223).

Recognition of and embracing techné is important in the empathic design process. By engaging in empathic modeling to experience techné, the designer gains an education about the lived experience of the person who is legally blind/blind. The designer can also gain more insight based on their own experiences than that gleaned from other user/experts they initially sought to better understand.

1.4.4. The User/Expert who is Legally Blind/Blind in the Industrial Design Process

The user/expert who is legally blind/blind can offer much insight into the design process. This user/expert’s lived experience could include the care of a guide dog, the need to employ adaptive equipment for the computer, specialized cooking equipment, the need to label clothing, storage areas, and essential items with large print or Braille identifiers, and even the need to learn Braille to read. In product design, the legally blind/blind user/expert can inform the designer about what it is to be a person who is blind/legally blind. This could entail the designer using ethnography to observe the user/expert doing normal activities or actually engaging in an empathic modeling experience to gain a small inkling of knowledge about the user/expert’s daily life. The legally blind/blind user/expert can use the daily life experiences that the user/expert encounters to assist the designer in that empathic modeling
exercise. These legally blind/blind user/experts form a defined community of individuals. Specific cultural knowledge of those individuals, who are in this legally blind/blind community, is that of “performance, practice, and embodied experience” (Strickfaden and Devlieger, 2011: 211).

Additionally, the legally blind/blind user/expert can aid the designer’s form and material choices, helping to discern whether or not a texture works, whether something is too audible or not audible enough, whether it is too heavy or light, or whether something is too large or small. Should the designer be working in a space, the user/expert can inform the designer on placement of objects, the optimal placement of Braille and Braille signage, textures for the floor, and even the location and direction of lighting fixtures for the optimum and appropriate lighting.

Many user/experts such as parents with children or those who are in the elder population are already designers. Including people with disabilities as the user/expert/designer can enhance and improve upon Industrial Design practice by eliminating the need to go outside the design firm or studio for the expertise that these individuals have and that is needed in environmental, service, or product design. These user/expert/designers can employ the shared language of the design team, give insight that others on the team do not have, implement methods of empathic modeling in order to give a small amount of insight into their world of disability, as well as conceptualize, create, and finalize products, services, and environments that are more accessible and of an inclusive nature.

This discussion of industrial design, the generic design process, the user-centered design process, the empathic design approach, techné, and the user/expert in design practice
and process is important to the overall understanding of the study. Further, the implications of the Americans with Disabilities Act (ADA) and the ADA Standards of Accessible Design are significant to understanding the purpose of this study and future research in this area.
CHAPTER 2

LEGAL BLINDNESS AND DESIGN [BACKGROUND]

2.1 Blindness and Design

In this discussion there are several terms that will be used. Descriptive terms such as low vision, visual impairment, legal blindness, and blindness are all terms that are used to describe visual disabilities and their adjectival forms are applied to the people who have those disabilities. A person can have a visual impairment or low vision and not be legally blind or blind. Similarly, a person who uses eyeglasses or contact lenses is generally thought of as having a minor visual impairment. In *Borderlands of Blindness*, it states that different usage of the terms “impairment,” “disability,” and “disablement,” are an over arching way to describe “disability” in a variety of contexts, but there is no precise understanding of these terms. A shared language should be developed to eliminate the ambiguity of their meanings (Omansky, 2011: 15). The ambiguity of legal blindness is not only in the language. People who are legally blind do not see in the same manner as do people who are classified as blind. This is evidence in images from the film “Light in the Borderlands” by Ruiz and Strickfaden (2013). These images (Figure 2.1) taken by people who are legally blind indicate how each individual sees differently.

![Figure 2.1: Images from "Light in the Borderlands" by Ruiz & Strickfaden (2013).](image)
For purposes of clarification, in this document the terms “legally blind” and “blind” are the only terms used as descriptions for persons with visual disabilities. In medical and legal realms, people with limited vision such as light perception, or who are able to see only light/shadow and those with no sight at all, are considered “blind.” The term “legally blind” refers to people with visual acuity (central) that is 20/200 with correction in the best eye or a visual field (peripheral) of less than 20 degrees in both eyes or 10 degrees in each eye (JVIB, 1997). This study was conducted by a user/expert who is legally blind and a designer. Figure 2.2 depicts a variety of ways in which a person can see.

![Figure 2.2: Depictions of different visual issues (from left to right) – Retinitis Pigmentosa; Age Related Macular Degeneration; Cataracts; Corneal Edema; 'Normal' vision](image)

When looking at design for people with disabilities, one is struck by the use of symbols indicating that a product, space, or environment is accessible for all. Although there are internationally recognized symbols used to indicate specific accommodations (Figure 2.3), the accepted sign used internationally to indicate accessible environments is the sign with the wheelchair user with the blue background (Figure 2.4). Interestingly enough, even if ‘accessibility’ signage is posted, the space or environment may not be accessible to all people with disabilities. There are many places where people who are legally blind/blind are not considered in the design of spaces. Although a person may see Braille on elevators or signage, when it comes to the design of public spaces, placement of objects, directions, and other opportunities to create a truly accessible environment, there are many areas where access for those who are legally blind or blind is limited or non-existent—areas with limited lighting and...
no large print or Braille available, such as in hotel lobbies, conference centers, and transportation spaces. In many cases, the people responsible for the planning, layout, building, and interior design of spaces do not have adequate knowledge or understanding of what is necessary and required by the Americans with Disabilities Act (1990, 2010).

2.2 Americans With Disabilities Act and its Implications

The Americans with Disabilities Act (ADA) was enacted in 1990 in the United States to “prohibit discrimination and ensure equal opportunity for people with disabilities in employment, State and local government services, public accommodations, commercial facilities and transportation” (U.S. Dept. of Justice, 2014). There are similar laws in many countries throughout the world and although many have components that are comparable to the ADA, there are not many that are as expansive. There are also countries that have no particular laws regarding accommodation. In 2010, amendments to the original ADA were signed into law.
This law and its amendments were enacted to be sure that people with disabilities were given the same employment and housing opportunities as those without disabilities, and to provide accessibility standards for construction of buildings. Many of these statements are fairly straightforward however there are issues that need to be addressed with the interpretation of the design guidelines. In the ADA, there are specific design guidelines for new and old construction of state and local government facilities as well as public accommodations and commercial facilities.

The ADA has given access to or made it possible for children with both physical and intellectual disabilities to go to school and be part of an integrated classroom. These children grow up and become adults that want more out of life than just being placed in a group home or to be taken care of for the remainder of their lives. Naturally all people want to get an education, work, and live independently, which is one of the core reasons the ADA was developed. In general, getting and education, working and living independently becomes an issue of access—access to education, employment, economic independence in order to purchase a home, car, and other needed equipment which is necessary to support people with disabilities and often times is extremely expensive.

Titchkosky comments in *The Question of Access: Disability, Space, Meaning* (2011),

Access is a way to orient to, and even come to wonder about, who, what, where, and when we find ourselves to be in social space. Through the perceptual consciousness of ‘access,’ people take social life into account as a space of questions regarding who belongs where, under what auspices, and during what times or through what particular thresholds. Access is tied to the social organization of participation, even to belonging. Access not only needs to be sought out and fought for, legally secured, physically measured, and politically protected, it also needs to be understood – as a complex form of perception that organizes socio-political relations between people in a social space (2011, 3-4).
Twenty-four years after the implementation of the ADA, there are still issues of access in all types of spaces – public and social. The largest of these issues is perception – perception of people with disabilities and how they function in social spaces, many of which are not prone to inclusiveness and the perception of the people who are working to assist in providing access to those who need it. The ADA Design Guidelines (see Appendix D) were put into place to assist those in the architecture and construction fields with guidelines that promote and provide accessible spaces for all. The ADA Design Guidelines address modifications to buildings constructed before January 26, 1992, considered existing buildings and sites as well as buildings construction after that date and deemed ‘new construction’. There are provisions in the ADA and its Design Guidelines for Title II – those public organizations/companies including state and local governments and all associated services, programs, and activities – and those for Title III – those private organizations/companies that operate public accommodations falling under 12 distinctive classifications.

When access ramps are placed at the rear of previously constructed buildings, the perception of those who need to access it could be that they, as an individual, are inferior or have lesser value than others because the ramp is at the rear of the building, not the front. The issue could simply be that the individuals that constructed and installed the ramp read the requirements in the ADA Design Guidelines and placed the ramp where it fit the guidelines, or that putting the ramp in the front would deter from the façade of the architecture of the building. Interpretation of the law, who is doing that interpretation, and how they are interpreting it are all equally important to elements for inclusive design and for providing access to all.
2.3 Complexity of Circumstance

There are many access and mobility difficulties that people with disabilities encounter in their daily lives. Some issues can be more difficult than others, depending upon the disability. Many activities including bathing, cooking, dressing, walking alone, travel, and using public restroom facilities have obstacles that need to be considered. Most of these experiences can be uncomfortable if they have to be done with someone else's assistance, such as dressing or bathing. Numerous people with disabilities live with the fact that their daily life requires the aid of another person, or personal assistant who assists them with everything from the most mundane to the most private of personal daily activities. There are activities that people who are legally-blind/blind have difficulties with that most others with disabilities do not, such as reading printed labels to make sure they are using the correct personal care product or medicine, making sure they are in the correct restroom facility, and even in some cases, making sure that the person they are speaking with does not walk away without saying something before they leave.

2.3.1 Embodied Experience

People who are legally blind/blind have lived experiences that are full of sensory input—auditory, olfactory, gustatory, tactile, and even in some cases visual, as do many people. These experiences differ based upon each individual’s eye disorder, environment, and social circumstances. Each experience is unique to that individual, their body, and it’s memory. This becomes an embodied experience. It is said that, for people who are legally blind or blind, their other senses become better or more intense (ASA, 2012) when in reality people who are legally blind or blind learn how to pay more attention to the things they hear, smell, feel, or touch because they must rely on those senses to make up for the deficit in
visual information they receive (ASA, 2012). That being said, many people who are blind or legally blind excel at using their hands to locate objects, read, and aid in their discovery of the world around them. If Braille is used, the fingertips run over the bumps of each letter as it is read. The hands operate as a detector to find things in an unfamiliar space. Hands trail along a wall to find doorways, or where a hallway changes direction, and find Braille signs, fire alarms, or light switches. The feet can also be used to detect things, such as the edges of stairs or curbs, variations in the sidewalk, or potholes that are in the crosswalk. Tactility is an extremely important part of life as a legally blind/blind person. Functioning with a white cane is limiting but the cane acts as the ‘seeker’ to find pathway obstacles and dangers as well as those that are peripherally located. Many people who are legally blind/blind use a cane but there are those that prefer to use a guide dog1.

Other senses also come into play. It is extremely important for people who are legally blind or blind to be safe while traversing the outdoor environment. Sound is the element that allows these individuals to travel safely, most importantly those of the traffic, sirens, and people. Sound it is especially important if one has a dog guide. The sound of approaching dogs and their owners allow the guide dog user to take appropriate precautions with the dog to keep both safe. The sense of smell is heightened and the person with a guide dog is usually very aware of where that dog is, whether or not the dog had an accident, and where that occurred to facilitate its rapid and efficient removal. Odors are also evident in the kitchen and one can tell by the smell whether or not something is burned in the pan, and occasionally if

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1 Some agencies refer to service animals used by people who are legally blind/blind as “dog guides.” This practice was recent stemming from issues surrounding the use of “guide dog” as a trademark and/or proprietary term. Because its propriety use is still under debate, and because it is the most commonly recognized term for service animals designated for use by people who are blind/legally blind, the term “guide dog” will be used throughout this thesis to refer to those service animals.
something is warm or hot. It is very important when a kitchen or home is equipped with gas appliances as the odor from gas is extremely pronounced.

Memory is something that is an added benefit. Generally, when someone who is legally blind/blind goes into a new space or environment, that person immediately begins to become familiar with the space, and commit that layout to memory so that, should the individual return to that space, movement through the space is somewhat easier. Each experience can be retained in the memory for a while. Memory is also an important part of daily living because if one is navigating familiar spaces the occasional misplaced item can be quickly found, usually by bumping into it.

If you are a person who is legally blind or blind, hygiene definitely becomes an issue due to the ways in which the hands are employed. Touching to find things becomes a hazard especially in restrooms, kitchens, on the bus, or in any environment that is public. Germs are spread by the simplest touch. Although there are those individuals who are legally blind/blind that do not use their hands as assistive devices, many do use their hands to assist with directions, prevent an inadvertent accident, or even just find a door. As a result, these individuals are exposed to germs that others have inadvertently left behind.

2.3.2 Spatial Environments

The spatial environment is made up of a material landscape with many objects and people, making it challenging to navigate, to say the least. One of the most necessary, complex circumstances for people who are legally blind/blind concerns the spatial environments that they encounter. People who are blind/legally blind often times find it necessary to carry a plethora of items to assist them on a daily basis, especially if they use a guide dog. Backpacks or messenger bags are good for transporting numerous items as well as
those that are both large and small. If the individual wants to shop, items that are needed cover a large range. The individual would need a purse/wallet, which holds the bus pass, credit cards or cash, and identification. The individual cannot leave the house without taking the white cane or if the person is a guide dog user, the leash and harness attached to the dog, disposable bags, paper towels or some sort of cleaning cloth in case the dog encounters some chemical or foreign substance on its paws, and a collapsible bowl for water.

When a person moves through a spatial environment, especially a public/social space, there are other people with whom one has to contend. If the individual uses a white cane, it is a bit difficult to move through without hitting a passerby with the cane, possibly catching the cane on an object, or even a crack in the sidewalk. Additionally, in some cities and towns the outdoor public spaces are at a minimum, which results in the spaces doing double duty. Streets can hold food fairs or music festivals, and the sidewalks become plenne-aire restaurant seating. This can cause issues for people who use white canes and guide dogs, minimizing the space surrounding the seating while turning it into an obstacle course. This does not make for safe travel.

The material landscape changes frequently. Old buildings are torn down and new buildings replace them. Every new space one visits is different. People who are blind/legally blind must rely on their senses and memory to maneuver around the buildings that they visit on a regular basis. Buildings with which these users are unfamiliar or that are new require patience, concentration, and time to move through or around. Additionally, although there are specific requirements for accessible design in the ADA, similar spaces vary from building to building because different people interpret the guidelines differently. This is especially true of restroom facilities. Many buildings have similar layouts for each floor and for public
restroom facilities. Different buildings have different restrooms and not all of the equipment inside these restrooms is in the same place. This poses a very large accessibility predicament for people who are legally blind/blind.

