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AIRPORT COOPERATIVE RESEARCH PROGRAM

ACRP RESEARCH REPORT 177

Enhancing Airport Wayfinding for Aging Travelers and Persons with Disabilities

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AIRPORT COOPERATIVE RESEARCH PROGRAM

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Gresham, Smith and Partners (GS&P) was the primary research consultant. Jim Harding, Director of Environmental Graphics at GS&P, served as the Principal Investigator. Additional GS&P contributions include literature review and research assistance by Dr. Sheila Bosch, editorial review of the guidebook by Sue Halford and Jim Alderman, architectural design considerations by Wilson Rayfield, and project coordination by John Florie.

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FOREWORD

By Theresia H. Schatz
Staff Officer
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ACRP Research Report 177: Enhancing Airport Wayfinding for Aging Travelers and Persons with Disabilities is a comprehensive, practical guidebook to help airport operators, airlines, and planners assist aging travelers and persons with disabilities to travel independently within airports using pedestrian wayfinding systems. The guidebook addresses travel by people with cognitive, sensory, and other mobility challenges. It includes a template for a baseline airport wayfinding accessibility audit; instructions to assist airports in creating a signage and services gap analysis as well as a wayfinding plan; the aspects of visual, verbal, and virtual wayfinding information to help the passenger with directions; and methods that would allow aging travelers and passengers with disabilities to comfortably utilize technology for wayfinding. The guidebook also has suggestions for web-based information for assistance (e.g., airport, airline, and TSA websites); standardization of wayfinding user interface systems within the airport(s), including technological interfaces; and compliance with federal and international regulations and standards.

Independent travel in airports for aging travelers and passengers with disabilities such as low vision/blindness, mobility limitations, or problems with short-term memory presents complex navigational challenges that are not met by standard approaches to wayfinding and signage. While adequate illumination and ADA-compliant signage (as recommended in *ACRP Report 52: Wayfinding and Signing Guidelines for Airport Terminals and Landside*) may provide some benefit, additional efforts are needed to help these passengers travel independently in airport environments. Meeting the wayfinding needs of these travelers is currently accomplished by the provision of personal guides for assistance. In the United States, currently implemented accessible wayfinding systems are not optimized to provide information for wayfinding and travel by people with cognitive, sensory, or mobility challenges in complex indoor environments such as airports. Currently, the field is centered on development of indoor position-sensing technologies such as beacons and on delivery of wayfinding information via accessible applications for smart phones. With the projected growth in the number of aging travelers, it is imperative to develop practices to accommodate their wayfinding needs in addition to those of passengers with disabilities.

Under ACRP Project 07-13, research was conducted by Gresham, Smith and Partners in association with Open Doors Organization, Arora Engineers, Georgia Institute of Technology, University of South Florida, John K. Duval, and Southwest Airlines. The objective of this guidebook is to help airports successfully communicate information to aging travelers and persons with disabilities to help them find their way using the principles of universal design. It is worth noting that most of the report's recommendations can be used to benefit all travelers. The guidebook covers the different elements of the passenger journey through departures, arrivals, and connections. An essential part of the research, conducted at

Austin-Bergstrom International Airport, was field testing of a prototype mobile application serving as the basis of the application guidelines criteria. Appendix A contains a Wayfinding Accessibility Audit Checklist developed as part of the research, Appendix B provides a table listing application review criteria, and Appendix C provides virtual airport models of customer journey segments.

MS Word files of the Wayfinding Accessibility Audit Checklist (Appendix A) and the table of application review criteria (Appendix B), as well as a PowerPoint presentation that summarizes the project, are available for download. To access these files, go to www.trb.org and search on *ACRP Research Report 177*.

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CHAPTER 1

Introduction

1.1 Introduction

The goal of enabling aging travelers and persons with disabilities to travel independently in airports presents complex navigational challenges in complex spaces that are not easily met using ordinary wayfinding approaches. Additional efforts are needed to help these passengers travel independently and with dignity in airport environments.

In order to meet these challenges, the goal of this research is to "create a difference that creates change" by applying a holistic approach that helps deliver exceptional results. By combining the physical space with information space, the tools and research in this guidebook are intended to help airports implement a comprehensive wayfinding system that provides customers with diverse abilities the information they need—how and when they need it—to enhance their wayfinding experience throughout each journey segment.

The primary audiences for this report are airports, airlines, the TSA, planning/design consultants, and others who either directly control various components of the passenger flow process or are directly involved in its design. It is important for each of these groups to understand, as demonstrated by the following facts, that the needs of aging travelers and persons with disabilities are not being adequately addressed.

The U.S. DOT has also issued an Annual Report on Disability-Related Air Travel Complaints since 2005. This report to the United States Congress summarizes data from U.S. and foreign carriers on the written disability-related complaints they receive annually. The complaints are categorized by type of disability and type of complaint, with the resulting matrices published online for each carrier as well as for domestic carriers, foreign carriers, and all carriers. From

American Disability-Related Passenger Complaints Up by 55 Percent in June 2014

As reported by George Sensalis from Reduced Mobility Rights (27 August 2014), the U.S. DOT's Air Travel Consumer Report showed a 55 percent increase in disability-related complaints in June 2014 (U.S. DOT 2014). This report, published monthly, tabulates complaints by passengers with disabilities filed directly with the Aviation Consumer Protection Division of the U.S. DOT.

Over a 10-year period, U.S. DOT Annual Reports to Congress showed a 139% increase in disability-related complaints for all air carriers.

	Total # of Disability Complaints Received by Domestic Carriers	Total # of Disability Complaints Received by Foreign Carriers	Total # of Disability Complaints Received by All Carriers
2004	10,193	1,325	11,518
2005	12,194	1,390	13,584
2006	12,075	1,691	13,766
2007	13,926	1,364	15,290
2008	12,557	1,449	14,006
2009	15,496	1,572	17,068
2010	19,347	1,654	21,001
2011	18,953	2,419	21,372
2012	20,584	2,859	23,443
2013	21,965	3,281	25,246
2014	24,044	3,512	27,556

Source: U.S. Department of Transportation
Annual Report of Disability-Related Air Travel Complaints

2004 to 2014, disability-related complaints for all carriers more than doubled, from 11,518 to 27,556 (U.S. DOT August 2015).

While disability-related complaints to airlines have generally risen year on year, the pattern in types of complaints has been quite regular. Most notably, "failure to provide service" to "other/wheelchair" has each year made up roughly half of the total disability-related complaints. These complaints relate to failure to receive wheelchair assistance in the terminal, i.e., assistance requested to and from the gate, for the most part by aging travelers.

The number of wheelchair assists at large U.S. airports (such as Hartsfield-Jackson Atlanta International Airport, Los Angeles International Airport, Miami International Airport, and Minneapolis St. Paul International Airport) now top 1 million annually, so it is no surprise that airlines and their service companies are failing to keep up with demand. This situation, given the aging population and the increasing size and complexity of airports, is likely to present even more of a challenge in the coming decades.

A 2015 market study from the Open Doors Organization (a nationwide survey conducted by Mandala Research, LLC) revealed that travel by individuals with disabilities generates $17.3 billion in annual spending, up from $13.6 billion in 2002 (Open Doors Organization 2015).The 2015 study also reported that among adults with disabilities who traveled by air, 72 percent encountered major obstacles with airlines and 65 percent with airports. Together, these findings demonstrate that persons with disabilities spend money traveling despite their needs not being adequately met. These findings, combined with the projected growth in the number of aging travelers who may experience varying degrees of cognitive, sensory, and mobility impairments, underscore the importance to airports of implementing practices to accommodate the needs, including the need for wayfinding, of these user groups. It is also worth noting that many of the practices recommended in this guidebook are mandated by the ADA and Air Carrier Access Act (ACAA).

Congress has responded to the need to increase access to products and services for people with disabilities by passing legislation in a range of areas, including education, employment, transportation, assistive technology, and electronic and information technology. Some legislation guarantees the civil rights of individuals with disabilities, other legislation establishes procurement requirements for specific agencies, and other legislation imposes accessibility requirements on producers of products and providers of services. Some legislation is at the federal level, and some is at the state level. Described below are several relevant federal laws in the United States.

Section 504 of the Rehabilitation Act of 1973 requires that programs and services that receive federal funding make those programs and services available to individuals with disabilities and provide reasonable accommodations. In 1986, Section 508 was added as an amendment to the Rehabilitation Act of 1973. Section 508 requires that electronic and information technology developed, procured, maintained, or used by the federal government be designed to be accessible to people with disabilities.

The ADA Standards (and 2010 amendments) are civil rights legislation that builds on and extends the reach of Section 504. The ADA Standards require that public programs and services be accessible to people with disabilities and that they provide accessible, "effective communication," regardless of what medium is used for that communication. In addition, access to digital technology is emerging as a new frontier in the enforcement of civil rights for persons with disabilities. The virtual part of communication is a key part of this guidebook along with verbal and visual communication.

1.2 Research Objective

The objective of this guidebook is to help airports successfully *communicate* information to aging travelers and persons with disabilities to help them *find their way* using the *principles of universal design.*

1.2.1 What Is Communication?

Communication (visual, verbal, and virtual) is the act of conveying intended meanings from one entity or group to another through the use of mutually understood signs and semiotic rules. However, visual information will not help persons who are blind. Likewise, verbal information is limited in how it can help persons who are deaf. Virtual information, too, is not equally accessible to all. Therefore, a comprehensive wayfinding strategy incorporates all of the different forms of communication in order to effectively share information with all individuals, regardless of their abilities or disabilities.

1.2.2 What Is Wayfinding?

As described by the Society for Experiential Graphic Design, wayfinding refers to information systems that guide people through a physical environment and enhance their understanding and experience of the space. In an airport environment, wayfinding is a vital system that is just as essential to the effective performance and use of the building as any other building system, such as structural and electrical systems. Without an electrical system, there are no lights for people to see where they are going. Similarly, without a well-planned wayfinding system, customers will struggle to find their way and to use the building as intended. This is a key concept in creating an airport's wayfinding philosophy and strategy.

1.2.3 What Is Universal Design?

The principles of universal design guide the design of products and environments to make them usable by all people to the greatest extent possible without the need for adaptation or specialized design. While all principles may not be relevant to all designs, any airport, planner, or designer can apply the principles of universal design to any project.