Accessibility issues are not always obvious. Although a restroom facility has the international symbol posted (see figure 2.2), it probably is not accessible to all. There may be a larger stall intended for people with disabilities to use, but often people without disabilities use these stalls because they are unoccupied and have more space. When this occurs, people must wait until the stall is free or choose to use another stall. How is a guide dog user to comply with the guide dog school’s instruction to bring the guide dog into the stall the user enters when there is not enough space? The person who is legally blind/blind can find the doorway but how can the individual tell when someone else enters the restroom without a door that opens and closes? One can find a sink to wash in but how does one find the paper towels or hand blow dryer without touching a sink that someone with a cold touched a few minutes previously? Accessibility is a problem for people who are legally blind/blind because although these individuals fall into the ‘international’ category for disability, the architects, interior designers, and designers generally consider that only the Braille signage and indicators to comply with the ADA Design Guidelines need to be taken into consideration. If the paper towel dispenser is within a dimensional range that is compliant with the ADA guidelines, then these professionals determine that is all that needs to be done. It is rare that the placement of objects in one restroom facility are in the exact same or at the least a comparable location in another restroom in the same building. This poses a problem for people who are legally blind/blind, as they cannot use the memory gained in one restroom to assist them in the second.
2.3.3 Social

Social issues that occur for people who are legally blind/blind include problems with violence and hygiene. Violence of all categories including verbal abuse, intimidation, harassment, swearing, threats, bullying, physical abuse, and vandalism against people with disabilities in the United Kingdom is considered a type of ‘hate crime’ while in the U.S., the ‘hate crime’ does not include verbal abuse or swearing as those would be considered as part of the Constitutional protection for freedom of speech (Sherry, 2013: 84) Although violence against people with disabilities is a global issue, the manner with which it is dealt is dependent upon the culture. Although the U.S. has collected statistics for crimes against people with disabilities since 2004 the compelling numbers are not accurate because numerous victims do not report the crimes. The crime statistics that were collected for this period do show insight into patterns of violence. These patterns show that simple assault is most common (Sherry, 2013: 87-88).

![Violent Crime Against People with Disabilities](image1)

![Victimization - Sex & Race](image2)

**Figure 2.5**: Tables on Violent Crime Against People with Disabilities – by type (left) and by sex and race (right).

According to the Bureau of Justice Statistics (Figure 2.5, left side) the National Crime Victimization Survey indicates that the rate of simple assault perpetrated against people with
disabilities, is most prevalent. The total number of crimes reported against people with disabilities aged twelve or older in 2011 was 922,900 of which 521,810 or fifty six and five tenths percent (56.5%) were simple assaults. Additionally, the serious violent crimes numbered 401,090 of which 58,600 or six and five tenths percent (6.5%) were rape or sexual assault; 143,630 were robberies or fifteen and five tenths percent (15.5%); and 198,860 or twenty-one and five tenths percent (21.5%) were aggravated assault. Those individuals between the ages of sixteen and nineteen years were three times more likely to be victimized than those without disabilities. Most of the rapes and sexual assaults were perpetrated by either former or current domestic partners/spouses.

This same report (Figure 2.5, right side) characterized these statistics by race and sex and found that in 2011, crimes were perpetrated against forty-two of every one thousand males with disabilities, which is double the twenty-one and six tenths (21.6) perpetrated against males without disabilities. Crimes were perpetrated against fifty-three and three tenths (53.3) of every one thousand females with disabilities, which is triple the seventeen and three tenths (17.3) perpetrated against women without disabilities. Dividing the numbers according to race and the statistics show that fifty-one and seven tenths (51.7) of every one thousand individuals were white, thirty-seven (37) were black, twenty-six and five tenths (26.5) were classified as other which includes Native Americans, Asians, Native Hawaiians and other Pacific Islanders. Astonishingly, seventy-eight and two tenths (78.2) of every one thousand individuals were two or more races. The Hispanic population is equally susceptible at thirty-one and six tenths (31.6) per one thousand individuals (Harrell, 2013). These figures indicate that crime more than triples in some cases when an individual has a disability.
Alternately, the Hate Crime Victimization 2004-2012 Statistical Tables published by the Bureau of Justice Statistics, states that the Hate Crime legislation was entered into law in the U.S. on 23 April 1990 and “requires the Attorney General to collect data” on crimes perpetrated against people that are prejudiced based on race, ethnicity, and sexual orientation. This law was amended in September 1994 and went into effect in 1997, to include crimes with a bias toward people with disabilities. It was further amended in 2009 to include a bias based on gender or gender identity. These statistical tables (Table 2) indicate that in 2004, eleven percent (11%) of hate crimes were perpetrated against people with disabilities. This number increased to twenty-two percent (22%) in 2011 and decreased to eleven percent (11%) in 2012 (Meuchel Wilson, 2014).

In this background information the ADA and the associated implications to people with disabilities are discussed in relation to this study. Additionally, issues with different environments that affect people who are legally blind/blind were conferred and put into perspective for the purposes of this study. Other issues affecting people who are legally blind/blind such as crime were addressed. The next chapter explains the initial interviews conducted and the design brief clarifies the objectives for this study.
3.1 Initial Interviews

In order to narrow the focus of the research for this study, it was necessary to interview and survey a number of individuals to ascertain what the most problematic issues with which people with disabilities must confront when they travel. After obtaining the Institutional Review Board (IRB) approval, personal interviews and additional surveys were conducted to determine the direction of the design brief for this project. The original intention was to look at public transportation spaces and ask user/experts with disabilities what issues were encountered while traveling. A total of eighteen (18) individuals took part in the interviews/surveys of which one (1) was a wheelchair user and the remaining seventeen (17) were legally blind with limited fields of vision or light perception only. There were eight (8) male and ten (10) female and of the seventeen (17) legally blind respondents, many used guide dogs rather than white canes.

All of the respondents traveled on a fairly regular basis (two to three times per year). All used the airport, train or bus station, and only two (2) rarely traveled alone. The major issues that the respondents indicated on the interviews or surveys that were issues for them were difficulties with the employees at the facility, construction areas, the need to ask for directions, and the most common issue was related to restroom accessibility in the facilities. The respondents felt that many of the restrooms were hard to find, especially if there were no doors. It was also difficult at times for the respondents to determine the gender of specific restrooms because of signage. Several respondents commented that there was no flight
information in provided in the airport restrooms. The most common complaint was that the stalls for people with disabilities always seemed to be placed at farthest point from the door. Additionally, it was difficult to locate items in the restrooms, such as paper towels and soap dispensers. The final issue most commented upon was that there was inadequate identification of restroom facilities in the public spaces. Overall, the respondents commented that the restroom facilities in airports, train and bus stations were the most difficult obstacles that were encountered during travel. The comments that were received from the respondents informed the direction of this study.

3.2 Design Brief

The initial interviews determined that problems exist in current restroom facilities at airports. These interviews provided information from the respondents as to the areas that they personally had difficulties with while traveling. Although there are design specifications in the ADA Design Guidelines (2010) for public restroom facilities, not all airport restrooms are alike. When a person who is legally blind/blind travels independently, not knowing the layout of a restroom facility is a daunting prospect. In many instances, the individual will be required to ask a total stranger for assistance at least once during a traveling experience. Whether the person who is legally blind/blind must ask for assistance with directions or with the location of an object within the restroom facility, it is sometimes difficult for those who need that help to ask for it, without feeling that they have somehow failed.

In order to complete the design process, a designer must understand the scope of the design problem before the designer or design team embarks on discovering a solution. In areas where a designer is unfamiliar with the user or a user’s experience, a scenario can
sometimes assist the designer in that understanding. The scenario below is one from the user/expert’s point of view:

The passenger who is legally blind/blind arrives at the airport with a medium sized suitcase on wheels, a backpack, and a guide dog. After checking in, the passenger goes through the TSA checkpoint and then embarks on the journey to the departure gate. Once at the gate, the passenger realizes that there is an urgent need to find a restroom. There are 45 minutes before boarding and the passenger dashes, as much as possible, to the closest restroom. Entering the open doorway, the passenger sees only men. Wrong restroom. The passenger turns around to depart and find the women’s restroom. Once that is accomplished, the passenger must find a stall for people with disabilities so the guide dog can enter as well. Once the passenger has completed the task at hand, it is outside to the sink. At the sink, the passenger cannot find the soap and then begins to look around. The soap dispenser is located to the left of the sink area on the wall and the passenger moves to the location. After washing, now the passenger must find paper towels. Trailing a hand along the sink to the wall, the passenger finally finds the paper towel dispenser, pulls out a couple towels, dries her hands, and then grabs her backpack, the handle of the suitcase, and the guide dog harness. The passenger heads back to the departure gate but cannot find the door out of the restroom. After a twenty-minute expedition to use the restroom facility, the passenger returns to the departure gate, through the hoards of people with 5 minutes to spare.

While people who are legally blind/blind are a part of the overall population of people with disabilities, they seem to be often times overlooked in the design of accessible public spaces. Although it is presumed when the ‘international’ disability sign is posted, that modifications to public spaces are in place for all people with all disabilities, there are many areas that continue to need improvement. While accessibility guidelines provide guidance for layout of public spaces for designers to follow, more attention needs to be paid to the design issues that affect this overlooked population. This design study, conducted by a user/expert/designer, begins with the research of public restroom facilities in public transportation spaces (airports, train and bus stations) for ease of access, safety issues, and hygiene for people who are legally blind/blind. Surveys, interviews, and ethnographic
observations assist the designer in narrowing the scope of the design problem. This study ends with the creation of a more inclusive, less time-consuming solution(s) to this problem, and more importantly, for the legally blind/blind community. This includes issues with placement of equipment in the facility itself and the interpretation of the ADA guidelines by the architects, construction workers, and installers.

3.3 Public Restroom Facilities

Typically, public spaces involve teams of people to assist in their creation. These people include engineers, architects, project managers, construction workers, bricklayers, interior decorators and more. The beauty of architecture is found in its diversity; two buildings may have similar characteristics, but rarely are they perfectly duplicated. In the case of public restroom facilities, this can be problematic as the variations in facilities add layers of challenge for people who are legally blind/blind.

Some public restrooms do not have doors at the entrance, rather they have open pathways, and although wide enough for a wheelchair to pass through, no actual door makes it a bit difficult for a person who is legally blind/blind to hear if people are coming and going in the restroom. Lighting is also an issue. Dark areas are often times placed throughout the facility. One of the darkest areas can be the entrance itself, which makes going in and out difficult if there are people coming in the opposite direction. These issues create concerns of safety for women, and in some instances men, who are legally blind or blind that are traveling on their own.

Getting to a stall in a crowded restroom can be difficult when one does not have a disability; and add to that limited or no vision, a guide dog, and luggage and it becomes extremely difficult. Many of the stalls that are ADA accessible are positioned close to a wall to
provide the most space for someone with a disability, which creates a problem for people who are legally blind/blind when trying to find the actual stall. Maneuvering around numerous individuals or waiting in line because the stall is occupied, is not only difficult but also time consuming when people are in a hurry. Many times, people without disabilities use these stalls as well because they are unoccupied and have more space. This becomes a problem when someone with a visual disability needs to use the stall and must wait or find a smaller stall. Additional issues arise when the accessible stall does not have a sink and the individual needs to maneuver back to a general sink area for hand washing.

Hygiene is also an issue, especially in restrooms. People come and go and some can sometimes be ill when they travel. According to Ozonoff and Pepper (2005), typically fifty percent (50%) of the air in the plane is re-circulated and although many airliners use “high efficiency air particulate (HEPA) filters,” (2005; 917) there is no definitive data to verify that these filters eliminate the circulation of viruses in these enclosed spaces. Additionally, the article comments that the likelihood of a person getting an infectious disease can depend upon how close in proximity of a person’s seat to ‘passenger 0.’ Other factors that promote the likelihood of someone becoming ill as the result of airline travel include the frequency of travel, number of people contacted, and the fact that we are more globally connected than ever (2005). Sleep deprivation can also affect a person’s ability to remain healthy while traveling. All of these factors open everyone up to the exposure of germs and possible illness. Touching the sink prior to hand washing can leave germs behind for the next person who touches the same spot. Many times one can find restrooms in transportation facilities quite crowded to the point that there is a wait in line for a stall. When the facility has a number of
people coming in and out, it can be sometimes difficult to move if a guide dog and luggage are also involved.

Additional issues with hygiene affect people with disabilities in other ways as well. In “Barrier-Free Travel,” Harrington (2009) comments that first time travelers can be anxious about using the toilet on an airplane. Harrington, a user of a wheelchair, provides suggestions for persons traveling on airlines check to see what type of airplane they will travel on before boarding as all post-1992 aircraft in the U.S. must have at least one accessible restroom. Foreign carriers arriving or departing the U.S. must also comply with this regulation on aircraft placed into service or ordered after 13 May 1990. One suggestion she gives is to fly on a plane with an accessible toilet. She also comments that many people experiment with their diet such as vitamins, eating less, and their fluid intake to avoid having to use a restroom on board (Harrington, 2009). These issues combine to create the current lived experience of a person who is legally blind/blind and enjoys independent travel.

3.4 Detailed Problem Identification of Current Designs

Current facilities vary in both dimension and shape of the space. Some restrooms are long and narrow and provide several short rows of stalls, such as those in the Chicago O’Hare Airport (Illinois, USA). Although there are more stalls, these stalls are spread over a broader space, which makes locating the several ADA accessible stalls difficult for those who are legally blind/blind. In the case where the facilities are small, such as the Champaign’s train and bus facility, Illinois Terminal, there are only four (4) stalls in total and one (1) accessible stall which are all difficult to maneuver in. There are some instances in women’s restroom facilities when the stall for people with disabilities doubles as a stall for women that require a changing table for babies. This can be an issue if the changing table is installed inside the stall
as it limits maneuvering in the stall for everyone as well as cluttering the material landscape making navigation in the space challenging.

The ADA Design Guidelines stipulate only three instances where careful attention to lighting must take place: in stairwells, elevators, and on signs (Osterberg, 2010, 1.12, 1.97, 1.122; DOJ, 2010, 3.140). These sections of the ADA require at most 5 foot candles (54 lux) in elevators, “adequate lighting level without glare or strong shadows,” in stairwells, and 10-20 foot candles on sign surfaces (100-300 lux) and the level must be uniform on signage (Osterberg, 2010, 1.12, 1.97, 1.122). There is no direct lighting recommendation elsewhere in the ADA for open spaces, restrooms, or other areas in buildings.

Lighting is limited at best in many facilities because of small wattage of the bulbs, no fixtures, or incorrect placement of fixtures. There is adequate lighting around the sinks but in the other areas of the restroom, especially above the stalls, lighting is at a minimum in many facilities. Adding to the limited lighting is the darker colored walls and floors that many buildings put into their interior spaces. People with limited or no night vision (inability to see in dark areas) can miss the yellow ‘wet floor’ signs, walk into other occupants, and walk into a facility for the opposite sex if the lighting or fixtures are lacking.

The placement of the soap and towel dispensers, waste receptacles, and in women’s restrooms the feminine protection dispenser is random. Although the placement of these objects follows the ADA Design Guidelines, issues with their placement remain. The guidelines list a range of measurements, including one that is preferred and even thought the fixtures may be on an accessible route, mounted within appropriate reach ranges, and do not intrude on the accessible route more than four (4) inches, they may not be placed in the preferred range. Some are placed where the individual installer deems the best within that
range and, because an individual does this, not all are installed in the same place. This placement also depends upon the overall design of the restroom facility.

Signage that contains Braille must also be installed in these facilities. Again, because an individual does the installation, the signs are not always placed according to the ADA Design Guidelines. Some signage that indicates the different type of restrooms, i.e., women, men, family, are required to be placed within eighteen (18) inches to the right side of the doorway and forty-eight (48) to sixty (60) inches from the floor. As people see differently at different distances, the further the sign is placed from the door, the more opportunities for a misplaced traveler. Additionally, if there are signs made available in the stalls themselves, they also need to be positioned as close to the door as possible to allow the occupant to get instructions on special features in the stall before they actually make use of the lavatory.

Another issue commented upon in the initial interviews were the locking mechanisms of the stall doors. Some were placed on the inside of the door and had a swinging arm type of mechanism that could be moved into a notch on the corresponding part on the actual stall wall. Although this type of lock is fairly easy for most people to maneuver, it is not very safe. Anyone could slide a thin piece of metal or even a sturdy card (I.D. or credit) in through the space between the door and stall wall, and with a slight upward thrust, open the door in seconds, not allowing the occupant much time to realize what was occurring. Other locks are embedded in the door, itself and have a very small profiled disk that turns to throw the lock in place. Although this type of mechanism is more stable, it is sometimes difficult to find as it does have a slimmer profile and this also creates issues should someone have problems with dexterity.
Minor issues with placement of the toilet paper dispenser are minimal. The guidelines allow for a minimum dimension between the grab bars in an accessible stall and the toilet paper dispenser and in some cases, the dispenser becomes too low to reach if it is below the grab bar and too high to reach if above. Other items that can be reviewed include the handles or buttons of the flushing mechanisms on toilets, the spacing under the stalls, and directional instructions for people who are blind/legally blind without them having to ask for assistance. Figure 3.1 is a mind map that details many of the issues involved in this study.

![Mind Map](image)

**Figure 3.1**: Mind Map that depicts the problems in the design brief.

### 3.5 Summary of Design Brief as Identified by User/Expert/Designer

Overall, restroom facilities in airports need to be redesigned to function well and in a timely manner for the user who is blind/legally blind. The number of accessible stalls is limited and all stalls are inadequately spaced, placed, and secured which leaves the
occupants vulnerable during a very private experience. Lighting is a problem in many areas, especially near doorways and above stalls. There is often either dark colors or more often one single color for walls, floor, stalls, and cabinets. This means that if there is no delineation of color, it is difficult for people who are legally blind/blind have difficulty finding a reference point to help with balance, direction, and prevent them from getting dizzy. Add to this the dimly lit areas and this leads to a treacherous comfort break. This comprises just a part of the material landscape of people who are legally blind/blind.

Hygiene issues related to placement of soap and towel dispensers or electric hand dryers, waste receptacles are an issue. If one cannot find any of those items the individual will need to use their hands to find the appropriate items, thus leaving the person open to touching germs, which could make them ill. Additionally, if the accessible stalls are occupied the individual who is legally blind/blind will have to locate another, smaller stall which is more difficult to maneuver in if one has to bring their luggage and guide dog inside with them. Signage can also be a hindrance if it is not placed within reach both at the doorway and inside the stall near the door. One must also be careful with signage, as one can never be sure whose hands have touched the Braille instructions. The placement of toilet paper dispensers, feminine protection dispensers, and locking mechanisms need to be addressed, as do the handles and/or buttons of the flushing mechanisms, spacing under the stalls, and a means of directing the person who is legally blind/blind to the appropriate stall. If several of these issues could be modified, this would aid in providing a more independent, private, and accessible experience for people who are blind/legally blind.

Traveling through the lived experience and current material landscape of a person who is legally blind/blind can be a daunting prospect. Concerns relating to a change in this
material landscape are explained in the design brief. Research into these concerns is explored further in the next chapter.
CHAPTER 4:

RESTROOM EVALUATION AS A USER/EXPERT [RESEARCH]

4.1 Restroom Surveys, Design Opportunities

Initial interviews highlighted the problematic areas for the respondents. A research protocol (see Appendix C) was constructed to systematically evaluate each restroom facility researched. This protocol identified the specific restroom sections, as one would experience them beginning with the outer entryway, traveling through a restroom experience, and finally returning to the entryway. The protocol allowed the user/expert to act as a researcher in order to evaluate the specifics of a facility from the user/expert’s point of view. There were four major facilities evaluated: the Illinois Terminal Women’s restroom (Champaign, Illinois, USA); Chicago O’Hare Airport Women’s restroom on Concourse K (Chicago, Illinois, USA); Shannon Airport Women’s restroom (Shannon, Ireland); and lastly Willard Airport Women’s restroom (Champaign, Illinois, USA).

The first restroom facility researched is located in the Illinois Terminal (Champaign, Illinois, USA). The train, long distance buses, and local buses arrive and depart from this facility. The restrooms are located on the first floor and although the trains arrive/depart from the second floor, the first seems to be the most appropriate place for the restrooms. There are a total of three (3) stalls in the women’s room and one of them is designated specifically for people with disabilities and is considered ‘accessible.’ The walls and doors of the stalls do not reach the floor. They hover about one foot above and are only connected to the walls on either side of the room.

The second facility is at O’Hare International Airport (Chicago, Illinois, USA). O’Hare has 4 terminals and 9 concourses including 185 gates and 70 restroom facilities. The layout of the
each terminal is quite different and, as a result, the number of restroom facilities varies according to the concourse and terminal. The Concourse layout includes B and C in Terminal 1; E and F in Terminal 2; G, H, K, and L in Terminal 3; and M in Terminal 5, which is the international terminal. The women’s restroom evaluated was located in Concourse K.

The third facility is located at Shannon Airport (Shannon, Ireland). The airport has two (2) floors, one (1) concourse, and fourteen (14) arrival/departure gates. There are five different restroom locations throughout the airport. The women’s restroom evaluated was located on the main level, past the check-in counter on the left. There were no visible signs to indicate the location until the facility was within approximately twenty (20) feet. The facility had four (4) stalls and there was a separate accessible restroom. It was this accessible restroom that was evaluated.

The fourth and final facility is located at Willard Airport (Champaign, Illinois, USA). The women’s restroom facility is located to the left of the escalators on the first floor of the airport. There are a total of five (5) stalls including one (1) accessible stall. The facility has an open entryway that leads into the facility with a wall to obstruct the view of any passersby. This facility was the basis for the final design solutions explained in Chapter 5.

4.2 Accessibility of Facilities Examined

Illinois Terminal (Champaign, Illinois USA): the user/expert located the entryway an enclosed area approximately sixty (60) inches wide, walked through and entered the open doorway. One of the first things noticed was the floor tile, which had a matte finish. The furthest stall from the doorway, the third of three stalls, is the accessible stall. Located on the wall just behind the door to the accessible stall was a ‘baby diapering station’ (Figure 4.1a). This can interfere with the accessibility of this stall because, if not properly closed and
secured, the stall door, which opens outward, cannot open completely making it difficult for a person to enter. The stall dimensions allow for the maneuvering or a radial turning of a person in a wheelchair. The stall is also well equipped with grab bars at appropriate heights on the side and back of the stall, complying with ADA requirements. The grab bar at the back of the stall is on the wall directly above the wall-mounted toilet. The toilet paper dispenser, although a bit low on the wall, is accessible (Figure 4.1b). Also placed in the stall is a corner shelf, which would not necessarily be visible to all users. It is large enough to place shopping bags, a backpack, or other personal items, which one would not want to place on a public restroom floor. The stall has a laser eye for detecting the user’s movement as that user stands up or moves off the seat, and automatically flushes the toilet. The locking mechanism is one that attaches to the door with screws and has a rotating arm, which is then placed in the slot on the stationary wall of the door to lock the stall.

O’Hare Airport (Chicago, Illinois, USA): At the entryway there was no solid door to the restroom, just an opening. The “Women” international restroom symbol was at the door opening (Figure 4.1c) and had Braille on the sign. This is a plus, however a person who is legally blind/blind may miss the sign, depending upon their visual issue. The door opening led to a dimly lit corridor where it was difficult to see anything to assist in orientation. After
the user/expert’s eyes adjusted to the darkness it was noted that two paths led into the facility. There was a path to a sink area that shortly thereafter veered to the left and one that continued on for a short walk then veered to the left. Both paths led to 5 or 6 stalls, the last stall in each row was accessible and attached to the end wall. Similar to those stalls in Illinois Terminal, the walls and doors did not go to the floor and hovered approximately one foot above. They were attached and embedded into the walls of the facility. The accessible stall has enough space for a person in a wheelchair to complete a radial turn (one that is 360 degrees). The stall door opens out and the locking mechanism is embedded into the door. There is a laser eye to flush the toilet but also one on the seat to advance the plastic seat covers on the toilet seat. The laser eyes may create issues for people who are legally blind/blind, as they may not be able to see the laser eyes, resulting in a problem discerning the nature and function of the seat cover mechanism along with difficulty in the act of using and flushing the toilet.

Shannon Airport (Shannon, Ireland): No directional signs were in place to indicate the location of the restroom facility on the main level of the airport (Figure 4.2a). Once past the check-in counter a sign for the restrooms was to the left of a large pillar. The user/expert went to the entrance of the restroom facility and opened the door. There were four stalls in the restroom but none were accessible. The accessible women’s restroom was located across the hall in a separate room. The user/expert entered the accessible restroom, which was larger than the stalls in the regular facility. This restroom also included a sink and accompanying fixtures. Even with these other fixtures, the restroom seemed large enough for a person in a wheelchair to accomplish a radial turn. There were grab bars located on the wall to the right
and behind the toilet. The toilet paper holder was on the wall just below the grab bars. The tile on the floor was a bit textured but otherwise easily traversed.

Willard Airport (Champaign, Illinois, USA): The entryway to the facility is wide enough for two people to pass each other (Figure 4.2b). There are five stalls in total and one stall that is accessible. The accessible stall is the furthest from the doorway and against a wall (Figure 4.2c). This stall has enough space to ensure a person in a wheelchair can complete a radial turn. There is a changing table on the interior of the stall attached to the wall and since the stall door opens out, the changing table does not interfere with the operation of the stall door. It does reduce, by a small amount, the space inside the stall. The stall contains grab bars to the right and behind the toilet. The toilet paper dispenser is placed under the grab bar to the right of the toilet.

Figure 4.2a: Shannon Airport main level Restroom behind pillar.
Figure 4.2b: Entrance to the accessible restroom at Willard Airport.
Figure 4.2c: The grab bar is placed to the left of toilet rather than directly behind.

4.3 Safety Issues in Facilities Reviewed

Illinois Terminal (Champaign, Illinois, USA): One of the issues brought up in the initial interviews was related to the locking mechanisms on the stall doors. These locking devices can either be embedded into the door or attached to the inside of the door. The locking mechanism on the door (Figure 4.3a below) is attached with screws and the profile is approximately one and one-half inch out from the door. The lock has a rotating latch which,
should someone choose to, would be easily unlatched by sliding a thin piece of metal or a credit card in between the stall wall and the door and moving it in an upwards direction. Lighting at the entryway of this restroom facility was inadequate as the pathway was dark and it was difficult to see the actual entryway for the user/expert. The other areas of the restroom were very well lit.

O'Hare Airport (Chicago, Illinois, USA): The user/expert noticed that the lock was set into the door itself (Figure 4.3b), rather than being an attachment either to the inside or outside of the door. Inside locks with swinging or push type of latches tend to fall apart and become useless in a public washroom due to the heavy volume of traffic. The type of latch chosen for this restroom seems to be fairly stable and easily maneuvered, even if someone has dexterity issues although the handle is a bit small; because it is embedded, the latch has a slimmer profile and does not easily catch on clothing, bags, or other items likely to be carried when traveling. The lighting in this facility made it difficult for the user/expert to move through the space. The entryway was dimly lit to the point that the user/expert actually walked into a person on the way into the restroom. Other areas were also difficult to maneuver through. The lighting above the sink was very bright and the user/expert had problems with glare bouncing off the mirrors above the sink. The stall area was also dimly lit causing the user/expert to move cautiously while in the stall.

Shannon Airport, (Shannon, Ireland): the accessible restroom at the Shannon Airport had a more sturdy door as it was a single room and the locking mechanism was placed a few inches higher than those locks in stalls in the USA. This may cause a problem for people who are of smaller stature, as they may not be able to easily reach the lock when attempting to put it in place. This is also an instance where someone who is legally blind/blind and lives in the
United States would have to find the lock because the individual’s embodied experience has the locking mechanism in a lower location. The restroom facilities in Ireland also have doors and walls that meet the floor (Figure 4.3c). This prevents possible intruders reaching under the door or stall to take an individual’s suitcase or other belongings. The lighting in the common area of the main restroom facility was very bright. The accessible restroom was well lit except at the entrance hallway, which was dimly lit causing the user/expert to move with caution.

Willard Airport (Champaign, Illinois, USA): stall doors also contain the embedded lock however the stall walls (Figure 4.3d) have a gap from the bottom of the door to the floor of approximately ten (10) to twelve (12) inches. An additional issue that the user/expert noted in this facility pertained to the placement of the paper towel dispensers in relation to the sinks. These dispensers were approximately four (4) feet from the closest sink which means that if a person washes their hands then moves to get paper towels, the person must either shake off their hands before moving to eliminate dripping water on the tile floor or they could move quickly to get the towels dripping a little water on the floor. This means that the user would have to use extra paper towels to mop up the spillage or it could be a safety issue as before the water dries on the floor the next user could slip and fall. The lighting at the Willard Airport facility was bright except for at the entrance, which was not well lit at all. The path along the
obstructing wall was dark and dimly lit to the point that the user/expert did not see the ‘Caution: Wet Floor’ sign on the left side of the pathway into the restroom.

4.4 Hygiene Problems with Facilities Surveyed

Illinois Terminal (Champaign, Illinois, USA): there were several issues related to hygiene that were evaluated. The stalls all contained a laser eye that, when a person moves to either stand up or in some cases moves slightly either left or right, can automatically flush the toilet (Figure 4.4a). This is rather disconcerting if a person cannot see that it is there or does not know its function. Should a person who is legally blind/blind not know the laser eye is in use, they may try to locate a flushing mechanism. As a person who is legally blind, this user/expert will attempt to locate objects needed while in the stall, before using the lavatory. This user/expert will give the space a systematic check from the back of the toilet to the front to make sure that there is awareness of the location of all fixtures. When no flushing mechanism appears visible, this can cause the user anxiety because something has obviously been missed; this is not a comfortable feeling to have in this situation.