1.3 Purpose of the Guidelines

ACRP Report 52: Wayfinding and Signing Guidelines for Airport Terminals and Landside was developed to help airports understand wayfinding strategy, principles, and logic that are necessary in planning, creating, implementing, and maintaining a signage and wayfinding system (Harding et al. 2011). The purpose of ACRP Project 07-13, "Enhancing Wayfinding for Aging Travelers and Persons with Disabilities" was not to repeat the content in *ACRP Report 52,* but to extract and distill relevant information as required to create an easy-to-follow guide that supports the recommendations resulting from the ACRP Project 07-13 research. For information and details associated with the specific aspects of airport wayfinding that are not addressed in this guidebook, please reference *ACRP Report 52.*

While the title of this guidebook includes the phrase "Enhancing Airport Wayfinding," the content also includes recommendations, requirements, and best practices that are not strictly wayfinding per se. However, in order to achieve the overall objective of helping aging travelers and persons with disabilities travel independently, an airport has to consider more than just helping these customers know where to go. Factors like having a place to sit become just as important as knowing where one is sitting. In other words, if an airport doesn't have a comprehensive list of considerations, these customers will encounter issues that affect their ability to travel independently regardless of their wayfinding abilities. Therefore, this guidebook is about more than just wayfinding; it is about a customer experience that promotes independent travel for aging travelers and persons with disabilities.

A fuller discussion of the broader needs of aging travelers and persons with disabilities and the innovative ways that airports can meet them are being addressed in ACRP Project 01-31, "Innovative Solutions to Facilitate Accessibility for Airport Travelers with Disabilities." Readers should also refer to *ACRP Synthesis 51: Impacts of Aging Travelers on Airports* (Mein, Kirchhoff, and Fangen 2014).

1.4 Organization of the Guidebook

Chapter 2 addresses the first and most important aspect of this guidebook, understanding who aging travelers and passengers with disabilities are and what their needs are. Creating an airport environment that meets the needs of these user groups by applying the principles of universal design not only helps these travelers, but also has the added benefit of enhancing the travel experience for all customers. Throughout the guidebook, there will be content that seems like it applies to any customer; that is exactly the point and a key concept behind the principles of universal design that are introduced in Chapter 2. The word "customers," as used in the context of this guidebook, is representative of the target audience—aging travelers and persons with disabilities.

Chapter 3 focuses on wayfinding strategies and what types of information are communicated using the three "Vs" of communication—visual, verbal, and virtual. For example, visual wayfinding information is the most basic navigational tool, encompassing all static signage. While visual information is the workhorse of the wayfinding world, it is important to understand the factors that need to be considered for aging travelers and persons with disabilities.

Verbal information is another key piece of the puzzle. For older adults and passengers with disabilities who need further instruction on how to reach their destination, offering verbal assistance is very important, so a consideration of whom verbal information is shared with, along with how and where it is communicated, is part of Chapter 3.

When the term "virtual" is used in wayfinding, it is referring to dynamic, non-static navigational tools. In essence, digital tools can range from computers used at home for pre-trip planning, to out-of-house tools such as mobile devices and airport-provided digital information that enhance the travel experience.

Information can also be communicated tactilely; therefore Chapter 3 also discusses types of tactile information that can aid those with vision loss to find their way independently.

Section 3.6 in Chapter 3 will help airports conduct a Wayfinding and Services Gap Analysis. When information is presented in only one mode, the result will create wayfinding gaps. Customers with or without disabilities process information differently, and where visual signage might be sufficient for one passenger, verbal wayfinding can fill in the gaps for another. Similarly, where virtual information isn't enough for a traveler, architectural cues can guide them in the right direction. This section provides approaches for analyzing wayfinding problems. The Wayfinding and Services Gap Analysis will result in a recommended plan of action for improving an airport's wayfinding system to meet the needs of aging travelers and persons with disabilities.

Chapters 4, 5, 6, and 7 will equip airports with the method to *create a difference that creates a change,* and, where appropriate, explain why it is important to create a difference that creates a change. Many of the issues and challenges that aging travelers and persons with disabilities face in airports begin in the airport's planning stage. Chapter 4 focuses on the factors that should be included as part of an airport's planning process. Chapters 5, 6, and 7 are organized based on the customer's experience at the airport using the three basic types of customers: departing, arriving, and connecting. Within each of these chapters, a checklist for each specific journey segment is outlined to emphasize the opportunities a small, medium, or large airport can employ to enhance the wayfinding experience. Research shows that there is no single airport that is a best practice model. However, there are some airports that do a better job than others. Hence, the guidebook's approach uses the best ideas and examples around the framework of the Wayfinding Accessibility Audit Checklist and is supported graphically with virtual airport models of various journey segments (see Appendix C).

Technology plays an ever-increasing role in every aspect of life. Chapter 8 will describe some of the technologies encountered in the airport wayfinding travel experience, best practices for implementation, and how the principles of universal design can be incorporated to expand or enhance the capabilities of technology to be inclusive of as many people as possible regardless of limitations or disabilities.

1.5 Implementation Considerations

While wayfinding analyses and accessibility audits do exist, up to this time there has not been a consolidated audit that truly merges issues associated with both aging and disabilities into an all-inclusive assessment. Therefore, the ACRP Project 07-13 research has focused on creating a Wayfinding Accessibility Audit Checklist (provided in Appendix A) that provides airports with a step-by-step process by which to evaluate their airport from a point of view that will benefit aging travelers and persons with disabilities.

In order to properly apply the recommendations and requirements in the Wayfinding Accessibility Audit Checklist, it is critical to read Chapter 2 to understand the user needs of the different types of passengers with disabilities and aging travelers, followed by Chapter 3, which focuses on the kind of information needed to communicate with the various passenger types. Subsequently, referencing the Wayfinding Accessibility Audit Checklist in Chapters 4, 5, 6, and 7 will equip the reader to *create a difference that creates a change.*

CHAPTER 2

Understanding the Needs of Aging Travelers and Passengers with Disabilities

2.1 Introduction

Chapter 1 was about why this guidebook is needed. Before addressing the WHAT and HOW in subsequent chapters, it is vital to understand who the target audience is in addition to the needs of aging travelers and persons with disabilities. These needs result from a wide range of physical, sensory and cognitive challenges, the severity of which, along with many other factors, will impact the ability of aging travelers and persons with disabilities to navigate independently in the airport environment.

This chapter will first discuss universal design and its principles, illustrating their application in airports. It then examines wayfinding needs for individuals with specific types of disabilities and steps that airports can take to meet those needs. A separate section in Chapter 2 discusses aging travelers, who are more likely to have multiple functional limitations. This chapter also covers technology used by these user groups, appropriate language, and resources that airports can call on as they begin the process of putting this information to practical use.

While user needs are discussed within broad disability categories—blind and low vision, deaf and hard of hearing, ambulatory and non-ambulatory, and intellectual disabilities including autism and dementia—it is important to understand that each person with a disability is an individual with unique needs. For example, the needs of a traveler with late onset vision loss will be different from someone born partially sighted, even though their visual acuity is more or less identical. Coping skills, psychological makeup, past travel experiences, and much more have a role to play. It is because of these individual differences that the primary focus must be on creating universal accessibility, enabling wayfinding by all travelers regardless of ability, rather than meeting the assumed needs of a general disability type.

As noted in Chapter 1, this guidebook cannot effectively address every conceivable wayfinding scenario for every traveler with a disability. Some individuals will never be able to travel independently and will always require assistance provided by an airline, airport, or travel companion to reach their gate. However, by paying attention to the needs of persons with disabilities and applying the principles of universal design in all new construction, expansion, and renovation projects—right from the start of the planning and design process—an airport will enhance the overall wayfinding experience for its customers while reducing the need for specialized services and facilities.

2.2 Universal Design and Its Principles

Universal design, also known as inclusive design, design-for-all, life span design, and human-centered design, is "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Connell et al. 1997). This concept, which originated in the 1970s as part of the U.S. disability rights movement, has gained momentum as societies across the globe struggle to accommodate their rapidly aging populations. Initially viewed as an unobtainable and expensive ideal, universal design is now recognized as a key element in sustainability since it guarantees a wider product market, limits the need for renovation or redesign, and minimizes the need for special services or accommodations (Levine 2003).

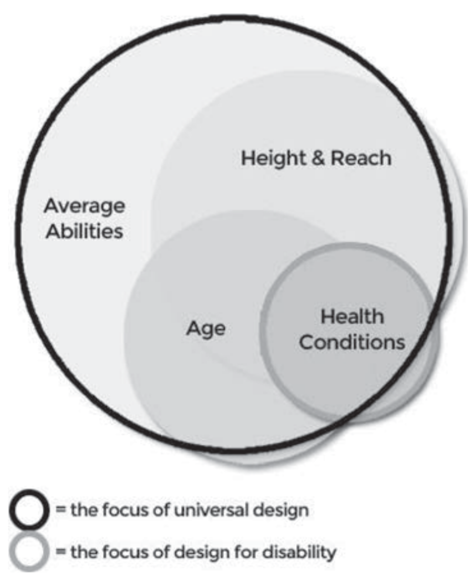
Universal design is especially applicable to airports where the customer base is not only diverse in terms of age, size, and abilities, but is likely to be experiencing an airport for the first time, burdened with luggage or strollers, and perhaps unfamiliar with the local language. Both the Canadian Transportation Agency (CTA 2007) and the FAA advocate universal design in their airport advisories (FAA 2012 and 2016). According to Advisory Circular 150/5220-21C: Aircraft Boarding Equipment (FAA 2012):

> As applied to the field of aviation, universal design is fundamental to the safe and efficient transportation of the flying public. In keeping with the concept of universal design, the overall philosophy of this document is to specify both the performance and design requirements that enable seamless and integrated transportation options for all passengers.

While legal accessibility standards are minimum requirements meant to eliminate physical barriers for people with disabilities, universal design "seeks to provide improved usability and safety for all in the community." It thus avoids the "arbitrary dichotomy" of people with disabilities versus the "able-bodied," which can be divisive and stigmatizing. Universal design also covers the needs of disability groups not covered by the ADA Standards, for example, people of short stature and individuals with cognitive disabilities (Levine 2003).