Other issues in this facility related to hygiene manifest themselves in the sink area. This restroom has a large, narrow sink at which several people can stand at the same time. This sink also has laser eyes, which turn the water on and off (Figure 4.4b). If one cannot see the laser eye, then washing one’s hands is not possible. The soap dispenser is to the left of the laser eye and under the top portion of the sink. It is located slightly back from the edge of the overhang and can be difficult to find even with excellent vision. Additionally, this facility does not use paper towels but instead uses a hot blow dryer. As a guide dog user, this user/expert has problems controlling the guide dog because the hot air blows directly on the dog, whose leash is on the wrist of the user/expert during this process.
O’Hare International Airport (Chicago, Illinois, USA): the facility also had a laser eye for the flushing mechanism (Figure 4.4c). There were additional issues within the accessible stall, including automatically advancing plastic covers on the toilet seat (Figure 4.4d) and Braille instructions on a sign positioned behind the toilet on the left side of the wall (Figure 4.4e). Placing the signage next to the doorway can give greater access to the operational instructions of the toilet seat covers for people who are legally blind/blind, as well as those who are not. This mechanism also has a laser eye over which the user’s hand must be waved to advance the plastic cover. This laser eye has a cover that is dark green with a hand that appears on the cover. The color of the cover and its location are difficult for a person who is blind/legally blind to see, making the mechanism a challenge to use. This can leave the user who cannot advance the cover vulnerable to germs or bacteria left by the previous user. Should the user having difficulty move to another stall, it could also be equipped with the same mechanism, leaving the user to decide whether or not they should expose themselves to this hygiene risk, or risk their health by not using the toilet regularly and becoming ill in the process.

The user/expert found this facility’s sink area a bit easier to use. The soap dispenser was placed between two sinks and was easily accessible. The facility had both paper towels and a hot blow dryer for hand drying. The paper towel dispenser had a waste receptacle built in which allows for easy disposal. There was an additional waste receptacle closer to the path.
to the door so a person did not have to worry about where they could dispose of the used towels if the first area was crowded.

Shannon Airport (Shannon, Ireland): in the accessible facility, there were push-button flushing mechanisms. Although this does limit the amount of surface area a person has to touch when using the mechanism, the button is behind the toilet about mid-way up the wall (Figure 4.5a) and can be difficult to locate for someone who is legally blind/blind. This also opens this individual up to locating the button by touching the wall, leaving them vulnerable to germs left behind by a previous user. As there was a sink located within the accessible restroom, hand washing can be accomplished fairly quickly. The paper towel dispenser was within close reach of the sink on the right. Located just below and to the left of the sink was a waste receptacle for the paper towels.

Willard Airport (Champaign, Illinois, USA): had a regular flushing mechanism in the accessible stall (Figure 4.5b). Although this method is familiar to most users, in this case, because the pipe to the toilet was longer than expected, this makes finding the flushing mechanism tricky. The facility offered the same type of sink (Figure 4.5c) that can be found at the Illinois Terminal in Champaign, Illinois. In this case, the shelf above the sink featured two (2) laser eyes to turn on and off the water. The soap dispenser was not under the shelf rather it was positioned at the middle of the shelf and protruding straight forward rather than being
placed under the shelf. This dispenser was easily located, providing the user with a faster hand washing experience. Next to the sink was a cabinet top that a person could use to place belongings while they were using the sink. It was a bit long and made moving from the sink to the towel dispenser a bit awkward. The towel dispenser was one at which the user was required to press a lever to advance the paper towels (Figure 4.5d). This could be done with a hand or arm, if the user did not want to spread germs. The paper towel dispenser had an accompanying waste receptacle, which made the separate receptacle right next to it seem like overkill. Located above the shelf was a hand sanitizer dispenser, a bit redundant because it was directly above the sink. There was a second hand sanitizer dispenser on the opposite end of the facility placed on the wall next to the second towel dispenser. This hand sanitizer unit had an automatic eye and if one walked in front of the eye, it would dispense hand sanitizer whether or not there was a hand to catch it.

4.5. Summary of Restroom Surveys

There were similar issues throughout the airport restroom facilities surveyed. The user/expert experienced difficulties in all of the facilities including laser eyes that make using the toilet plastic covers and two of the sinks complicated to use properly for someone who is legally blind/blind. Lighting was a problem in all of the facilities, especially at the entryway. Hygiene issues associated with these devices occur when the user is unaware of the mechanism’s existence in the facility.

The user/expert noted two issues that pertained to all of the facilities. The first was related to the ‘regular’ stalls in these facilities related to the direction in which the stall door opened. The accessible stall doors all open outward. The ‘regular’ stalls all had doors that opened into the stall, making maneuvering in the stall very difficult for the user. Something
else noted by the user/expert during the surveys pertained to the tile used on the floors. All of
the facilities used a plain matte finished tile. In this area, color differences were also evident in
these facilities. Three of the four facilities visited had dark colored floor tile and two had
minimal distinction between the floor and wall color, which can be difficult for people who
are legally blind/blind to maneuver through especially in dimly lit areas. Possible solutions
and concepts will be explored and devised for these issues in the next chapter. It is
anticipated that these solutions can enhance the lived experience and material landscape of
the user who is legally blind/blind.
5.1 Tactile Tile – Accessibility

The user/expert evaluated the information that was gained during the airport restroom facility surveys as a designer and began the ideation/concept generation phase of the process. The initial things that the user/expert/designer evaluated related to accessibility issues in all of the facilities. The user/expert/designer determined that many times people who are legally blind have directional challenges when moving through crowded spaces and spaces with which they are unfamiliar. If the person is a cane user, traversing large crowded spaces can be treacherous because many people are concerned with their personal movements, rather than that of others. If the user has a guide dog it is a bit easier as the dog will take commands from its owner and move through the space effortlessly, as they are trained to do. The cane and the guide dog are assistive devices that aid people who are legally blind/blind in their navigation. Before using these tools correctly, the person who is legally blind/blind must take training in orientation and mobility (O & M). This training instructs the individual in the proper method of using a white cane to move about their home, work, or social environment. Once O & M training is completed and the individual is certified to use a white cane, the individual may apply for a guide dog should they so choose. It can take weeks, months, or even years for a dog to become available at one of the many schools throughout the United States. Once the individual is called to the school, training can take anywhere from two (2) to four (4) weeks at the school. The new guide dog user will then go home with their new companion that will assist the person with their navigational needs.
Although the guide dog and cane assist the individual very well while traversing through areas that are familiar to the user, unfamiliar areas can still cause problems for the person who is blind/legally blind. Additionally, if the individual is traveling independently, the travel experience can place additional stress on the person who is legally blind/blind. Alleviation of this stress was the initial goal of the user/expert/designer. The initial ideation began by looking at a variety of methods to assist an individual with navigation. GPS systems are becoming more prevalent but those do not work indoors because of the lack of RF mapping technology the Wi-Fi that is currently in place in many buildings cannot work alone with GPS devices (TRX Systems, 2013).

The user/expert/designer explored many different avenues and finally came upon an idea that would use a type of navigational system that is currently in use. The concept of tactile tile is currently used to identify the edges of train platforms and curbs for people who are legally blind/blind. These ‘tiles’ are also referred to as ‘truncated domes’ because of the way in which the top of the domes are flattened. The ADA requires that the space on transportation platforms covered by truncated domes is twenty-four (24) inches wide and the entire length of the platform. The truncated domes are laid out in a vertical and horizontal pattern. The dimensions of the domes are indicated in Figure 5.1a. The user/expert/designer’s initial idea was generated on an iPad™ using the Bamboo™ Application (Figure 5.1b). The concept was to generate a series of tiles that, when put together on a floor, created a pathway. The tiles can be placed strategically from the outer door to the accessible stalls, eliminating the need for GPS or other navigational devices other than those a person who is legally blind/blind already uses. Four (4) tiles were created with domes that are closely (within 1/8 inch) spaced together to create an elevated surface over which the person requiring the
navigation assistance places their feet. Through the shoe, the person will be able to detect the pathway, thus navigating to the accessible stall independently.

5.2 Personal Travel Kits – Hygiene

There are many cultural differences that individuals should be aware of when they travel. In some countries, the public restroom facilities do not contain toilet paper. People who travel to these areas need to have a method of cleaning appropriate areas while visiting these countries. A possible solution to aid the person who is legally blind/blind while traveling in these areas is a personal travel kit. After British officials stop an attempt to blow up a plane when liquid explosives were hidden in carry-on luggage, the laws have changed not only in the U.S. but also worldwide to combat the terrorist threats that have occurred. The Transportation Safety Administration (TSA) has specific requirements for liquids when you travel. Each passenger is allowed to carry one quart-size, zip top bag, which contains liquids, aerosols, and any gels on their flight in a carry-on bag. This plastic bag can contain clear bottles of which can hold only 3.4 ounces (100 ml) per volume of liquids. The TSA considers this the ‘3-1-1’ rule and state that additional liquids can be packed in a checked suitcase for longer trips (TSA, 2013).

Many times, although a person can visually recognize the contents of a clear plastic bottle, it is difficult to do when you are in the shower, water in the eyes. Adding a simple
texture to the outside of the bottle accomplishes two things. First, it provides a method for identification of those items by a person who is legally blind/blind that has difficulty with visual identification. Secondly, it allows for identification of a particular product that the user has placed in that bottle, without the user having to visually identify the product. Additionally, these bottles can be placed in the one quart sized bag as required by the TSA or they can be placed in the checked luggage, to prevent having the items inspected in the security line. These items are similar to those currently on the market with one exception, the texture on the outside of the bottle. A user can place shampoo, conditioner, and body wash into the bottles registering in their memory what identifying texture indicates each item. The user can add to the plastic bag, their own personal washcloth to make a personal hygiene kit, which they can place in their carry-on luggage and use when needed in those countries that do not provide toilet paper. In the depictions in Figure 5.3a and 5.3b, color was added to the bottles to make them more visible.

*Figure 5.2a & 5.2b:* Personal Hygiene kit bottles – color options. Clear plastic also available.
5.3 Audible Signals – Hygiene

One of the key issues people who are legally blind/blind deal with is trying to understand what is contained in a restroom stall after they enter. A person can, while traveling, experience many different restroom layouts, especially when it is internationally. Careful consideration to the idea that a person using the facility is not made to feel inept because of the unfamiliarity of the space they are visiting. Malnar and Vodvarka state in “Sensory Design” (2004) that there are subtleties in relation to sound and the effects “depends on their being strange and recognizable at the same time” (2004: 141). They continue saying that because sound is a common part of the built and natural environments, a person may assume that studies regarding the characteristics of sound are extensive, but they have not. Unwanted sound, or noise, is the more usual study topic. This continues discussing acoustics of architecture and other aspects of sound such as the body being the local for sensory information, conscious or otherwise (2004).

Taking a cue from the systems made available to people who are legally blind/blind as reading devices for a Windows based computer operating system (Jaws™, ZoomText™, Kurzweil 1000™ Reader) and the audible crosswalk signals that are now being installed around the local area, the user/expert/designer sketched out possibilities for an audible signaling device that can be installed in the accessible stall. The final possibility (Figure 5.3a) was then generated in a SolidWorks™ CAD model (Figures 5.3b & c). These devices can be placed in the accessible stalls and when a user enters, detects that user, and begins to describe the layout of the accessible stall. This is extremely beneficial when the user is unfamiliar with the surroundings and the objects located therein. As an example, a user enters the accessible stall in the facility at Concourse K, O’Hare International Airport (Chicago,
Illinois, USA) and does not know where the toilet is located. The audible device can inform the user that the toilet is approximately three (3) steps forward, turn to the right, and take two (2) steps. The device can then describe before the user proceeds to the toilet, that the plastic cover requires advancing and a person must wave their hand over the back of the toilet seat to make this happen. Taking the guesswork out of this experience can make the user feel more independent, able, and may also assist in a faster use time.

5.4 Larger Stalls – Accessibility & Safety

Accessible stalls are required to have greater area to enable a person who uses a wheelchair to enter and use the stall with the least amount of problems. The ADA Accessible Design Standards (2010) elaborates the minimum and maximum dimensions that are required for appropriate accessibility. The following is an example of the manner in which the ADA requirements are defined:

604.7 Dispensers. Toilet paper dispensers shall comply with 309.4 and shall be 7 inches (180 mm) minimum and 9 inches (230 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be 15 inches (380 mm) minimum and 48 inches (1220 mm) maximum above the finish floor and shall not be located behind grab bars. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow (ADA, 2010: 164).
Although the dimensions are stated in both metric and the U.S. systems (millimeters and inches), it is left to the person who is either designing or installing the fixtures as to the placement within that dimensional range. A preferred dimension would be ideal in these situations, so as not to have problems with the placement. When looking at the above quoted directions imagine that the bottom outlet of the toilet paper dispenser is placed at the minimum height from the floor, of fifteen (15) inches. This dimension for some individuals may be too low. Likewise, the forty-eight (48) inch maximum may be too high for others. There should be a mutually beneficial ‘preferred’ dimension at which the dispenser can be placed in order to satisfy the majority of the population that frequents these facilities.

The same can be said of the dimensions for an accessible stall. The toilet for an ambulatory accessible stall must be placed between seventeen (17) inches (430 mm) and nineteen (19) inches (485 mm) from the partition wall in the facility. Additionally, for a wheelchair accessible stall the minimum is sixteen (16) inches and maximum is eighteen (18) inches. The dimensions of each of these stalls are similar with the wall placement being perpendicular to the sidewall and a minimum length of sixty (60) inches (1525 mm) and the front wall being a minimum of fifty-six (56) inches (1420 mm) perpendicular to the rear wall of the stall. Although sixty (60) inches or five (5) feet seems like it provides enough space for a wheelchair, ease of use of these accessible stalls would benefit from larger dimensions on both sides. Changing minimum dimensions in the ADA to preferred dimensions would assist in alleviating confusion about where the stall walls can be placed for the most accessibility.

The user/expert/designer examined the five (5) stalls at the Willard Airport Restroom facility to determine the measurements and placement of the stall walls. The dimensions of the accessible stall fell under the ADA guidelines of fifty-six (56) inches from the rear wall to
the front wall and sixty (60) inches from the solid concrete, sidewall to the secondary stall wall. The doorway was thirty-three (33) inches, which falls between the minimum of thirty-two (32) inches and the preferred distance of thirty-six (36) inches. The remaining four (4) stalls had doorways of twenty-three (23) inches and stall dimensions of thirty-three (33) inches from wall to wall and fifty-six (56) inches from rear to front wall. The doors for the four (4) regular stalls opened inward, while the door for the accessible stall opened outward and only had a thirty-two (32) inch clearance when the ADA requires forty-two (42) inches (Osterberg, 2010; ADASAD, 2010).

One of the issues that drew the attention of the user/expert/designer was the misplacement of the rear grab bar in the accessible stall (see Figure 4.2). This grab bar is required to be placed “a. are 36in. (915mm) long minimum; and b. extend 12in. (305mm) toward the side partition from the centerline of the toilet. The remaining length extends to the transfer side of the toilet” (Osterberg, 2010: 138). This grab bar is incorrectly placed because it was not placed according to the centerline of the toilet, as indicated above. The correct placement of this grab bar needs to be twelve (12) inches to the left of the centerline of this toilet but because the pipe that provides water to the toilet is too long, the grab bar cannot be placed over it, thus the incorrect placement occurred.

Other items that were examined included the dimension of the space from the paper towel dispenser nearest the accessible stall (first stall) and the first sink of sixty (60) inches and the paper towel dispenser nearest the fifth stall to the second sink of fifty-four (54) inches. The counter placement in the facility was directly opposite of the accessible stall entrance next to the first paper towel dispenser. This counter was approximately five (5) feet long and abutted the sink area. None of the remaining four (4) regular stalls were walk-in accessible stalls.
The user/expert/designer entered all of the stalls in this facility to better understand what dimensional restrictions existed. The wheelchair accessible stall was quite roomy but inclusion of the changing table in the stall limited some of the space. The changing table protruded from the wall approximately four (4) inches. If a person were to enter the stall in a wheelchair, there could be a problem with that person accidentally colliding with the changing table whether or not it was secured in place. Should the stall walls be placed a few inches further from each wall, the wheelchair would fit more comfortably in the space while maintaining the required space for the turning radius of the wheelchair as well as the toe clearance required. Adding six (6) inches to the dimension of the wall placement, the walls would then be placed at sixty-six (66) inches from the side wall and sixty-two (62) inches from the rear wall. Changing the required stall width for the ‘regular’ stalls from thirty-three (33) inches to forty-four (44) inches would allow the stalls to be considered ‘walk-in accessible’ stalls, with grab bars on the side walls. Creating this modification would also provide a space for people who are legally blind/blind to use instead of the ‘wheelchair accessible’ stall. This would allow people who use wheelchairs access to the ‘wheelchair accessible’ stall, while at the same time a person who is legally blind/blind would have access to the ‘walk-in accessible’ stall that had enough room for not only the person but their accompanying guide dog and their luggage. Additionally, by changing the direction the doors to the ‘regular’ stalls open, which would be outward, the person using that stall would not have to maneuver themselves around the door while squeezing themselves into the small space around the toilet. Modification to how the door opens should not impede people’s access to the sink area or the paper towels. The layout for this facility (Figures 5.4a and 5.4b) would only change slightly. The overall number of stalls would be reduced by one but the four (4) stalls that
remained would be more spacious with doors that open outward, possibly resulting in less
time needed to enter, use, and exit each stall.

Figure 5.4a: Layout of stalls at Willard Airport, accessible stalls at left
Figure 5.4b: Angled view to show tactile tile on floor.

5.5 Outer Restroom Doors – Safety

Although the previous measures will assist in accessibility and hygiene for a person
who is legally blind/blind, other issues remain. One of the key indicators that a person is not
alone in a space is the sounds another person makes: that of moving around the space, using
items in the space such as the faucets, paper towels or hot blow dryers, or the sound of shoes
hitting a tile floor. When a space is crowded with numerous individuals all carrying or pulling
bags behind them, it is sometimes difficult to hear when people come and go. Additionally,
when a person is occupied with their own schedule, they can sometimes be unaware of the
mundane sounds that are heard in a public restroom facility. Many times, more attention is
paid to the opening of doors because of our embodied experiences. A person opens doors to
enter and exit buildings, especially the home. Doors are opened and closed in classrooms,
offices, and restrooms. This is a sound that is embedded in our embodied memories. As an
additional safety measure, it may be beneficial to place an outer door on the restroom
facilities to assist in safety concerns for a person who is legally blind/blind. Inserting a door
(Figure 5.4b) would provide an audible signal to the people who are blind/legally blind that are using the facility, which informs them that someone has either departed or entered the restroom. This alert could prevent a possible assault in the facility as well as make the person who is legally blind/blind more aware the individuals around them providing a more secure environment.

5.6 Feedback from Users

Discussion with people who are legally blind/blind and travel independently with either a white cane or a guide dog gave positive feedback to the design concepts for the restroom facility in the airport. One person said that, although they personally would probably not purchase a personal hygiene kit for traveling because it was just one more thing they would have to pack, he thought that there would be individuals who would like the idea of having quick access to cleansing materials, should none be available. A guide dog user thought that the tactile floor tiles would be a great way to navigate anywhere, let alone in a restroom facility. She preferred to travel with her guide dog and has four children and a husband. Although she stated it was rare that she traveled on her own, she appreciated the idea of the tiles and suggested that they could even go into rest stop restroom facilities on the highway.

Many users stated that they would prefer the larger stalls to having more stalls in a facility. One gentleman stated that because he was very tall and broad shouldered the current size of stalls were just too small for him to feel comfortable. He stated that he would like to enter a stall into which he could fit and move freely without worrying about banging his knees on the toilet as he was trying to close the door. Another user was interested in the audible signals for the accessible stalls. He is blind with some light perception, uses Jaws™
screen reading software and is used to audible reading. He thought the audible signals in the stall would help him locating the toilet as well as whatever type of other devices that are used on the toilet as a convenience.

The different concepts that were generated for this study were the result of detailed research into the ADA Standards for Accessible Design (2010), the airport/transportation facilities at Illinois Terminal (Champaign, Illinois, USA), O’Hare International Airport (Chicago, Illinois, USA), Shannon Airport (Shannon, Ireland); and Willard Airport (Champaign, Illinois, USA). An added benefit to this study was that the researcher was not only a designer but also a user/expert who is legally blind and whose embodied experiences assisted greatly in the design research and design process. Although user feedback on the detailed concepts and solutions was positive, the user/expert/designer identified other issues which could be explored further to find similar solutions that would assist in a more accessible, independent experience for people who are blind/legally blind. The conclusions discovered by the user/expert/designer are elaborated upon in the next chapter, as are additional recommendations for future design research and work.
CHAPTER 6:  
DESIGN PROCESS AS A USER/EXPERT [CONCLUSIONS]

6.1 The Role of the User/Expert in the Design Process

The design process is iterative and long. This study explored accessibility and inclusion by incorporating the user/expert into the design process. The generic design process was originally in place when industrial design was at its beginnings and it has been modified through the years to incorporate the user into the process. The universal design or user-centered approach incorporates the user into the process midway between concept generation and concept refinement. This is an excellent place for the user to have input into the concepts, before they are refined and the product enters into the final phase, production. In the empathic design approach, the design process incorporates the designer and the user working together to complete the design brief including the user/expert into the user’s role is very beneficial in the design process. If the user/expert works with the designer, as in the empathic design approach, the user/expert can inform the designer about experiences that the user/expert had with similar products, telling the designer what does and does not work about that product, so that the designer can avoid the same mistakes or improve upon a previous design.

The designer can also conduct ethnographic research with the user/expert. The designer can then see on a one-to-one basis how the user/expert deals with certain problems or issues that they may have in their everyday life. The user/expert has embodied experiences with which the designer may not be familiar. It is this knowledge and the ways in which the user/expert has transformed their material landscape the designer must learn to understand. Alternately, the designer could engage with the user/expert in an empathic modeling
exercise that puts the designer in the user/expert’s shoes and enhances the designer’s understanding of that embodied experience.

In these ways, the user/expert imparts their knowledge and gives insight into a lived experience that the designer needs to understand before they begin the concept generation for a particular product. It is this understanding that can aid the designer in the form, material, and overall design of a product, space, or service for the user/expert. The user/expert can then evaluate the concept and then determine what does and does not work about the design; after this the designer can refine and improve the original concept so that it works appropriately for its user. Including the user/expert on the design team provides insights to which the design team may not have access.

6.2 The User/Expert Process Model Proposition

Incorporating the user/expert into the design process can be a winning proposition for all concerned. The inclusion of a user/expert can influence the outcomes of the design process in a positive manner, one that aids in providing viable products, spaces, and services for those individuals in the user/expert group. In other words, if the user/expert is a person who is deaf or partially hearing, then the outcomes could assist this group of individuals in their lived experience as well as change their material landscape. If the user/expert is a person who is legally blind/blind, the outcomes from this association with a design team could be beneficial to this group’s lived experience, change their material landscape, and may offer them opportunities for independence that they may not have experienced otherwise.

This team association can also benefit the team members who are not part of the user/expert group. Working with a user/expert exposes the team to a different lived experience than those with which they are familiar, i.e., their own. Each individual is affected
differently through this association. It is hoped that, by associating with user/experts, the design team will become more observant and more aware of those things around them that need to be modified or changed. This team effort can aid in providing not only better lived experiences for those user/expert groups for whom they are designing but also for the aging population of ‘baby-boomers’ who, as they age, will become their own user/expert group. Additionally, this association may result in the conception and design of viable products for these user/expert groups that may also be viable for the entire population as a whole.

The user/expert is added to the design process and diagramed in Figure 6.1. The ‘User/Expert Process Model’ has adopted the empathic design process approach and incorporated the user/expert into the process, with the user at the beginning of the design brief. Once the team understands exactly who the user/expert group is for whom they will be designing, they can then introduce a user/expert from that group as a part of their team.
As a member of the team, the user/expert can instruct the team on empathic research methods, including empathic modeling exercises that can aid the design team in better understanding the user/expert group. The process includes the team obtaining items or creating their own, that will aid in their empathic modeling experience such as: making goggles or using a blindfold to simulate being legally blind/blind; using ear plugs to simulate being deaf. Although this is very beneficial to the design team for the purpose of understanding the user/expert group, this in no way compares to the user/expert’s daily-lived experience and all of the situations with which the user/expert must contend throughout their life. It does, however, give the design team a brief glimpse into this lived experience in order to assist with the overall design brief.

After the empathic research is completed the concept generation phase begins. If the user/expert has used similar products an explanation of what worked on the product and what did not work can assist with the new concept generation. Additionally, the user/expert can have insights into what may work better than the products that are currently on the market. This is where the embodied experiences of the user/expert come into play. These experiences allow the user/expert to find solutions that may be considered unorthodox by a designer or their team, but make sense because of the embodied experiences of the user/expert. The design team is working with an unfamiliar entity, in an unfamiliar and sometimes uncomfortable arena, to create products, environments, or services for this user/expert group. This is, in effect, stepping outside of the proverbial design process box.

The concept selection follows the initial generation. The concept selection is as equally important as the initial ideation. Selecting an appropriate concept will, in the long run, aid in the final concept refinement which then results in a viable product. The user/expert
can aid in the concept choice based on their embodied experience, understanding which concept might be a better choice, which has a better form and fits more accurately. Once the selection is completed, the concept refinement is the final stage. The user/expert can explain what needs to be changed or modified and from those modifications a model can be generated for the user/expert to test and give feedback. This feedback can then change the model again, and again, so that the design team ends up with the most viable possible concept for the client. The product of this teamwork is viable solutions to aid in providing a more independent experience for the user/expert group.

6.3 Challenges of The User/Expert

One of the challenges of the user/expert on the design team relate to how the team members regard the user/expert. If the individual is seen as just a user, not having a specific expertise, then the team may not be a good fit. If, however, the user/expert is brought into the team arena and the team is told that the individual has expertise in their embodied experience that can inform the design process, the design team may be more open to the association. It is through this association that the design team will gain understanding of the lived experiences of the user/expert group and this will aid in their concept generation as well as produce viable outcomes.

The user/expert may also find challenges due to the way in which the design team understands this lived experience. If the person is a wheelchair user, they could be viewed as someone who is less knowledgeable because of their disability. Temple Grandin, Ph.D. often refers to individuals with disabilities as “[d]ifferent not less” (Grandin, et al., 2010). The user/expert must highlight the differences of their embodied experience in order to aid the design team in their understanding of the problems concerned with the particular product,
environment, or service that the team is working on. It is through this instruction from the user/expert that the design team can understand the problem, as well as understand that the user/expert is “[d]ifferent not less” (Grandin, *et al*., 2010).

Other challenges the user/expert may face during this process relate to transportation to and from the offices in which the design team must meet; personal health issues, depending upon their disability; or the user/expert may have issues with any assistive technologies (such as their cane or guide dog) they may employ to aid in their day-to-day lives. The viewpoint of this user/expert/designer is such that these issues become secondary when there is an opportunity to aid a design team in their design process in order to provide a user group with more viable solutions to help their everyday problems.

6.4 **Recommendations**

Recommendations that have arisen as a result of this design study and thesis fall into several categories within the scope of the design brief. The user/expert/designer concentrated on specific areas to problem-solve as discussed earlier. Throughout this study, the user/expert/designer found several other areas that required attention but fall under the auspices of the building construction and maintenance arenas. These recommendations pertain to these additional areas.

6.4.1 – ADA Interpretation

The first area concerns the interpretation of the ADA (2010) and the ADA Standards of Accessible Design (ADASAD, 2010). The manner in which these documents are written leaves a great opportunity for miscommunication to the architects, construction workers and other professionals with regard to the appropriate placement, dimensions, and sizes of elements which fall into the realm of accessibility. These written descriptions are very distinct with
regard to what dimensions are necessary for appropriate placement and give a minimum and maximum appropriate dimension. These dimensions can be a broad range, which leaves the individual installer with the final placement choice. This can be a problem if the object, such as a sign with Braille instructions, is placed out of reach of the individual user or in a place that the individual user who it was designed to help cannot find it. If these individuals installing the objects were exposed to empathic modeling through a consultation with a user/expert/designer, they might understand more about the material landscape of people with disabilities, how their embodied experiences inform their everyday existence, and why it is so beneficial for people with disabilities to be more independent. Additionally, if interpretation of the ADA and ADASAD were included in regular training of the individuals who install these fixtures, objects, etc., the end results can be beneficial to the entire population.

6.4.2 Color

The second area of concern is related to the use of color in public airport restroom facilities. Holtzschue (2011) states in “Understanding Color: An Introduction for Designers,” that the eye senses the color of something but it is the mind that perceives the color and it does not necessarily happen at a conscious level. She continues by saying that “[c]olors are understood in context” (2011: 4) and they are experienced at diverse levels of recognition depending on where and how someone sees them. Additional elements contribute to the perception of color:

Colors may be perceived as an aspect of form, as light, or as surroundings. Colors permeate the environment, are an attribute of objects, and communicate without words. Environmental color is all encompassing. Both the natural world and man-made environments immerse us in colors, whether they are the cold whites of Antarctica, the lush greens of tropical forests, the
accidental color compositions of urban streets, or the controlled-color environments of architecture, landscape design, interior design, or theater design. (2011: 4)

There are many people who are legally blind/blind that have issues relating to color. Holtzschue’s statements about perception of color are at the heart of this problem.