Universal design, as Figure 2-1 illustrates, cannot meet every user need. There will always be individuals whose disability is so severe that additional facilities and services will be required. This is especially the case in the airport setting, infamous for being complex, confusing, noisy, and crowded, and where tolerance for error is low given the time constraints of catching a flight. However, the needs of these individuals will be "easier to address if universal design is the starting point" (Pruett and Pruett n.d.).

Both older individuals and people with disabilities value their independence and work hard to maintain or regain it, even when dealing with severe functional limitations. With the rapid



Source: Pruett and Pruett, n.d. p. 5.

Figure 2-1. Applicability of universal design versus design for disability.

Source: ACRP Project 07-13 Research Team

Figure 2-2. Automatic doors.

development and proliferation of digital technologies, more and more people can now achieve a level of independence inconceivable in the past. By applying the principles of universal design as well as the strategies described below that are specific to particular disability types, airports can help their customers function independently and find their way successfully despite the constraints of these uniquely complex environments.

The seven principles of universal design, originated and copyrighted by The Center for Universal Design, North Carolina State University (Connell et al. 1997), are in common use worldwide, and are readily applicable to all types of design, from buildings and signage to websites and the latest digital technologies. The seven principles are listed and discussed below.

Principle 1: Equitable Use. The design does not disadvantage or stigmatize any group of users.

Automatic doors (as shown in Figure 2-2) are a classic example of a design that works well for everyone while also embodying Principle 6: Low Physical Effort.

Locating the elevator, escalator, and stairs in close proximity and easy view of one another (see Figure 2-3) meets not only Principle 1: Equitable Use but also Principle 2: Flexibility in Use;

Source: ACRP Project 07-13 Research Team

Figure 2-3. Elevator, escalator, and stairs in close proximity at Chicago O'Hare International Airport.

Source: ACRP Project 07-13 Research Team

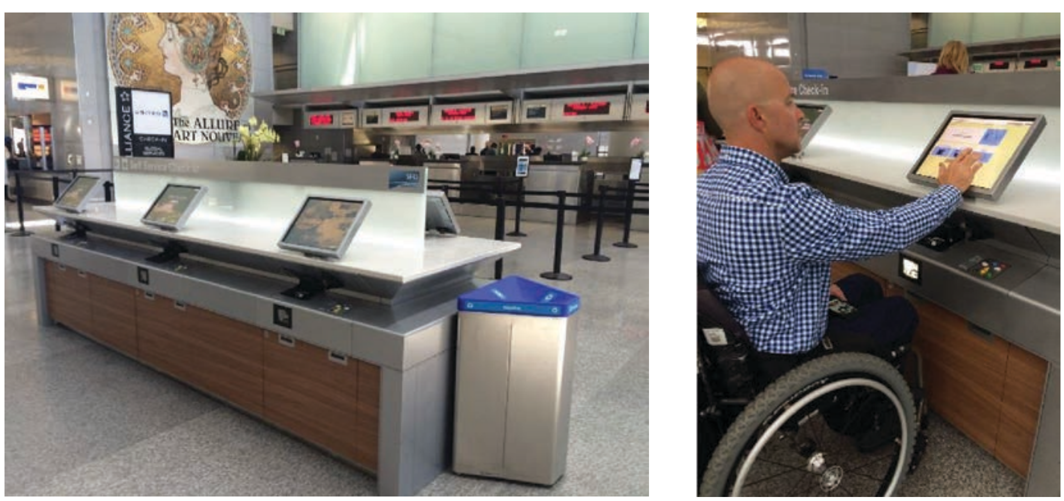
Figure 2-4. Bi-level information desk at Tampa International Airport.

Principle 3: Simple, Intuitive Use; and Principle 6: Low Physical Effort. Signage includes directional reinforcement as well as confirmation that passengers are heading toward their desired destinations.

Principle 2: Flexibility in Use. The design accommodates a wide range of individual preferences and abilities.

A building's design should allow people to use its features in more than one prescribed way, e.g., standing and seated, as at the information desk shown in Figure 2-4. Verbal communication is a very important part of the wayfinding experience for aging travelers and persons with disabilities.

New common-use self-service (CUSS) kiosks, designed in-house at San Francisco International Airport (see Figure 2-5), allow standing and seated users to input information in a variety of ways: by scanning a passport or other ID, typing on the touch screen, or using the EZ Access keypad. An audio jack allows those who are blind to get instructions verbally. Since all six stations at each table are accessible (exceeding the 25 percent mandated under ACAA regulations), these CUSS kiosks also illustrate Principle 1: Equity in Use.



Source: ACRP Project 07-13 Research Team

Figure 2-5. Accessible CUSS kiosks at San Francisco International Airport.

Principle 3: Simple, Intuitive Use. Use of the design is easy to understand regardless of the user's experience, knowledge, language skills, or current concentration level.

Clear lines of sight in Heathrow's international terminal and prominent, illuminated signs that identify each section of check-in counters (see Figure 2-6) allow passengers, regardless of knowledge, language skills, or current concentration level, to easily determine which direction they need to walk.

Principle 4. Perceptible Information. The design communicates necessary information effectively to the user regardless of ambient conditions or the user's sensory abilities.

Redundancy of information, i.e., providing all essential information in a variety of modes such as written, symbolic, tactile, and verbal, is fundamental to creating a wayfinding system that works for all users. The Chicago Lighthouse for the Blind has two interactive, tactile maps (shown in Figure 2-7) designed by Touch Graphics, Inc., and IDEA Center, University of Buffalo. Users can either touch the map directly to trigger playback of information or navigate a menu of options by pressing right and left arrows.

The elevator directory at Heathrow Airport (shown in Figure 2-8) lists the facilities located on each floor in Braille; tactile text and arrows; pictograms; and large, high-contrast fonts. While ADA Standards do not require directories or directional signage to include tactile information, an airport may determine that its inclusion is necessary for effective wayfinding by customers with vision loss. The elevators are also automatic and provide verbal announcements at each floor.

Integration of visual paging into flight information display systems (FIDSs), now becoming common in airports worldwide, is a good example of Principle 4: Perceptible Information. While these FIDSs do not feature audible output for those with vision loss, data feeds to smartphones via airport and airline applications now help to fill that information gap. The placement of the FIDS, airport map, and directory at eye level (as shown in Figure 2-9) also illustrates Principle 1: Equitable Use, Principle 2: Flexibility in Use, and Principle 7: Size and Space for Approach and Use.

Principle 5: Tolerance for Error. The design minimizes hazards and the adverse consequences of accidental or unintended actions.

In Hong Kong International Airport and San Francisco International Airport, changes in surface texture and railings are typically used to alert passengers to the entrances and exits of

Source: ACRP Project 07-13 Research Team

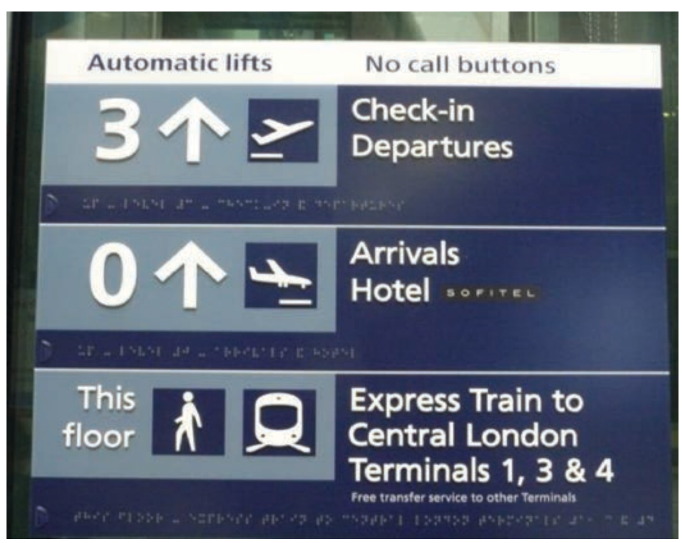
Figure 2-6. Check-in hall in Terminal 5 at Heathrow Airport.

Source: https://www.buffalo.edu/news/releases/2014/11/029.html

Figure 2-7. Tactile map at Chicago Lighthouse for the Blind.

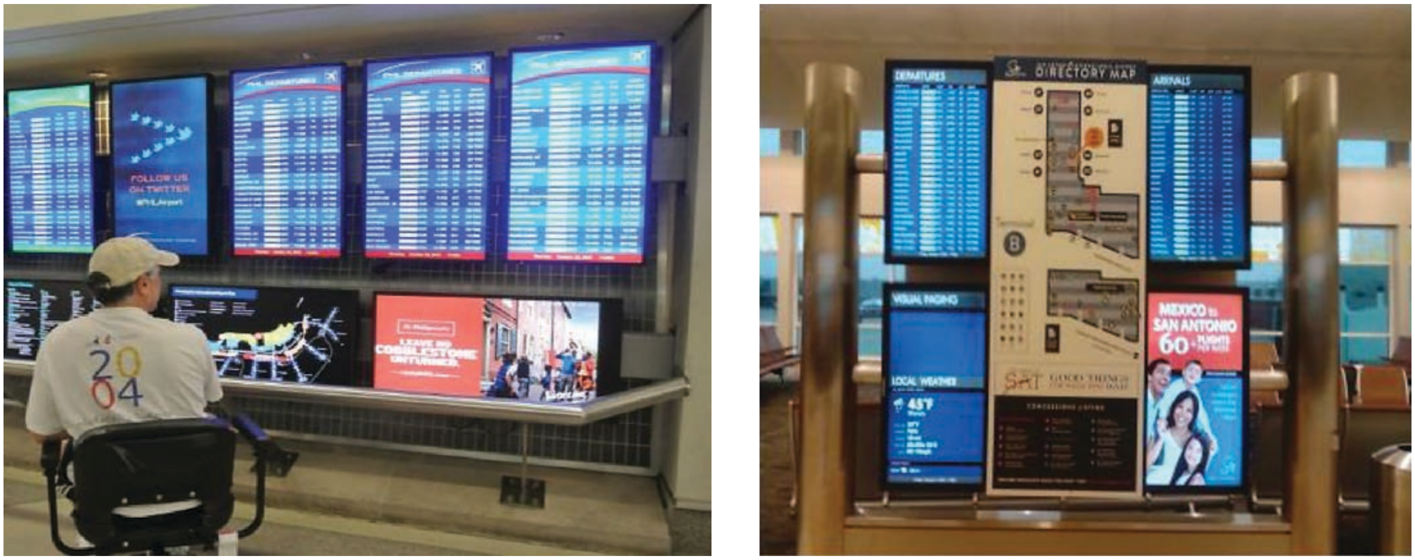
moving walkways (see Figure 2-10). San Francisco International Airport also uses railings to prevent entry by luggage carts as opposed to just a warning sign. Railings at both airports are cane-detectable to minimize any danger to customers using white canes or guide dogs. Hong Kong International Airport also uses arrows to indicate the direction of travel, another safety precaution.