Perception of color when a person is not able to see it at all or has issues discerning contrast makes this perception ambiguous. Should a person drop something on the floor, locating the object could be difficult due to the person’s perception of color. This is why, when a person who is legally blind/blind travels, their experiences in public airport restrooms can be harrowing. If the restroom has floors, walls, counters, stalls, and ceilings that are all similar or the same color, when these individuals move, their limited vision can play tricks on them. As a user/expert, this has occurred on more than one occasion and has resulted in bruised body parts or other injuries because of walking into a door, wall, or counter.

One solution to the problem is to remove the similarities and incorporate contrast into the environment. Walls that are lighter in color that contain a ‘sight line’ of a darker color can inform the user who is legally blind/blind where they are located (Figure 6.2). Although a darker floor tile can cover a multitude of sins (spillage, dirt, etc.) the darkest tile is not always a good solution because should a user who is legally blind/blind drop something on the floor, it becomes more difficult to locate unless the object is light in color. It can also be an issue if the user bends down to retrieve the object because limited vision can also cause balance problems if a person moves too quickly. By incorporating a different color into the design scheme, the user is able to discern the slight difference in color and contrast, which can result in fewer problems in the future.
6.4.3 Lighting and Illumination

Lighting and illumination in public restroom facilities need attention. Some eye diseases affect the individual’s night vision; lighting, good and bad, can be a deciding factor in the experiences in which people who are legally blind/blind choose to participate. When traveling, public airport restrooms are made available around the clock for the many passengers who traverse through the airports because airplanes arrive and depart throughout the day.

As stated earlier in this document, the ADASAD only discusses three instances in relation to lighting: elevators, stairways, and signage. One of the areas not discussed is the restroom in public facilities. If a person who is legally blind/blind has limited or no night vision, situations where there is low or limited light may also be problematic. This seems to come into the arena of the electricians installing the lighting fixtures and the building maintenance crews who change the bulbs. Realistically, it is understood that the airport
would like to save finances in any way that they can and electricity seems to be the most viable option: turn off the lights and other electrically operated objects throughout the facility and they save money. Another way that can assist in this is to use lower wattage bulbs. The problem with using these lower wattage bulbs is that they don’t always illuminate the area adequately enough for those people who are legally blind. Poor illumination can be an underlying cause of accidents for a person who is legally blind, and may result in costing the facility more money in the long run as a result of possible lawsuits.

A solution to this problem can be that the facilities change their bulbs from incandescent to the newest technology, the light emitting diode or LED light. Invented by Nick Holonyak, Jr. with a team at Bell Labs in the 1960’s, LED’s have come a long way since the early days when only one color, red, was available. In addition to providing a more intense light, if a number of LED’s are placed together in a bulb, the LED uses less electricity than a regular incandescent bulb and even fluorescent tubes, which are difficult to dispose of because of their contents. (Port, 2005). If the facilities change the type of bulb used, it will not only increase the illumination in areas where they currently use lower wattage bulbs, but it is also a sustainable solution to the problem and can result in lower electricity costs for the airports.

6.5 Future Research

There are other aspects of this study that should be researched further. Solutions to signage issues of illegible text from distances, color choices on the location signs that blur or muddle the text are examples of additional issues that arose during this study. The user/expert/designer only just began investigation into this area. The user/expert/designer believes that by incorporating other user/experts into the design process this study can be
expanded to include those user/experts who are deaf or have hearing loss, those user/experts who use wheelchairs to improve on current designs and layouts in public restroom facilities, and those user/experts who have dexterity issues such as arthritis to improve upon locking mechanisms and other gripping issues that occur in restrooms with faucets, flushing mechanisms, etc. The user/expert/designer’s future research can include the spaces leading into the restrooms, the airport facilities themselves, as well as other public spaces where people who are legally blind/blind or have other physical limitations can work as user/experts to improve, expand, and make more accessible those spaces in which they traverse or visit daily.

6.6 Conclusion

Throughout this study, the user/expert/designer found a myriad of possibilities to address in relation to travel experiences of a person who is legally blind/blind. During this experience the user/expert/designer not only learned more about the generic, the user-centered, and the empathic design processes, but also what it means to be a user/expert, the user/expert’s techné, personal knowledge, and where the user/expert fits within the design team. The user/expert/design now understands more about how to incorporate design and advocacy together and how instruct users to become user/experts, how integration of environments can assist in a more inclusive and accessible experience, and how previously known entities (such as truncated domes) can be modified to slightly change an environment for a more independent lived experience.

Although some of the solutions and recommendations that the user/expert/designer found could increase initial building costs the long-term benefits that occur as a result can increase independent travel for many people with disabilities especially those who are legally
blind/blind. These benefits can also include an increase in revenues for those companies associated with the travel industry such as hotels, restaurants, and other venues that people enjoy visiting when traveling to new or different places.

While the user/expert/designer explored many areas of concern, the eventual solutions to the problems were thoughtfully and carefully conceived, selected, and refined, resulting in solutions that can aid in and promote the independent travel that a user who is legally blind/blind can experience. These solutions can be a seamless integration into a traveler’s material landscape and thus results in more enjoyable lived experiences for all.

Pullin states in “Design meets Disability” (2009) that:

“…[W]hen Braille is employed in inclusive design, rather than in publications or products specifically for people who read Braille, it inevitably becomes part of the visual and tactile experience of sighted people — a visible, if illegible, part of their environment” (2009: 61).

This inevitable integration of experiences for people, who are legally blind/blind and those who are not, can result in an environment in which every person is comfortable, no one stands out as being less, and the experiences of all can be accessible and inclusive.
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GLOSSARY

Blind (adj.) – Unable to see because of injury, disease, or a congenital condition; when a person has limited light perception and/or able to see light and shadow, or no sight at all.

Empathy (noun) – The ability to understand and share the feelings of another.

Empathic Design – The application of empathy into the design process.

Empathic Modeling – The individual takes on another’s experience for a short period in order to better understand and share the feelings of that person.

Foot-candle – A non-SI unit of illumination (no longer used), equal to that of the measure of one candela on a surface from one foot away. This measurement is used in the United States and is equivalent to one lumen per square foot or 10.764 lux.

Legally blind – A person is considered to be ‘legally blind’ by medical professionals, the U.S. government, and other agencies if they have visual acuity that is correctable to 20/200 in the best eye, or peripheral fields of less than 10° in each eye (20° in both eyes).

Lived experience – The practical contact with and observation of, facts or events during a person’s lifetime.

Low Vision – describes people who have visual difficulties that limit the ability to see. It is usually used to describe all types of people with different types of eye diseases or conditions.

Lux (noun) - The SI unit of illuminance, equal to one lumen per square meter.

Material Landscape – The objects that surround an individual throughout their lifespan. This includes but is not limited to those items in your home, your office, and those that are most familiar and used on a regular basis by the individual.

Safe (noun) - Protected from or not exposed to danger or risk; not likely to be harmed or lost.

Safety (noun) - The condition of being protected from or unlikely to cause danger, risk, or injury; (as a modifier) Denoting something designed to prevent injury or damage.

Sympathy (noun) – Feelings of pity or sorrow for someone else’s misfortune.

Techné (noun) - considered to be the knowledge that is enacted in daily life, is naturally occurring, involves genuine human expertise, and is bound to necessity and something practical. Techné is connected to embodiment, which is defined as experiences and performances that are contained within the memory of peoples’ bodies. Further to this, physical and emotional attributes and characteristics are aspects of embodiment. The ability to empathize with others is connected to basic human emotions. It is techné and embodiment that bridge people’s emotions towards the creation of empathy (Strickfaden and Devlieger, 2011: 223)
**Universal Design** – is the way in which objects, spaces, and environments are made safer and more accessible for the widest range of people.

**User/Expert** (noun) – anyone who has developed natural experience in dealing with challenges in our build environment (Ostroff, 1997).

**User/Expert/Designer** – a user/expert who has knowledge, both learned and experienced, as an industrial designer.

**Visual Acuity** – Sharpness of vision, measured by the ability to discern letters or numbers at a given distance according to a fixed standard; this is a partial determinant of legal blindness (correction in the best eye of 20/200 meaning that the individual being tested sees at 20 feet what others see at 200 feet).

**Visual Impairment** – used to describe people with visual difficulties that limit the ability to see. It can include those individuals who are required to wear eyeglasses or contact lenses as well as those who are legally blind or blind. (JVIB, 1997)²

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² Unless otherwise stated, definitions of terms are from the Oxford English Dictionary.
APPENDIX A

QUESTIONNAIRE FOR SURVEY PARTICIPANTS
Design for Inclusion: Providing Safety in Public Transportation Spaces
Prof. Kevin Reeder, Research Principal Investigator

These are the questions that will be asked of those voluntary participants after signing the Consent Form.

1. Do you consider yourself to have a disability?
2. If yes, what is that disability?
3. Does your disability affect upon your ability to travel?
4. If yes, in what ways? (Example: Do you decline invitations from friends, not go out to restaurants, and stay at home more often?)
5. Why do you believe this occurs?
6. Have you recently visited a train station, bus station, or airport, either in a newly built building or a retrofitted building?
7. If so, what kind of space was it (see list above)?
8. Was the space newly built or a retrofitted building?
9. Generally, when thinking about the public spaces specifically used for the purposes of travel that you have visited in the past, do you think that there are adequate modifications to accommodate ALL people including those with disabilities?
10. If not, can you give examples of where these spaces fail to accommodate and if yes, how were they designed to accommodate people with disabilities?
11. Generally, when thinking of the public spaces specifically centering around travel which are in newly design and constructed buildings, from your perspective, are they adequately designed to accommodate ALL people, including those with disabilities?
12. If not, can you give examples of where these buildings fail to accommodate or if yes, how were they designed to accommodate?
13. Do you believe that people who have disabilities are perceived by the general public as vulnerable when they travel?
14. Do you believe this perception can be changed?
15. How do you think this can be achieved?
16. Do you feel, as a person with a disability, that this perception influences how people expect you to behave or use a public space?
17. How?
18. As a person with a disability, do you feel safe when traveling alone?
19. Why or why not?
20. What do you think would help you in feeling safer when you travel?
21. Can you name and describe one specific situation when you were travelling alone where you felt unsafe?
22. When and where did this occur?
23. Do you believe that with simple modifications to a space specifically designed for travel purposes will assist in making you feel safer when you travel?
24. If a specific public space centered on travel (airport, train, or bus station) were available with safety modifications, would you travel more often?
25. Do you have any other comments to make about travelling?
CONSENT FORM

Design for Inclusion: Providing Safety in Public Transportation Spaces

You are invited to participate in a research study on a design for a product to be used in a travel-oriented public space including train stations, airports, and bus stations. These spaces will be looked at from the perspective of a person with a disability to determine in what areas of these spaces can be improved or changed to accommodate those with disabilities in the most helpful manner. This includes speaking to persons with disabilities at the beginning of the design process rather than at the end in order to get a better idea of what they need. This study is conducted by Professor Kevin Reeder, Responsible Project Investigator (RPI), an Associate Professor of Industrial Design at the School of Art + Design from the University of Illinois at Urbana-Champaign. The Research Team is comprised of 2nd Year Industrial Design Graduate Student, Sheila M. Schneider.

This study will take approximately 1 hour of your time. You will be asked to complete an video recorded interview, audio recorded interview, or a survey about your familiarity with public transportation spaces, such as train stations, airports, and bus stations, how you feel moving through these spaces, and what kind of issues you may have while doing so. Necessary personal information such as your image and disability may be used in the final work. You may also be contacted for additional follow up questions or clarifications, which may take approximately 3/ to 1 hour. The final work will be submitted in thesis form for publication and each person being interviewed will have the option to:

a.) Request your images not be used in printed and video publication

b.) Request complete anonymity in publication of any form (images will be pixilated)

c.) Request to completely terminate participation in study

Your decision to participate or decline participation in this study is voluntary and you have the right to terminate your participation at any time without penalty. You may skip any questions you do not wish to answer.

Your participation in this research will be completely confidential and should your responses be used in any type of publication, you will be referred to with a pseudonym (e.g. Joe Smith, Mary Jones). Possible publications will be in a thesis document and presentation to a thesis committee and the results of the study may be published in journal articles or conference papers. Although your participation in this research may not benefit you personally, it will help us understand the experiences of people with disabilities and ways in which to provide travelers with disabilities more security and independence.

If you have questions about this project, you may contact Prof. Kevin Reeder at 217-333-0855 or by email at <kreeder@illinois.edu>. You may also contact the Research Team member, Sheila Schneider at 217-637-0304 or by email at <sschnei7@illinois.edu>.

If you have any questions about your rights as a participant in this study or any concerns or complaints, please contact the University of Illinois Institutional Review Board at 217-333-2670 (collect calls will be accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

I have read and understand the above consent form, I certify that I am 18 years old or older and, I indicate my willingness voluntarily take part in the study by signing below.

Participant ___________________________________________________________ Date __________

There are no risks to individuals participating in this survey beyond those that exist in daily life. Please print a copy of this consent form for your records, if you so desire.

Your decision to participate, decline, or withdraw from participation will have no effect on your current status or future relations with the University of Illinois at Urbana-Champaign.

Contact: Prof. Kevin Reeder, email: kreeder@illinois.edu or (217) 333-0855
Sheila M. Schneider, email: sschnei7@illinois.edu or (217) 637-0304

If you need to have a large print version of this form, please ask the RPI or Research Team and one will be provided.
APPENDIX C

RESTROOM SURVEY PROTOCOL
RESTROOM SURVEY PROTOCOL

This protocol is to aid in completing a systematic method to evaluate a variety of public restroom facilities at airports. Beginning at the entrance of each facility and moving through as if the experience is occurring will accomplish this task.

1. Examine entrance and measure openings.

2. Move toward accessible stall. Note difficulties encountered. Where is stall located? How far is it from the entrance to the accessible stall?

3. Measure doorway, width, and length of accessible stall. Observe objects in stall: toilet, grab bars, toilet paper dispenser, flushing mechanisms, shelves, etc.

4. Note any additional observations.

5. Measure doorways, width, and length of additional stall in facility. Note observations of objects in stall.

6. Observe hand-washing area. Note number of sinks, type of faucets, placement of soap and towel dispensers. Note waste receptacle placement.

7. Other observations of entire restroom should be noted, such as floor, shelving, hand sanitizers, etc.

8. As researcher is departing note any additional thoughts or observations about exit/entrance; signage, or other issues encountered.
APPENDIX D

2010 AMERICANS WITH DISABILITIES ACT STANDARDS FOR ACCESSIBLE DESIGN (ADASAD) CHAPTER 6: PLUMBING ELEMENTS AND FACILITIES

(601 – 612.3)
2010 ADA Standards for Accessible Design

Department of Justice
September 15, 2010
CHAPTER 6: PLUMBING ELEMENTS AND FACILITIES

601 General

601.1 Scope. The provisions of Chapter 6 shall apply where required by Chapter 2 or where referenced by a requirement in this document.