Airports that eliminate curbs along passenger loading and unloading zones can protect travelers with vision loss from inadvertently entering the roadway by installing tactile warning strips



Source: ACRP Project 07-13 Research Team

Figure 2-8. Tactile elevator directory at Heathrow Airport.



Source: ACRP Project 07-13 Research Team

Figure 2-9. FIDS at eye level with screen for visual paging at Philadelphia International Airport and San Antonio International Airport.

with truncated domes along the edge (as shown in Figure 2-11). These are more commonly used at curb ramps.

Principle 6: Low Physical Effort. The design can be used efficiently and comfortably and with a minimum of fatigue.

While automatic doors, restrooms with no doors, and flat baggage carousels are all examples of designs that minimize physical effort in airports, the most common complaint among older travelers and those with disabilities is the distance to and from boarding gates (Wolfe July 2003, Open Doors Organization 2015). By linking its four airside concourses, each of which has a separate security checkpoint, via separate shuttles from the centrally located main terminal, Tampa International Airport limits walking distances, as shown in Figure 2-12, and also simplifies wayfinding.

Sources: SFO-ACRP Project 07-13 Research Team; HKG https://www.archsd.gov.hk/archsd/html/ua/06_97.html

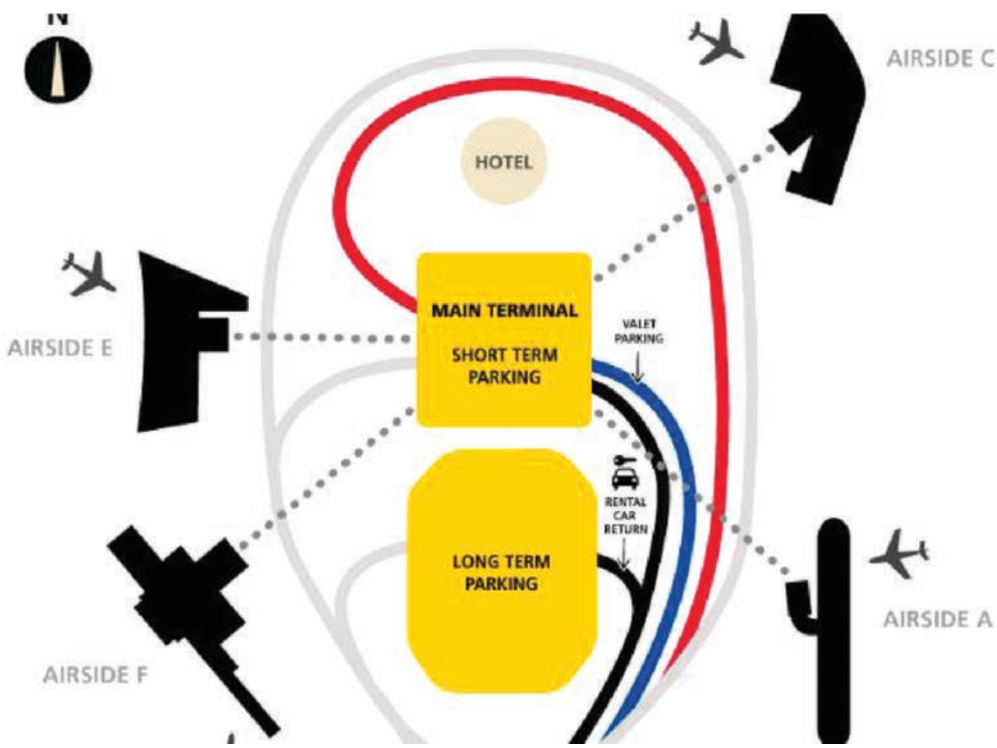
Figure 2-10. Moving walkways at San Francisco International Airport and Hong Kong International Airport.

Source: www.detectable-warning.com

Figure 2-11. Tactile warning strip along level entry to roadway.

Principle 7: Size and Space for Approach and Use. Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Flow-through elevators, like the one at Newark Liberty International Airport (shown in Figure 2-13), provide a straight path of travel for individuals using mobility devices and enable them to easily access elevator controls without turning or twisting. Persons with luggage carts and large suitcases also find these elevators easier and faster to use. By



Source: http://www.tampaairport.com/maps

Figure 2-12. Terminal map for Tampa International Airport.

Source: ACRP Project 07-13 Research Team

Figure 2-13. Flow-through elevator, AirTrain at Newark Liberty International Airport.

providing clear lines of sight, the elevator's glass walls are another example of Principle 3: Simple, Intuitive Use.

The wide turnstile shown in Figure 2-14 allows easy approach and use by people with wheelchairs, strollers, luggage, and bicycles, as indicated by pictograms displayed prominently on the entry gate. A tactile guiding strip, not shown in Figure 2-14, leads customers with vision loss to this wider turnstile, most likely because it can also more easily accommodate someone using a guide dog.

Source: http://metro4all.org/blog-en/amsterdam-accessibility-navigation/

Figure 2-14. Universally accessible turnstile at Amsterdam Metro.

2.3 Vision Loss

There are an estimated 20.6 million American adults (18 years or older) who experience vision loss, defined as difficulty seeing, even with glasses or contact lenses, or who are totally blind (CDC 2014). Approximately 10 percent of adults aged 85 and older are legally blind, and more than 20 percent experience low vision (Brabyn et al. 2000). Other people who may have difficulty using visual wayfinding strategies include those who may have forgotten their glasses, may not know that they need corrective lenses, or may be experiencing an ocular migraine.

While vision loss can take many forms and degrees, people with vision loss are typically grouped into two main categories: blind and low vision. Those considered to have low vision still rely mainly on their residual vision in order to perceive information and find their way through the environment. In terms of assistive devices, they may use scanners or magnifiers to access print information as well as larger fonts on computers and mobile devices. Persons who are blind depend more exclusively on their tactile, aural, and olfactory senses, and thus on technologies such as screen readers on computers, VoiceOver (iOS) or TalkBack (Android) on mobile devices, and, most recently, haptic devices. Individuals who lose their vision later in life typically do not learn Braille, relying instead on audible information and tactile lettering. It is estimated that only 10 to 15 percent of Americans who are blind can read Braille.

Individuals who are deaf-blind usually retain some usable hearing or sight, enabling them to navigate and communicate with the same technologies as other individuals with vision or hearing loss. Those with severe or complete loss of both hearing and vision face a much greater challenge. Basic techniques for communication with customers who are deaf-blind include tactile finger spelling, printing in block letters on the palm, and the use of Braille cards that feature a print and Braille alphabet. Some individuals may travel with their own device, such as a Screen Braille Communicator. This new technology enables face-to-face communication through the exchange of text and Braille messages between two portable devices, a Braille keyboard with Braille display, and a smartphone with QWERTY keyboard (see Figure 2-15). It can also enable remote digital communication via email, instant messaging, and calls using a text telephone for the hearing impaired.

Haptic technologies that convey information through touch are in development, but solutions to enable independent navigation through a complex, unfamiliar airport are not yet available.

Source: http://www.perkinselearning.org/videos/webcast/communication-technology-persons-who-are-deafblind

Figure 2-15. Deaf-blind communicator.

Most individuals who are deaf-blind travel with a companion to assist with navigation and communication. However, under the ACAA, persons with both severe hearing and vision loss must be allowed to fly alone if they can establish a means of communication with carrier personnel and can assist in their own evacuation from the aircraft in the event of an emergency (Part 382.29).

The age at which a person begins to lose vision, the extent of orientation and mobility (O&M) training a person has received (if any), and the length of time a person has experienced a vision loss all determine the individual's desire and ability to navigate independently. For independent navigation, the traditional assistive devices remain the norm for most, e.g., the white cane or long cane and the guide dog. These mainly help the person avoid obstacles or hazards rather than serving as a navigator.

Airlines are required under the ACAA to provide a human guide on request, and many travelers with vision loss will continue to depend on that service despite potentially long waits and uncertainty, communication problems, and poor service. For those who are younger and more tech savvy, deployment of new technologies to enable independent wayfinding in airports cannot come soon enough.

To further understand who travelers with vision loss are, it is important to illustrate practical measures that airports can implement to close wayfinding gaps and thereby enable customers with vision loss to function more independently and safely. Over the past 15 years, through surveys and focus groups, research by Open Doors Organization has identified a number of areas—pre-trip and at the airport—where access to services, facilities, and information is most problematic for people with vision loss. These range from the lack of accessibility and relevant content of websites and applications, to the challenge of finding assistance on arrival with ground transportation. These areas also extend to inappropriate assistance by airport, airline, and service company staff and the inaccessibility of static and digital signage.

Sections 2.3.1 and 2.3.2 list several steps to enhance wayfinding for customers with vision loss. Some of this guidance has been incorporated into the Wayfinding Accessibility Audit Checklist in Chapters 4 through 7 (which covers all user groups). The goal of spotlighting the guidance related to travelers with vision loss here is to help airports better understand this particular subgroup of travelers.

2.3.1 Steps to Enhance Wayfinding for Customers Who Are Blind

1. Make virtual information accessible and usable. For individuals who are blind, pre-trip planning is an important step in successfully navigating an airport. Virtual information should be legible by screen readers and provide detailed descriptive information. While the Department of Justice has not yet published web accessibility standards, a consent decree against H&R Block specified that it use WCAG 2.0, an indication that this will likely be the future standard. WCAG 2.0 AA is already the standard for airline websites under new U.S.DOT ACAA requirements (U.S. DOT 2013).
2. Where maps are provided on the airport website or mobile app, include narrative, text-based descriptions so that travelers who are blind can create a cognitive map of the airport. These should include a description of the overall airport layout as well as detailed descriptions of terminals and concourses and how passengers can move between them (interior or exterior walkways, automated people mover, shuttle buses, etc.). Include cardinal directions, left/right or clock-face directions, and approximate distances or walking times. Section 3.3.3 of this report includes text maps created by the ACRP Project 07-13 research team for Austin-Bergstrom International Airport. Another example comes from Cincinnati/Northern Kentucky International Airport's (CVG's) website, which now features 10 captioned wayfinding

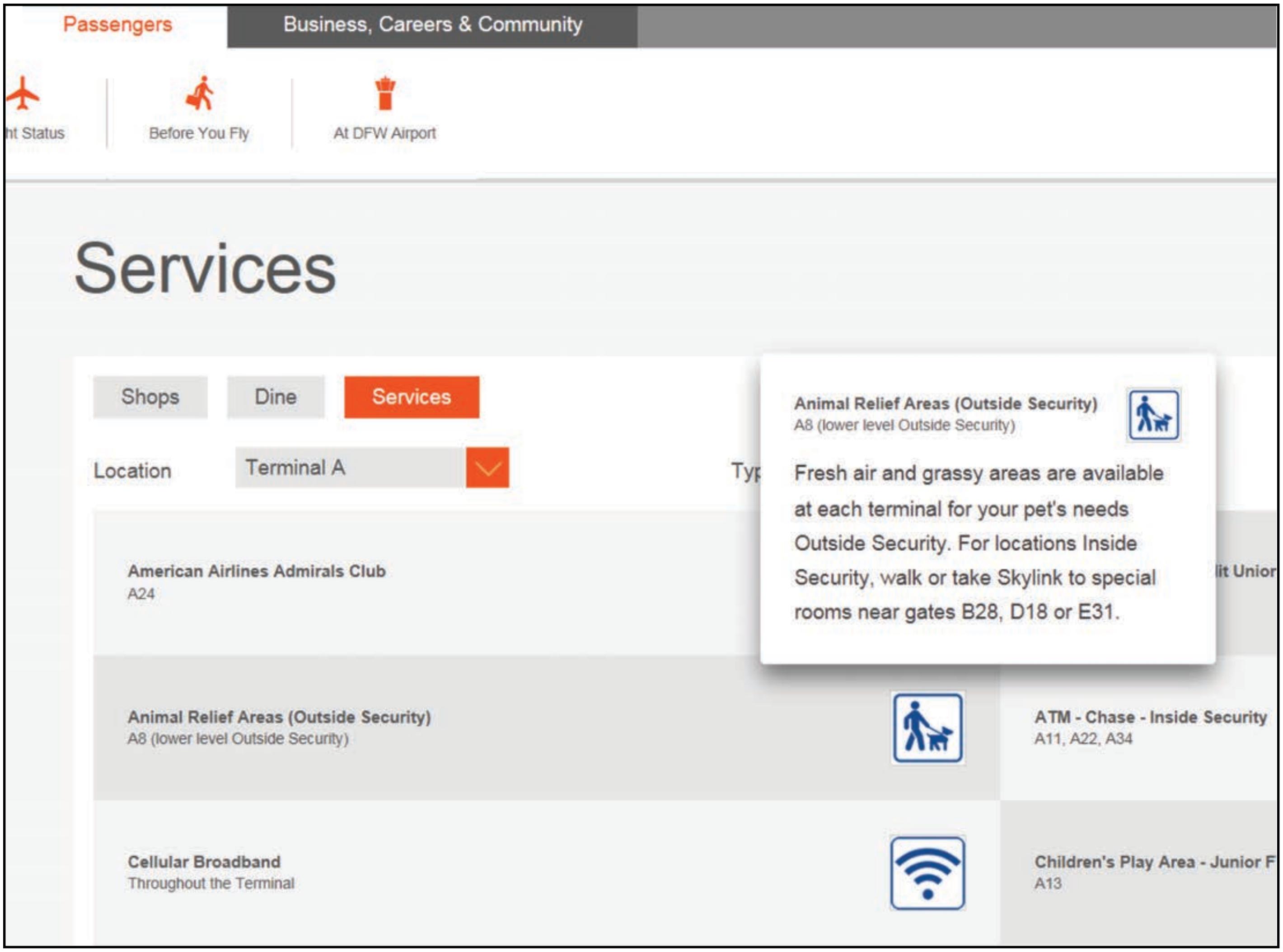
videos and posts the captions separately as "Step-by-Step Directions". (See screenshot from one of CVG's videos in Figure 2-16.)

To facilitate travel planning, list the location of all facilities and services. For example, visitors to the Dallas/Fort Worth International Airport website can click on "Shops, Dine and Services" to learn the terminal and gate location of each such facility including Service Animal Relief Areas (SARAs) (see Figure 2-17). For more information, see checklist item P-WS.04 in Chapter 4.

3. Make visual information scannable. Visual information should be clear and use contrast and fonts that are easily read by electronic scanning devices.
4. Make verbal information actionable. Staff assisting at information desks, call centers, and Travelers Aid should know how to give detailed directions so that customers who are blind can understand how far and in what direction to go. A specific direction can be indicated by cardinal points, left/right, or clock-face directions, e.g., the drinking fountain is at 1 o'clock. Including the approximate number of steps is helpful along with useful clues such as changes in floor surface or multisensory landmarks. Staff must also be fluent in English and other languages in common use locally or have access to translator services or applications.
5. Wherever possible, create SARAs airside as well as landside at each terminal. Large terminals may require more than one area in order to simplify navigation and reduce walking time and effort, especially important for those making connecting flights. Section 504 requirements for SARAs to be built airside went into effect in August 2016. Reference checklist item D-GA.35 in Chapter 5. 14 CFR Part 382 (ACAA) requires that the SARA be on an accessible route.
6. Make immediate access to information or assistance available at all airport arrival points: curbside for designated drop-off locations by private car, taxi, public transit bus, and shuttle bus, as well as at the airport's light rail or metro station. In Europe, this is mandated through the placement of accessible "help point" kiosks at all arrival points (European Community (EC) Regulation 1107/2006). Placing a courtesy phone to the right of the terminal entrance nearest the designated drop-off point is a simple, low-cost solution (this solution is in use at SFO). Reference checklist item D-AP.09 in Chapter 5.
7. Conduct audits to discover service gaps and hazards for travelers who are blind or have low vision. Typical problem areas include the following:
   - FIDSs and baggage information display systems (BIDSs). These typically provide information in visual format only, not in multiple formats as called for by Universal Design Principle 4: Perceptible Information.
   - Areas where wayfinding is complex and no information counter is available. For example, complex intra-airport transportation systems set outside terminal buildings, like AirTrains at John F. Kennedy International Airport and Newark Liberty International

Source: http://www.cvgairport.com/terminal/videos

Figure 2-16. Screenshot of wayfinding videos, Cincinnati/Northern Kentucky International Airport.



Source: Dallas/Fort Worth International Airport

Figure 2-17. Service locations including SARAs, Dallas/Fort Worth International Airport.

Airport. Other places where additional staff may be needed are shuttle van areas where pick-up for a specific hotel is at a particular door or where shuttles serving multiple routes stop at one location.

- Terminal maps, which typically are not tactile. Some tactile maps do exist in Europe and Asia, e.g., Charles De Gaulle International Airport, Leonardo Da Vinci (Fiumicino) International Airport, Munich Airport, and Hong Kong International Airport. Figure 3-43 shows one of the new interactive tactile maps with audio messages at Warsaw Chopin Airport.
- Lack of tactile warning strips at raised crosswalks, curb-free drop-off areas, and areas where pedestrian pathways cross vehicular routes in parking garages. (Universal Design Principle 5: Tolerance for Error). See Figure 2-11.
- Protruding objects in the path of travel. Examples include water fountains and fire extinguishers that are not cane-detectable as well as overhead hazards such as unenclosed stairwells. Single-tape, crowd-control barriers at check-in and security are also not detectable by cane or guide dog. To minimize hazards, accessible dual-tape barriers should be positioned along adjacent paths of travel. (Universal Design Principle 5: Tolerance for Error). See Figure 2-18.

Source: ACRP Project 07-13 Research Team

Figure 2-18. Cane-detectable crowd-control barrier at San Francisco International Airport.

8. Include people who are blind or have low vision on the airport's disability advisory committee. Not only can they participate in audits, they also can provide input on new construction, renovations, web content and accessibility, and emergency planning. Depending on the project, airports may also want to include professional experts such as O&M specialists. See Section 2.10 for additional information. Reference checklist item P-PD.01 in Chapter 4.
9. Provide disability awareness training to all airport front-line personnel that covers appropriate language, common courtesies, how to provide "actionable" directions to passengers with vision loss, and how to assist as human guides. The training should also provide an orientation to the airport's accessible facilities and services. Invite others working at the airport to participate, including concessionaires, TSA, shuttle drivers, etc. Reference checklist item P-CC.04 in Chapter 4.
10. Support training/familiarization opportunities for persons with disabilities in airports to increase understanding of procedures and airport layout. These trainings are typically run in conjunction with airlines, e.g., United Airlines' "Project Airport," and may include staff training opportunities as well. Reference checklist item P-CC.04 in Chapter 4.
11. Enable indoor navigation via smartphone through beacons, Wi-Fi localization, light-emitting diode (LED) visible light communication (VLC), or other emerging technology. See Chapter 8 for a more detailed discussion.

2.3.2 Additional Steps to Enhance Wayfinding for Customers with Low Vision

1. Make visual information easy to read. Use effective color contrasts, fonts, and lighting, and avoid glare to maximize readability. Place signage at eye level for close approach.
2. Make verbal information actionable. Staff assisting at information desks, call centers, and Travelers Aid should know how to direct customers with low vision, providing specific directions that include easily seen landmarks such as the dinosaur skeleton (shown in Figure 2-19) located at the entrance to the underground walkway linking Terminals B and C at Chicago O'Hare International Airport.
3. Avoid glare not just on signage but also on floor surfaces and use simple rather than complex patterns on carpets and floors (CNIB 2016); these are important considerations for safety as well as wayfinding. Abrupt shifts from dark to brightly lit areas should also be minimized.

Source: ACRP Project 07-13 Research Team

Figure 2-19. Dinosaur "brachiosaurus" landmark at Chicago O'Hare International Airport.