602 Drinking Fountains

602.1 General. Drinking fountains shall comply with 307 and 602.

602.2 Clear Floor Space. Units shall have a clear floor or ground space complying with 305 positioned for a forward approach and centered on the unit. Knee and toe clearance complying with 306 shall be provided.

EXCEPTION: A parallel approach complying with 305 shall be permitted at units for children's use where the spout is 30 inches (760 mm) maximum above the finish floor or ground and is 3½ inches (90 mm) maximum from the front edge of the unit, including bumpers.

602.3 Operable Parts. Operable parts shall comply with 309.

602.4 Spout Height. Spout outlets shall be 36 inches (915 mm) maximum above the finish floor or ground.

602.5 Spout Location. The spout shall be located 15 inches (380 mm) minimum from the vertical support and 5 inches (125 mm) maximum from the front edge of the unit, including bumpers.

![Drinking Fountain Spout Location](image)

Figure 602.5
Drinking Fountain Spout Location

602.6 Water Flow. The spout shall provide a flow of water 4 inches (100 mm) high minimum and shall be located 5 inches (125 mm) maximum from the front of the unit. The angle of the water stream shall be measured horizontally relative to the front face of the unit. Where spouts are located less than 3 inches (75 mm) of the front of the unit, the angle of the water stream shall be 30 degrees maximum. Where spouts are located between 3 inches (75 mm) and 5 inches (125 mm) maximum from the front of the unit, the angle of the water stream shall be 15 degrees maximum.
Advisory 602.6 Water Flow. The purpose of requiring the drinking fountain spout to produce a flow of water 4 inches (100 mm) high minimum is so that a cup can be inserted under the flow of water to provide a drink of water for an individual who, because of a disability, would otherwise be incapable of using the drinking fountain.

602.7 Drinking Fountains for Standing Persons. Spout outlets of drinking fountains for standing persons shall be 38 inches (965 mm) minimum and 43 inches (1,090 mm) maximum above the finish floor or ground.

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 space, clearance at fixtures, and turning space shall be permitted to overlap.

603.2.3 Door Swing. Doors 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 a clear floor space complying with 304.3 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.

Advisory 603.2.3 Door Swing Exception 1. At the time the door is installed, and if the door swing is reversed in the future, the door must meet all the requirements specified in 404. Additionally, the door swing cannot reduce the required width of an accessible route. Also, avoid violating other building or life safety codes when the door swing is reversed.

603.3 Mirrors. Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1,015 mm) 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 (890 mm) maximum above the finish floor or ground.

Advisory 603.3 Mirrors. 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 (1,880 mm) 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 (1015 mm) minimum and 48 inches (1220 mm) 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 604.3. 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 (405 mm) minimum to 18 inches (455 mm) maximum from the side wall or partition, except that the water closet shall be 17 inches (430 mm) minimum and 19 inches (485 mm) maximum from the side wall or partition in the ambulatory accessible toilet compartment specified in 604.6.2. Water closets shall be arranged for a left-hand or right-hand approach.

Figure 604.2
Water Closet Location

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 (1525 mm) minimum measured perpendicular from the side wall and 56 inches (1420 mm) minimum measured perpendicular from the rear wall.
604.3.2 Overlap. The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures, and the turning space. No other fixtures or obstructions shall be located within the required water closet clearance.

EXCEPTION: In residential dwelling units, a lavatory complying with 606 shall be permitted on the rear wall 18 inches (455 mm) minimum from the water closet centerline where the clearance at the water closet is 66 inches (1675 mm) minimum measured perpendicular from the rear wall.

Advisory 604.3.2 Overlap. When the door to the toilet room is placed directly in front of the water closet, the water closet cannot overlap the required maneuvering clearance for the door inside the room.
604.4 Seats. The seat height of a water closet above the finish floor shall be 17 inches (430 mm) minimum and 19 inches (485 mm) 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 (380 mm) minimum and 19 inches (485 mm) 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 side wall closest to the water closet and on the rear wall.

EXCEPTIONS: 1. Grab bars shall not be required to be installed in a toilet room for a single occupant accessed only through a private office and not for common use or public use provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with 604.5.
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.
3. In detention or correction facilities, grab bars shall not be required to be installed in housing or holding cells that are specially designed without protrusions for purposes of suicide prevention.

Advisory 604.5 Grab Bars Exception 2. 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 side wall grab bar shall be 42 inches (1065 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extending 54 inches (1370 mm) minimum from the rear wall.

Figure 604.5.1
Side Wall Grab Bar at Water Closets
604.5.2 Rear Wall. The rear wall grab bar shall be 36 inches (915 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

EXCEPTIONS: 1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, where wall space does not permit a length of 36 inches (915 mm) minimum due to the location of a recessed fixture adjacent to the water closet.

2. Where an administrative authority requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.

Figure 604.5.2
Rear Wall Grab Bar at Water Closets

604.6 Flush Controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with 309. Flush controls shall be located on the open side of the water closet except in ambulatory accessible compartments complying with 604.8.2

Advisory 604.6 Flush Controls. If plumbing valves are located directly behind the toilet seat, flush valves and related plumbing can cause injury or imbalance when a person leans back against them. To prevent causing injury or imbalance, the plumbing can be located behind walls or to the side of the toilet; or if approved by the local authority having jurisdiction, provide a toilet seat lid.

604.7 Dispensers. Toilet paper dispensers shall comply with 309.4 and shall be 7 inches (180 mm) minimum and 6 inches (230 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be 15 inches (380 mm) minimum and 48 inches (1220 mm) maximum above the finish floor and shall not be located behind grab bars. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow.

Advisory 604.7 Dispensers. If toilet paper dispensers are installed above the side wall grab bar, the outlet of the toilet paper dispenser must be 48 inches (1220 mm) maximum above the finish floor and the top of the gripping surface of the grab bar must be 33 inches (840 mm) minimum and 36 inches (915 mm) maximum above the finish floor.
604.8 Toilet Compartments. Wheelchair accessible toilet compartments shall meet the requirements of 604.8.1 and 604.8.3. Compartments containing more than one plumbing fixture shall comply with 603. Ambulatory accessible compartments shall comply with 604.8.2 and 604.8.3.

604.8.1 Wheelchair Accessible Compartments. Wheelchair accessible compartments shall comply with 604.8.1.

604.8.1.1 Size. Wheelchair accessible compartments shall be 60 inches (1525 mm) wide minimum measured perpendicular to the side wall, and 56 inches (1420 mm) deep minimum for wall hung water closets and 59 inches (1500 mm) deep minimum for floor mounted water closets measured perpendicular to the rear wall. Wheelchair accessible compartments for children’s use shall be 60 inches (1525 mm) wide minimum measured perpendicular to the side wall, and 59 inches (1500 mm) deep minimum for wall hung and floor mounted water closets measured perpendicular to the rear wall.

Advisory 604.8.1.1 Size. The minimum space required in toilet compartments is provided so that a person using a wheelchair can maneuver into position at the water closet. This space cannot be obstructed by baby changing tables or other fixtures or conveniences, except as specified at 604.3.2 (Overlap). If toilet compartments are to be used to house fixtures other than those associated with the water closet, they must be designed to exceed the minimum space requirements. Convenience fixtures such as baby changing tables must also be accessible to people with disabilities as well as to other users. Toilet compartments that are designed to meet, and not exceed, the minimum space requirements may not provide adequate space for maneuvering into position at a baby changing table.
604.8.1.2 Doors. Toilet compartment doors, including door hardware, shall comply with 404 except that if the approach is to the latch side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 42 inches (1065 mm) minimum. Doors shall be located in the front partition or in the side wall or partition farthest from the water closet. Where located in the front partition, the door opening shall be 4 inches (100 mm) maximum from the side wall or partition farthest from the water closet. Where located in the side wall or partition, the door opening shall be 4 inches (100 mm) maximum from the front partition. The door shall be self-closing. A door pull complying with 404.2.7 shall be placed on both sides of the door near the latch. Toilet compartment doors shall not swing into the minimum required compartment area.
604.8.1.3 Approach. Compartments shall be arranged for left-hand or right-hand approach to the water closet.

604.8.1.4 Toe Clearance. The front partition and at least one side partition shall provide a toe clearance of 9 inches (230 mm) minimum above the finish floor and 6 inches (150 mm) deep minimum beyond the compartment-side face of the partition, exclusive of partition support members. Compartments for children’s use shall provide a toe clearance of 12 inches (305 mm) minimum above the finish floor.

EXCEPTION: Toe clearance at the front partition is not required in a compartment greater than 62 inches (1575 mm) deep with a wall-hung water closet or 65 inches (1650 mm) deep with a floor-mounted water closet. Toe clearance at the side partition is not required in a compartment greater than 68 inches (1775 mm) wide. Toe clearance at the front partition is not required in a compartment for children’s use that is greater than 65 inches (1650 mm) deep.

Figure 604.8.1.4
Wheelchair Accessible Toilet Compartment Toe Clearance

604.8.1.5 Grab Bars. Grab bars shall comply with 609. A side-wall grab bar complying with 604.5.1 shall be provided and shall be located on the wall closest to the water closet. In addition, a rear-wall grab bar complying with 604.5.2 shall be provided.

604.8.2 Ambulatory Accessible Compartments. Ambulatory accessible compartments shall comply with 604.8.2:

604.8.2.1 Size. Ambulatory accessible compartments shall have a depth of 60 inches (1525 mm) minimum and a width of 35 inches (890 mm) minimum and 37 inches (940 mm) maximum.
604.8.2.2 Doors. Toilet compartment doors, including door hardware, shall comply with 404, except that if the approach is to the latch side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 42 inches (1065 mm) minimum. The door shall be self-closing. A door pull complying with 404.2.7 shall be placed on both sides of the door near the latch. Toilet compartment doors shall not swing into the minimum required compartment area.

604.8.2.3 Grab Bars. Grab bars shall comply with 609. A side-wall grab bar complying with 604.5.1 shall be provided on both sides of the compartment.

![Diagram of Ambulatory Accessible Toilet Compartment]

Figure 604.8.2
Ambulatory Accessible Toilet Compartment

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

604.9 Water Closets and Toilet Compartments for Children's Use. Water closets and toilet compartments for children's use shall comply with 604.9.

Advisory 604.9 Water Closets and Toilet Compartments for Children's Use. The requirements in 604.9 are to be followed where the exception for children's water closets in 604.1 is used. The following table provides additional guidance in applying the specifications for water closets for children according to the age group served and reflects the differences in the size, stature, and reach ranges of children ages 3 through 12. The specifications chosen should correspond to the age of the primary user group. The specifications of one age group should be applied consistently in the installation of a water closet and related elements.
### Advisory Specifications for Water Closets Serving Children Ages 3 through 12

<table>
<thead>
<tr>
<th></th>
<th>Ages 3 and 4</th>
<th>Ages 5 through 8</th>
<th>Ages 9 through 12</th>
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</thead>
<tbody>
<tr>
<td>Water Closet</td>
<td>12 inches (305 mm)</td>
<td>12 to 15 inches (305 to 380 mm)</td>
<td>15 to 18 inches (380 to 455 mm)</td>
</tr>
<tr>
<td>Centerline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet Seat Height</td>
<td>11 to 12 inches (280 to 305 mm)</td>
<td>12 to 15 inches (305 to 380 mm)</td>
<td>15 to 17 inches (380 to 430 mm)</td>
</tr>
<tr>
<td>Grab Bar Height</td>
<td>18 to 20 inches (455 to 510 mm)</td>
<td>20 to 25 inches (510 to 635 mm)</td>
<td>25 to 27 inches (635 to 685 mm)</td>
</tr>
<tr>
<td>Disperser Height</td>
<td>14 inches (355 mm)</td>
<td>14 to 17 inches (355 to 430 mm)</td>
<td>17 to 19 inches (430 to 485 mm)</td>
</tr>
</tbody>
</table>

604.9.1 Location. The water closet shall be located with a wall or partition to the rear and to one side. The centerline of the water closet shall be 12 inches (305 mm) minimum and 18 inches (455 mm) maximum from the side wall or partition, except that the water closet shall be 17 inches (430 mm) minimum and 19 inches (485 mm) maximum from the side wall or partition in the ambulatory accessible toilet compartment specified in 604.8.2. Compartments shall be arranged for left-hand or right-hand approach to the water closet.

604.9.2 Clearance. Clearance around a water closet shall comply with 604.3.

604.9.3 Height. The height of water closets shall be 11 inches (280 mm) minimum and 17 inches (430 mm) maximum measured to the top of the seat. Seats shall not be sprung to return to a lifted position.

604.9.4 Grab Bars. Grab bars for water closets shall comply with 604.5.

604.9.5 Flush Controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with 308.2 and 308.4 and shall be installed 36 inches (915 mm) maximum above the finish floor. Flush controls shall be located on the open side of the water closet except in ambulatory accessible compartments complying with 604.8.2.

604.9.6 Dispensers. Toilet paper dispensers shall comply with 308.4 and shall be 7 inches (180 mm) minimum and 9 inches (230 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be 14 inches (355 mm) minimum and 19 inches (485 mm) maximum above the finish floor. There shall be a clearance of 1½ inches (38 mm) minimum below the grab bar. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow.

604.9.7 Toilet Compartments. Toilet compartments shall comply with 604.6.

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605 Urinals

605.1 General. Urinals shall comply with 605.

Advisory 605.1 General. Stall-type urinals provide greater accessibility for a broader range of persons, including people of short stature.

605.2 Height and Depth. Urinals shall be the stall-type or the wall-hung type with the rim 17 inches (430 mm) maximum above the finish floor or ground. Urinals shall be 13 1/2 inches (345 mm) deep minimum measured from the outer face of the urinal rim to the back of the fixture.

Figure 605.2
Height and Depth of Urinals

605.3 Clear Floor Space. A clear floor or ground space complying with 305 positioned for forward approach shall be provided.

605.4 Flush Controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with 309.

606 Lavatories and Sinks

606.1 General. Lavatories and sinks shall comply with 608.

Advisory 606.1 General. If soap and towel dispensers are provided, they must be located within the reach ranges specified in 308. Locate soap and towel dispensers so that they are conveniently usable by a person at the accessible lavatory.

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: 1. A parallel approach complying with 305 shall be permitted to a kitchen sink in a space where a cook top or conventional range is not provided and to wet bars.
2. A lavatory in a toilet room or bathing facility for a single occupant accessed only through a private office and not for common use or public use shall not be required to provide knee and toe clearance complying with 306.

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 (610 mm) 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 (785 mm) 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.