4. Virtual information should be accessible and be adequate information for pre-trip planning. It should remain readable when font size is increased and contrasts changed. Information presented should scale as the magnification is increased.

2.4 Hearing Loss

According to the Hearing Loss Association of America (HLA), approximately 20 percent of Americans (48 million) report some degree of hearing loss. Among the population aged 65 and older, one in three are affected. Estimates from the National Health Interview Survey put the incidence of hearing loss at 15 percent of adults 18 and older (37.5 million). Incidence of disabling hearing loss is much lower overall but rises steeply with age. Among adults 45 to 54, 2 percent are affected. Among adults 55 to 64, 8.5 percent are affected; nearly 25 percent of adults 65 to 74 are affected; and 50 percent of adults 75 and older are affected (NIDCD 2016).

People who experience a significant hearing loss are typically grouped into two main categories: (1) deaf and (2) hard of hearing. Those who are deaf mostly rely on their vision to access information, although they may use either hearing aids or a cochlear implant and communicate orally rather than via sign language or cued speech. Individuals who are hard of hearing primarily use hearing and speech to communicate.

The main assistive device for people who are hard of hearing is hearing aids. Although many older adults in the United States have uncorrected hearing loss, even those individuals who use hearing aids may find them of little use in the noisy airport environment since hearing aids are basically individual loud speakers that magnify ambient sound. Thus, persons who are hard of hearing may need to rely more on visual information at the airport than in their daily lives.

Airports that install hearing loops, which transmit directly from microphones and public address systems to hearing aids with tele-coils or t-coils, can radically improve comprehension for this growing subset of hearing aid users. Since sale of hearing aids with t-coils is on the rise in the United States (up from 37 percent in 2001 to 60 percent in 2008), airports may be more interested in trying this technology, which is already quite common in parts of Europe where t-coils are standard (Greenemeier 2009).

Under the ACAA, people with hearing loss must self-identify to their air carrier in order to get prompt access to any verbal announcements (U.S. DOT 2008). Because the assistance requested is reportedly hit or miss, especially in the busy gate area, many people who are deaf do not notify the carrier or ask for any accommodation. Even though there is no requirement for the airlines to present boarding information visually, the trend is toward real-time display of boarding announcements on gate information display systems (GIDSs).

The ACAA and parallel requirements in the ADA do mandate that captioning on televisions and other audiovisual displays in passenger areas be turned on and that older televisions without captioning be updated as they are replaced or as that area of the terminal undergoes substantial renovation (U.S. DOT 2008).

Like the general population and those who are hard of hearing, individuals who are deaf navigate primarily through the use of visual cues and signage. The better the airport's wayfinding and signage system, the easier it will be for these individuals to travel independently to and from their gates. Problems typically arise when information needs to be exchanged through direct communication with airline or airport personnel, who typically do not know sign language.

One technological solution now in place at information booths at Minneapolis-St. Paul International Airport is remote video relay interpreting (VRI) via tablet. Many airlines now allow passengers to specify that flight changes and alerts be sent by text message, thus eliminating the need to communicate with gate or information agents. Visual paging is also increasingly the norm at U.S. airports.

Sections 2.4.1 and 2.4.2 list several steps to enhance wayfinding for customers who are deaf or hard of hearing. Some of this guidance has been incorporated into the Wayfinding Accessibility Audit Checklist in Chapters 4 through 7 (which covers all user groups). The goal of spotlighting the guidance related to travelers who are deaf or hard hearing here is to help airports better understand this particular subgroup of travelers.

2.4.1 Steps to Enhance Wayfinding for Customers Who Are Deaf

1. Provide verbal information visually wherever possible (Universal Design Principle 4: Perceptible Information).
2. Follow Universal Design wayfinding guidelines for design of the built environment and signage systems in order to improve ease of navigation and minimize the need to ask for directions from airport or airline personnel.
3. Enable communication between hearing staff and customers who are deaf by providing tablets, specialized communication devices such as UbiDuo and remote VRI. Tablets and text-based devices like UbiDuo also improve communication for travelers with speech disabilities. Reference checklist item D-GA.36 in Chapter 5.
4. Provide detailed visual maps online to allow passengers to plan their route in advance and identify the location of restaurants, shops, and services, including the location of assistive devices and SARAs for travelers with hearing alert dogs. See checklist item P-WS.03 in Chapter 4.
5. Require captioning of online wayfinding videos or virtual tours. See Figure 2-16, a photo of a captioned wayfinding video at CVG. Reference checklist item P-WS.16 in Chapter 4.
6. Post visual pages to a dedicated page on the airport's website (see Figure 2-20), so they can be accessed on a smartphone or tablet. Enable passengers to also send a page via email, text, or TTY since standard courtesy phones are inaccessible to deaf individuals. This also improves accessibility for persons with speech disabilities.
7. Include people who are deaf and hard of hearing on the airport's disability advisory committee. In addition to participating in audits and project planning, they can provide input on adaptive technologies, emergency communication, and staff training. Depending on the project, airports may also want to include professional experts. See Section 2.10 for additional information. Reference checklist item P-PD.01 in Chapter 4.

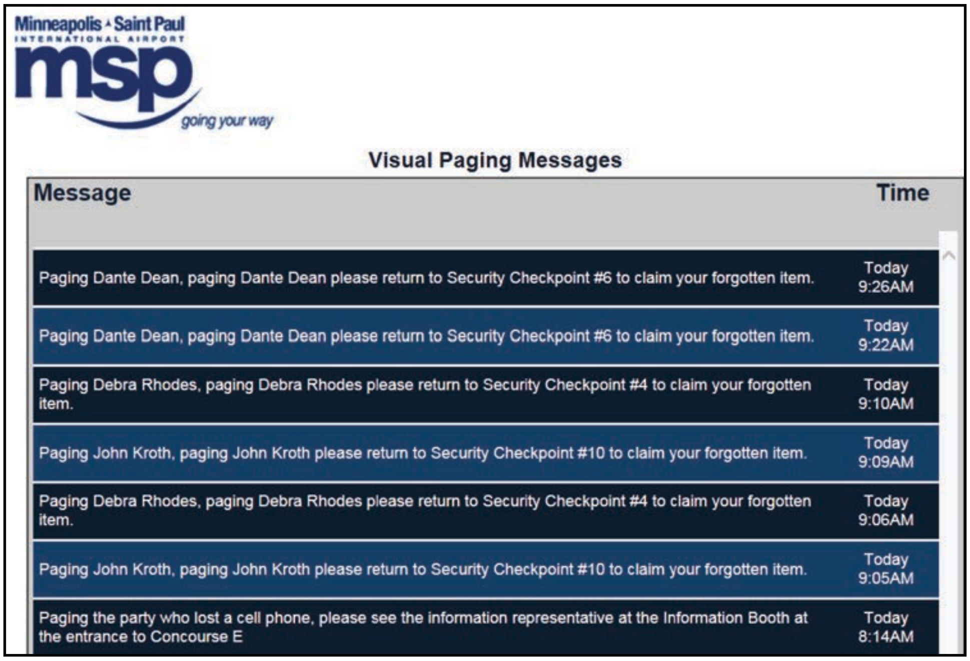


Figure 2-20. Visual paging on Minneapolis-St. Paul International Airport website.

8. Provide disability awareness training to all front-line personnel that covers appropriate language, common courtesies, and how to communicate with travelers who are deaf, hard of hearing, and deaf-blind. The training should also provide an orientation to the airport's accessible facilities and services. Invite others working at the airport to participate including concessionaires, TSA, shuttle drivers, etc. Reference checklist item P-CC.04 in Chapter 4.
9. Enable indoor navigation via smartphone through beacons, Wi-Fi localization, LED VLC, or other emerging technology. See Chapter 8 for a more detailed discussion.

2.4.2 Additional Steps to Enhance Wayfinding for Customers Who Are Hard of Hearing

1. Reduce noise through the use of sound-absorbing wall and floor materials, being careful not to unduly increase effort for individuals using wheelchairs, pushing wheelchairs, or rolling luggage. Reference checklist item P-PD.06 in Chapter 4.
2. Improve the quality of public address systems and/or terminal acoustics to make announcements more comprehensible (reference checklist item D-GA.48 in Chapter 5). Install hearing loops—also known as induction loops—in holding rooms and other areas where public address announcements are most critical, as well as at information desks. Post signage to alert passengers of the availability of hearing loops, as shown in Figure 2-21. In Europe, help points also are looped.

2.5 Reduced Mobility

Individuals with reduced mobility can be functionally grouped into two main categories: (1) non-ambulatory and (2) ambulatory. The former cannot walk at all and use manual or electric wheelchairs full time. The type of wheelchair often depends on whether the individual is a paraplegic (paralysis affects only the lower limbs) or quadriplegic (paralysis affects trunk and upper limbs as well).

Sources: http://www.hearingloop.org/GRAphotos.html and http://www.hearingloopsunlimited.com/news.html

Figure 2-21. Hearing loop signage at Gerald R. Ford International Airport and Greater Rochester International Airport.

Persons who use a wheelchair full time will for the most part navigate the airport in their own mobility devices and check and reclaim them at the door of the plane. They may or may not request assistance from the airline to assist with hand luggage and going through security. Many will navigate independently and thus need to be able to locate accessible routes where they differ from the general path of travel—such as elevators for level changes—as well as accessible facilities such as parking, restrooms, companion restrooms, charging stations, etc.

Persons who are ambulatory can still walk to some degree but may not be able to manage longer distances or climb stairs. Some may use no assistive device at all, while others may rely on a cane, walker, rollator (modern walker with four wheels), crutches, manual wheelchair, or electric scooter. Those traveling with a manual wheelchair may prefer to have it tagged at check-in unless they are accompanied by a family member or companion to provide assistance. Many of these individuals will request a wheelchair assist or electric cart to the gate, especially at larger airports, so independent navigation may not be an issue except before check-in and while in the gate area. Ambulatory travelers will also need to be able to locate accessible parking or ground transportation, elevators, and accessible multiuse or companion restrooms.

Sections 2.5.1 and 2.5.2 list several steps to enhance wayfinding for customers with reduced mobility. Some of this guidance has been incorporated into the Wayfinding Accessibility Audit Checklist in Chapters 4 through 7 (which covers all user groups). The goal of spotlighting the guidance related to travelers with reduced mobility here is to help airports better understand this particular subgroup of travelers.

2.5.1 Steps to Enhance Wayfinding for Customers Using Wheelchairs or Scooters

1. Wherever possible, make all paths of travel and entrances accessible (Universal Design Principle 1: Equitable Use). Where the accessible route diverges from the general path of travel, locate the accessible route as close as possible to the general one and preferably within sight. This is now required under the 2010 ADA Standards along with the specifica-

tion that if a circulation route is interior, the accessible route must also be interior (U.S. Department of Justice ADA 2010 Standards, §206.3). Reference checklist item D-RC.03 in Chapter 5.

2. Group elevators with stairs and escalators in easy view. If this cannot be done, include directional signage (Universal Design Principles 1, 3, 4, and 6). See Figure 2.3. Reference checklist item C-GA.20 in Chapter 7.
3. Make visual information readable from a seated position and ensure that nothing blocks the sign when viewed from a lower angle. Place electronic signage and airport maps at a lower level for easy reading from a wheelchair. Follow ADA Standards for font size for higher/overhead signage.
4. Designate accessible pick-up and drop-off areas and clearly identify them by signage (visible to both pedestrians and drivers) and on airport maps. This is a requirement for pick-up by paratransit agencies, which need an exact location when the reservation is made. Two U.S. airports that have such areas are Miami International Airport and Los Angeles International Airport. 2010 ADA Standards now require accessible loading zones every continuous 100 linear feet, not just one per terminal (U.S. Department of Justice ADA Standards, §202.9.1). Reference checklist item D-AP.15 in Chapter 5.
5. Provide detailed information on accessibility of private and public ground transportation as well as airport transportation systems and shuttles on the airport website and application, if applicable. Per the FAA, all airport shuttles on a fixed route, e.g., to parking, must be accessible. Where an intra-airport train system links numerous terminals and distances to the various stations are long, it may be preferable to create a parallel, accessible shuttle service for passengers with mobility issues or for those who use wheelchairs, e.g., the shuttle system at John F. Kennedy International Airport. Reference checklist item C-TT.01 in Chapter 7.
6. Clearly identify all accessible parking areas, accessible restrooms, and family/companion restrooms on airport maps, online, and in the terminal. If all multiuse restrooms are accessible, then include that information. While ADA Standards do not require a wheelchair symbol for an accessible restroom when all are accessible, this may not be obvious to foreign travelers who will assume that multiuse men's and women's restrooms have no wheelchair stall. Reference checklist item D-TK.17 in Chapter 5.
7. Post accessible signage identification on wheelchair and ambulatory stalls in restrooms. Although not required by ADA Standards, this is good practice for several reasons: (1) such stalls are not always easily identifiable, (2) travelers who need them may not be aware of the existence/functionality of ambulatory stalls, and (3) such signage may assist individuals with reduced mobility to gain preferential access when there is a waiting line.

2.5.2 Additional Steps to Enhance Wayfinding for Customers with Limited Mobility

1. Provide distances or walking times to other terminals and/or gates on airport signage as well as on websites and mobile applications so that persons with limited mobility can determine whether or not they can walk themselves and, if so, allow enough time to do so. This feature benefits all travelers but is especially important for this group.
2. Enable/encourage individuals who would like to walk to/from the gate themselves to do so by placement of seating at regular intervals along long corridors and concourses so they can rest en route. Install seating or additional seating at check-in and baggage claim and areas where people wait to be picked up; these areas typically have few, if any, seats. Designate, or require that airlines designate, priority seating at gate areas next to the podium so that those who need to pre-board are seated in close proximity to the boarding line/door.

2.6 Cognitive Disabilities

The category of cognitive or intellectual disabilities is very broad and encompasses a wide range of conditions that can also vary widely in their impact on the functionality of the individual. A limited number of cognitive disabilities are considered in this report, specifically:

- Developmental disabilities
- Learning disabilities
- Dementia, including Alzheimer's
- Short-term memory loss

Cognitive disabilities in the United States currently rank second in prevalence to mobility-related disabilities according to the Centers for Disease Control and Prevention (CDC 2015). From 2006 to 2008, the CDC reported that one out of six children in the United States had a developmental disability and that over a 12-year period the prevalence of developmental disabilities increased 17.1 percent, while the rate of autism increased by a shocking 289.5 percent. Autism now affects 1 in 88 children in the United States and 1 in 54 boys (Boyle et al. 2011). At the other end of the age spectrum, Alzheimer's is now impacting one in nine Americans over the age of 65 (5.2 million people), while many more experience some degree of short-term memory loss (Alzheimer's Association 2016).

Given the complexity of the airport environment and the fact that it is a place that one encounters only infrequently, not on a regular or daily basis, it is unlikely that persons with severe cognitive disabilities will navigate an airport alone or receive training to do so as they might in their own communities. However, there are many individuals with mild to moderate learning disabilities or in the early stages of dementia whose needs and preferences should be addressed through airport design, signage systems, and informational services. Beneficial design standards include clear sight lines with well-defined paths, striking landmarks, and appropriately located information or reception desks. Not only will clear paths and noticeable landmarks assist in easier navigation and memory of where certain things are located, they will also assist airport employees in giving directions.

It is important to note that the ACAA does mandate that persons with mental disabilities be allowed to fly alone if they can understand and follow instructions in case of emergency (U.S. DOT 2008). Airlines must, on request, provide an escort in the terminal for passengers with intellectual disabilities. However, there is no requirement that the escort stay with the passenger until the plane boards, a service gap that has led to incidents where travelers with dementia have become lost and even died.

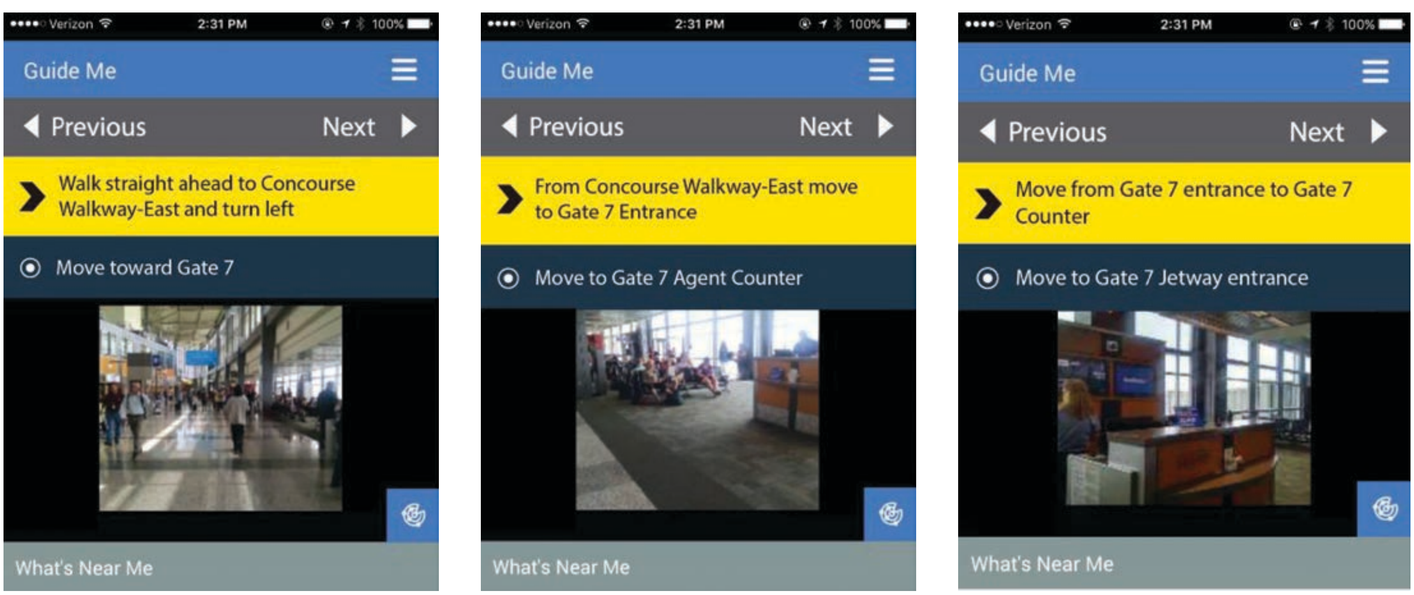
To bridge this gap for its customers, Air Canada offers a complimentary "Unaccompanied Adult" program. In the United States, this could be provided by airlines as a paid service, as it was previously at Northwest Airlines (U.S. DOT 2015). While U.S. carriers currently offer this service for "unaccompanied minors" only, not adults, a best practice among their service companies is to bring passengers with known cognitive disabilities to a staffed holding area where they can be supervised until it is time to escort them to the gate to pre-board. This ensures passenger safety while minimizing staffing requirements and costs. At U.S. airports, airlines may also issue a gate pass allowing a companion or family member to accompany a passenger with a disability in the secure zone, an option not typically available in Europe or elsewhere.

Recognizing that cognitive disabilities affect a growing number of air travelers, the U.S. DOT in 2015 issued new guidance on Part 382 entitled "Guide: Air Travelers with Developmental Disabilities" with tips for both passengers and service providers that underscore the importance of awareness training for all front-line staff (U.S. DOT 2015).

Research to understand the needs of travelers with cognitive disabilities and recommend appropriate accommodations is in the very early stages partly because it has always been assumed that such individuals could not live or function independently. However, a limited number of studies have focused on how technologies such as virtual reality and location-based delivery systems can help people with intellectual disabilities navigate successfully (Bosch and Gharaveis 2017). Application of universal design principles is of particular benefit to travelers with cognitive disabilities, whose needs for the most part fall outside the scope of ADA Standards.