6. The dip of the overflow shall not be considered in determining knee and toe clearances.

7. No more than one bowl of a multi-bowl sink shall be required to provide knee and toe clearance complying with 306.

606.3 Height. Lavatories and sinks shall be installed with the front of the higher of the rim or counter surface 34 inches (865 mm) maximum above the finish floor or ground.

   EXCEPTIONS: 1. A lavatory in a toilet or bathing facility 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 606.3.
   2. In residential dwelling unit kitchens, sinks that are adjustable to variable heights, 26 inches (735 mm) minimum and 36 inches (915 mm) maximum, shall be permitted where rough-in plumbing permits connections of supply and drain pipes for sinks mounted at the height of 26 inches (735 mm).

606.4 Faucets. Controls for faucets shall comply with 309. Hand-operated metering faucets shall remain open for 10 seconds minimum.

606.5 Exposed Pipes and Surfaces. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks.

607 Bathtubs

607.1 General. Bathtubs shall comply with 607.

607.2 Clearance. Clearance in front of bathtubs shall extend the length of the bathtub and shall be 30 inches (760 mm) wide minimum. A lavatory complying with 636 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 (305 mm) 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 or 607.4.2.

EXCEPTIONS: 1. Grab bars shall not be required to be installed in a bathtub located in a bathing facility for a single occupant accessed only through a private office and not for common use or public use provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with 607.4.

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 located 8 inches (205 mm) minimum and 10 inches (255 mm) maximum above the rim of the bathtub. Each grab bar shall be installed 15 inches (380 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

607.4.1.2 Control End Wall. A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge 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 (203 mm) minimum and 10 inches (255 mm) maximum above the rim of the bathtub. Each grab bar shall be 24 inches (610 mm) long minimum and shall be installed 24 inches (610 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

607.4.2.2 Control End Wall. A grab bar 24 inches (610 mm) 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 (305 mm) long minimum shall be installed on the head end wall at the front edge of the bathtub.

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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 308.4.

![Diagram of bathtub control location](image)

**Figure 607.5**
Bathtub Control Location

607.6 Shower Spray Unit and Water. A shower spray unit with a hose 59 inches (1500 mm) 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.

**Advisory 607.3 Shower Spray Unit and Water.** Ensure that hand-held shower spray units are capable of delivering water pressure substantially equivalent to fixed shower heads.

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

608.1 General. Shower compartments shall comply with 608.

**Advisory 608.1 General.** Shower stalls that are 60 inches (1525 mm) wide and have no curb may increase the usability of a bathroom because the shower area provides additional maneuvering space.

608.2 Size and Clearances for Shower Compartments. Shower compartments shall have sizes and clearances complying with 608.2.

608.2.1 Transfer Type Shower Compartments. Transfer type shower compartments shall be 36 inches (915 mm) by 36 inches (915 mm) clear inside dimensions measured at the center points of opposing sides and shall have a 36 inch (915 mm) wide minimum entry on the face of the shower.
compartment. Clearance of 36 inches (915 mm) wide minimum by 48 inches (1220 mm) long minimum measured from the control wall shall be provided.

![Diagram of shower compartment dimensions]

**Figure 608.2.1**
Transfer Type Shower Compartment Size and Clearance

**608.2.2 Standard Roll-in Type Shower Compartments.** Standard roll-in type shower compartments shall be 30 inches (760 mm) wide minimum by 60 inches (1525 mm) deep minimum clear inside dimensions measured at center points of opposing sides and shall have a 60 inches (1525 mm) wide minimum entry on the face of the shower compartment.

**608.2.2.1 Clearance.** A 30 inch (760 mm) wide minimum by 60 inch (1525 mm) long minimum clearance shall be provided adjacent to the open face of the shower compartment. **EXCEPTION:** A lavatory complying with 505 shall be permitted on one 30 inch (760 mm) wide minimum side of the clearance provided that it is not on the side of the clearance adjacent to the controls or, where provided, not on the side of the clearance adjacent to the shower seat.
Figure 608.2.2
Standard Roll-in Type Shower Compartment Size and Clearance

608.2.3 Alternate Roll-in Type Shower Compartments. Alternate roll-in type showers shall be 36 inches (915 mm) wide and 60 inches (1525 mm) deep minimum clear inside dimensions measured at center points of opposing sides. A 36 inch (915 mm) wide minimum entry shall be provided at one end of the long side of the compartment.

Figure 608.2.3
Alternate Roll-in Type Shower Compartment Size and Clearance
608.3 Grab Bars. Grab bars shall comply with 609 and shall be provided in accordance with 608.3. Where multiple grab bars are used, required horizontal grab bars shall be installed at the same height above the finish floor.

EXCEPTIONS: 1. Grab bars shall not be required to be installed in a shower located in a bathing facility for a single occupant accessed only through a private office, and not for common use or public use provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with 508.3.
2. In residential dwelling units, grab bars shall not be required to be installed in showers 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 608.3.

608.3.1 Transfer Type Shower Compartments. In transfer type compartments, grab bars shall be provided across the control wall and back wall to a point 18 inches (455 mm) from the control wall.

Figure 608.3.1
Grab Bars for Transfer Type Showers

608.3.2 Standard Roll-In Type Shower Compartments. Where a seat is provided in standard roll-in type shower compartments, grab bars shall be provided on the back wall and the side wall opposite the seat. Grab bars shall not be provided above the seat. Where a seat is not provided in standard roll-in type shower compartments, grab bars shall be provided on three walls. Grab bars shall be installed 6 inches (150 mm) maximum from adjacent walls.

Figure 608.3.2
Grab Bars for Standard Roll-In Type Showers
608.3.3 Alternate Roll-in Type Shower Compartments. In alternate roll-in type shower compartments, grab bars shall be provided on the back wall and the side wall farthest from the compartment entry. Grab bars shall not be provided above the seat. Grab bars shall be installed 6 inches (150 mm) maximum from adjacent walls.

![Diagram showing grab bars installation](image)

**Figure 608.3.3**
Grab Bars for Alternate Roll-in Type Showers

608.4 Seats. A folding or non-folding seat shall be provided in transfer type shower compartments. A folding seat shall be provided in roll-in type showers required in transient lodging guest rooms with mobility features complying with 606.2. Seats shall comply with 610.

**EXCEPTION:** In residential dwelling units, seats shall not be required in transfer type shower compartments provided that reinforcement has been installed in walls so as to permit the installation of seats complying with 608.4.

608.5 Controls. Controls, faucets, and shower spray units shall comply with 309.4.

608.5.1 Transfer Type Shower Compartments. In transfer type shower compartments, the controls, faucets, and shower spray unit shall be installed on the side wall opposite the seat 38 inches (965 mm) minimum and 48 inches (1220 mm) maximum above the shower floor and shall be located on the control wall 15 inches (380 mm) maximum from the centerline of the seat toward the shower opening.

![Diagram showing control location](image)

**Figure 608.5.1**
Transfer Type Shower Compartment Control Location
608.5.2 Standard Roll-in Type Shower Compartments. In standard roll-in type shower compartments, the controls, faucets, and shower spray unit shall be located above the grab bar, but no higher than 48 inches (1220 mm) above the shower floor. Where a seat is provided, the controls, faucets, and shower spray unit shall be installed on the back wall adjacent to the seat wall and shall be located 27 inches (685 mm) maximum from the seat wall.

Advisory 608.5.2 Standard Roll-in Type Shower Compartments. In standard roll-in type showers without seats, the shower head and operable parts can be located on any of the three walls of the shower without adversely affecting accessibility.

![Diagram of shower compartment with and without seat](image)

**Figure 806.5.2**
Standard Roll-in Type Shower Compartment Control Location

608.5.3 Alternate Roll-In Type Shower Compartments. In alternate roll-in type shower compartments, the controls, faucets, and shower spray unit shall be located above the grab bar, but no higher than 46 inches (1220 mm) above the shower floor. Where a seat is provided, the controls, faucets, and shower spray unit shall be located on the side wall adjacent to the seat 27 inches (685 mm) maximum from the side wall behind the seat or shall be located on the back wall opposite the seat 15 inches (380 mm) maximum, left or right, of the centerline of the seat. Where a seat is not provided, the controls, faucets, and shower spray unit shall be installed on the side wall farthest from the compartment entry.
608.6 Shower Spray Unit and Water. A shower spray unit with a hose 59 inches (1500 mm) 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. Shower spray units shall deliver water that is 120°F (49°C) maximum.

EXCEPTION: A fixed shower head located at 48 inches (1220 mm) maximum above the shower finish floor shall be permitted instead of a hand-held spray unit in facilities that are not medical care facilities, long-term care facilities, transient lodging guest rooms, or residential dwelling units.

Advisory 608.8 Shower Spray Unit and Water. Ensure that hand-held shower spray units are capable of delivering water pressure substantially equivalent to fixed shower heads.

608.7 Thresholds. Thresholds in roll-in type shower compartments shall be ¼ inch (13 mm) high maximum in accordance with 303. In transfer type shower compartments, thresholds ½ inch (13 mm) high maximum shall be beveled, rounded, or vertical.

EXCEPTION: A threshold 2 inches (51 mm) high maximum shall be permitted in transfer type shower compartments in existing facilities where provision of a ¼ inch (13 mm) high threshold would disturb the structural reinforcement of the floor slab.
608.8 Shower Enclosures. Enclosures for shower compartments shall not obstruct controls, faucets, and shower spray units or obstruct transfer from wheelchairs onto shower seats.

609 Grab Bars

609.1 General. Grab bars in toilet facilities and bathing facilities shall comply with 609.

609.2 Cross Section. Grab bars shall have a cross section complying with 609.2.1 or 609.2.2.

609.2.1 Circular Cross Section. Grab bars with circular cross sections shall have an outside diameter of 1 1/4 inches (32 mm) minimum and 2 inches (51 mm) maximum.

609.2.2 Non-Circular Cross Section. Grab bars with non-circular cross sections shall have a cross-section dimension of 2 inches (51 mm) maximum and a perimeter dimension of 4 inches (100 mm) minimum and 4.8 inches (120 mm) maximum.

Figure 609.2.2
Grab Bar Non-Circular Cross Section

609.3 Spacing. The space between the wall and the grab bar shall be 1 1/4 inches (38 mm). The space between the grab bar and projecting objects below and at the ends shall be 1 1/2 inches (38 mm) minimum. The space between the grab bar and projecting objects above shall be 12 inches (305 mm) minimum.  

EXCEPTION: The space between the grab bars and shower controls, shower fittings, and other grab bars above shall be permitted to be 1 1/4 inches (38 mm) minimum.
609.4 Position of Grab Bars. Grab bars shall be installed in a horizontal position, 33 inches (840 mm) minimum and 36 inches (915 mm) maximum above the finish floor measured to the top of the gripping surface, except that at water closets for children’s use complying with 604.3, grab bars shall be installed in a horizontal position 18 inches (455 mm) minimum and 27 inches (685 mm) maximum above the finish floor measured to the top of the gripping surface. The height of the lower grab bar on the back wall of a bathtub shall comply with 607.4.1.1 or 607.4.2.1.

609.5 Surface Hazards. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges.

609.6 Fittings. Grab bars shall not rotate within their fittings.

609.7 Installation. Grab bars shall be installed in any manner that provides a gripping surface at the specified locations and that does not obstruct the required clear floor space.

609.8 Structural Strength. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the grab bar, fastener, mounting device, or supporting structure.

610 Seats

610.1 General. Seats in bathtubs and shower compartments shall comply with 610.

610.2 Bathtub Seats. The top of bathtub seats shall be 17 inches (430 mm) minimum and 19 inches (485 mm) maximum above the bathroom finish floor. The depth of a removable in-tub seat shall be 15 inches (380 mm) minimum and 16 inches (405 mm) maximum. The seat shall be capable of secure placement. Permanent seats at the head end of the bathtub shall be 15 inches (380 mm) deep minimum and shall extend from the back wall to or beyond the outer edge of the bathtub.
610.3 Shower Compartment Seats. Where a seat is provided in a standard roll-in shower compartment, it shall be a folding type, shall be installed on the side wall adjacent to the controls, and shall extend from the back wall to a point within 3 inches (75 mm) of the compartment entry. Where a seat is provided in an alternate roll-in type shower compartment, it shall be a folding type, shall be installed on the front wall opposite the back wall, and shall extend from the adjacent side wall to a point within 3 inches (75 mm) of the compartment entry. In transfer-type showers, the seat shall extend from the back wall to a point within 3 inches (75 mm) of the compartment entry. The top of the seat shall be 17 inches (430 mm) minimum and 18 inches (455 mm) maximum above the bathroom finish floor. Seats shall comply with 610.3.1 or 610.3.2.

610.3.1 Rectangular Seats. The rear edge of a rectangular seat shall be 2⅛ inches (64 mm) maximum and the front edge 15 inches (380 mm) minimum and 16 inches (405 mm) maximum from
the seat wall. The side edge of the seat shall be 1 3/4 inches (38 mm) maximum from the adjacent wall.

![Diagram of Rectangular Shower Seat](image)

**Figure 610.3.1**
Rectangular Shower Seat

610.3.2 L-Shaped Seats. The rear edge of an L-shaped seat shall be 2 3/4 inches (64 mm) maximum and the front edge 1 3/4 inches (38 mm) minimum and 10 inches (405 mm) maximum from the seat wall. The rear edge of the "L" portion of the seat shall be 1 1/2 inches (38 mm) maximum from the wall and the front edge shall be 14 inches (355 mm) minimum and 15 inches (380 mm) maximum from the wall. The end of the "L" shall be 22 inches (550 mm) minimum and 23 inches maximum (585 mm) from the main seat wall.

![Diagram of L-Shaped Shower Seat](image)

**Figure 610.3.2**
L-Shaped Shower Seat

610.4 Structural Strength. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device, or supporting structure.
611.1 General. Washing machines and clothes dryers shall comply with 611.

611.2 Clear Floor Space. A clear floor or ground space complying with 305 positioned for parallel approach shall be provided. The clear floor or ground space shall be centered on the appliance.

611.3 Operable Parts. Operable parts, including doors, lint screens, and detergent and bleach compartments shall comply with 309.

611.4 Height. Top loading machines shall have the door to the laundry compartment located 36 inches (915 mm) maximum above the finish floor. Front loading machines shall have the bottom of the opening to the laundry compartment located 19 inches (360 mm) minimum and 36 inches (915 mm) maximum above the finish floor.

(a) top loading
(b) front loading

Figure 611.4
Height of Laundry Compartment Opening

612 Saunas and Steam Rooms

612.1 General. Saunas and steam rooms shall comply with 612.

612.2 Bench. Where seating is provided in saunas and steam rooms, at least one bench shall comply with 903. Doors shall not swing into the clear floor space required by 903.2.

EXCEPTION: A readily removable bench shall be permitted to obstruct the turning space required by 612.3 and the clear floor or ground space required by 903.2.

612.3 Turning Space. A turning space complying with 304 shall be provided within saunas and steam rooms.