Some guidance related to travelers with cognitive disabilities has been incorporated into the Wayfinding Accessibility Audit Checklist in Chapters 4 through 7 (which covers all user groups). The goal of spotlighting the guidance related to travelers with cognitive disabilities here is to help airports better understand this particular subgroup of travelers. Listed below are several steps to enhance wayfinding for customers with cognitive disabilities:

- Create signage that is clear, concise, and consistent and, where appropriate, includes pictograms because reading comprehension may be limited.
- Include pictograms, symbols, and storyboard-type pictures to make signs accessible to people with learning disabilities. Symbols can be read independently of text or as a means of assisting comprehension. This is beneficial for foreign travelers who also face literacy issues in airports. Reference checklist items P-PD.14, D-AP.11, D-GA.03, and A-GT.31 in Chapters 4, 5, and 6.
- When using colors to designate separate areas or terminals, apply them consistently throughout the signage system, from directories to directional signs and signage within the relevant location. Reference checklist item P-PD.10 in Chapter 4.
- When designing a wayfinding application, simplify text and limit navigation to one step per screen as shown in Figure 2-22.
- Providing the right information (usually in the form of a picture) at the right time (the decision point where one needs to make a directional choice) is the key to success for individuals with limited short-term memory. This will be discussed in more detail in Chapter 8.
- Include a person with an intellectual disability or someone who represents an organization serving those individuals, e.g., The Arc, on the airport's disability advisory committee. Depending



Source: ACRP Project 07-13 Research Team

Figure 2-22. Examples of wayfinding application with one step per screen.

Sources: http://www.thearc.org/wingsforautism and
https://www.mspairport.com/passenger-services/Navigating-MSP.aspx

Figure 2-23. Examples of autism programs at U.S. airports (Boston Logan International Airport and Minneapolis-St. Paul International Airport).

on the project, airports may also want to include professional experts. See Section 2.10 for additional information.

- Support training/familiarization opportunities for people with intellectual disabilities. Programs such as Wings for Autism (launched originally at Boston Logan International Airport) are run in conjunction with airlines and may include staff training opportunities. At least 15 U.S. airports currently host such programs for individuals with autism and their families. The Minneapolis-St. Paul International Airport "Navigating MSP" program allows individual travelers with cognitive disabilities of all types to schedule a private familiarization tour of the airport (see Figure 2-23).
- Include resources such as "social stories" or videos on the airport website to familiarize individuals with autism or other cognitive disabilities with the steps or touch points they must go through at the airport in order to take a flight. Examples include Gatwick Airport's "Autism Friendly Visual Guide," Vancouver International Airport's autism videos and resource kit (created in partnership with Canucks Autism Network), and Portland International Airport's "Let's Fly: A Photo Guidebook Tour."

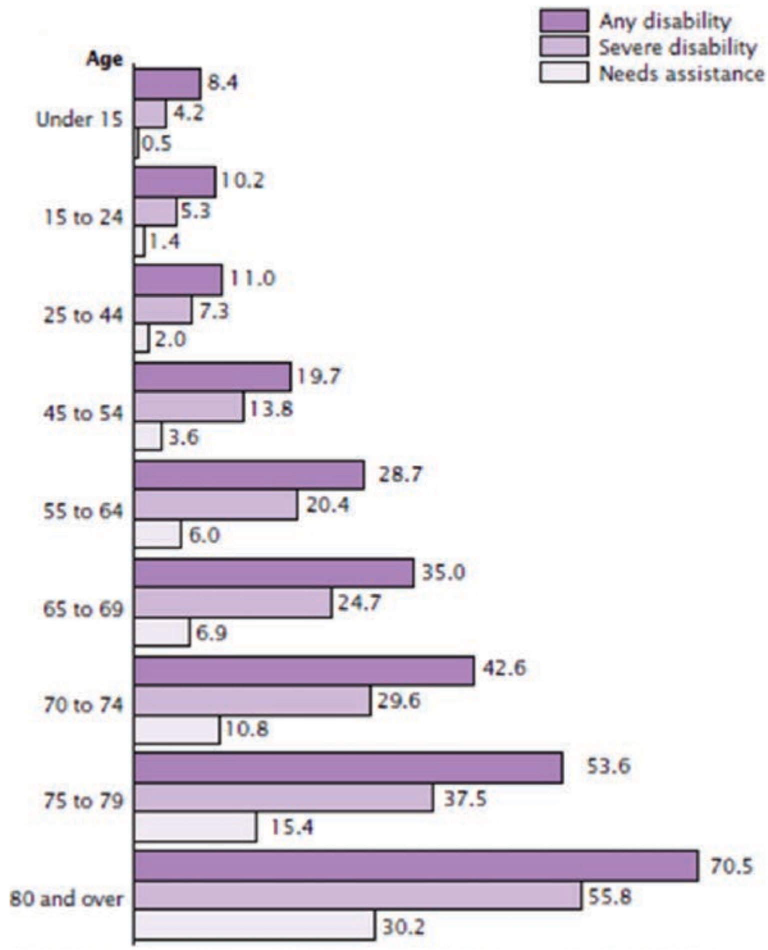
2.7 Aging Adults

While disability affects all age groups, its prevalence rises steeply with age, as shown in Figure 2-24. According to the U.S. Census Bureau (2012), 18.7 percent of Americans (56.7 million people) report having some degree of disability. By age 45 to 54, almost one-fifth (19.75 percent) have a disability. By age 65 to 69, this proportion jumps to more than one-third (35 percent), and by 80 and older, more than two-thirds (70.5 percent) of Americans report some degree of disability. Among Americans 65 and older, more than half (51.8 percent) have a disability; 36.9 percent have a severe disability.

Figure 2-25 shows how fast the older population is growing in the United States. It is easy to see why airports need to adapt quickly if they are not to be overwhelmed by this "gray tsunami." The U.S. Census Bureau projects that the number of Americans 65 and older will jump 78 percent from 2010 to 2030 (from 40.2 to 71.5 million) and 100 percent from 2010 to 2050.

It is not just in the United States that the population is rapidly aging. According to the World Health Organization (WHO), the percentage of people over age 60 in 2000 (11 percent) will double by 2050 (22 percent), equivalent to 2 billion people (WHO 2014).

The country with the highest median age is currently Japan, where 25 percent of the population in 2014 was already age 65 and over, compared to 14 percent in the United States, 15.7 percent in Canada, and 18.5 percent on average in Europe. Not surprisingly, Japan has become a leader in universal design as it strives to keep its elders as functionally independent as possible.



Note: The need for assistance with activities of daily living was not asked of children under 6 years.
Source: U.S. Census Bureau 2012.

Figure 2-24. Disability prevalence and the need for assistance by age: 2010.

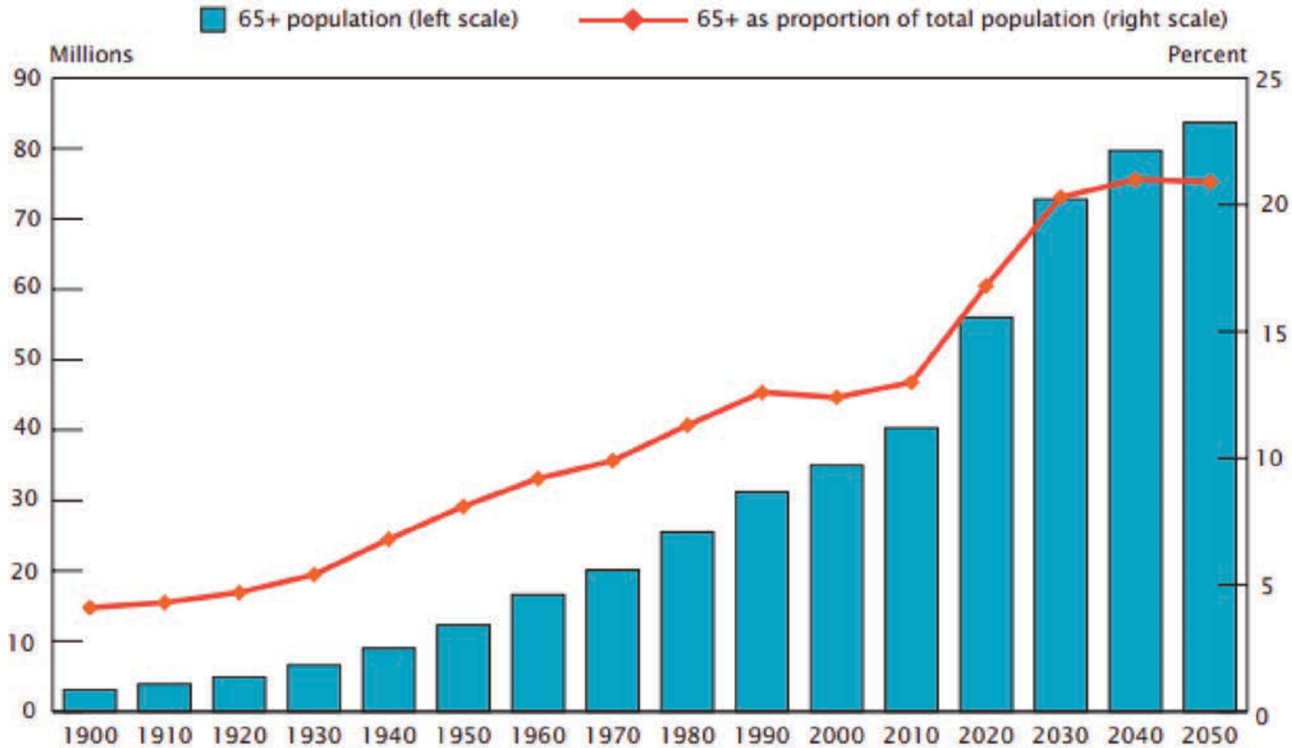
The most common disability among adults in the United States is reduced mobility, followed by hearing, cognition and vision disabilities, according to a 2014 report from American Community Surveys (U.S. Census Bureau 2014a). While an individual may be born with more than one disability or acquire a secondary condition at any age, it is typically older adults who develop multiple disabilities, a natural result of aging, including

- Reduced mobility—difficulty walking distances and climbing stairs and problems with balance.
- Hearing loss—more serious among men than women.
- Cognitive disabilities—short-term memory loss, dementia and loss of ability to wayfind
- Vision loss—cataracts and macular degeneration are most prevalent.
- Chronic health problems—diabetes, heart disease, arthritis, and chronic obstructive pulmonary disease (COPD) contributing to functional limitations.

As Figure 2-26 shows, this process occurs over time with the number of disabilities per individual rising with each 10-year increase in age.

One of the difficulties in accommodating the needs of aging adults is that they may themselves be unaware of the extent of their functional limitations if the onset has been gradual. This is

(For information on confidentiality protection, nonsampling error, and definitions, see *www.census.gov/prod/cen2010/doc/sf1.pdf*)



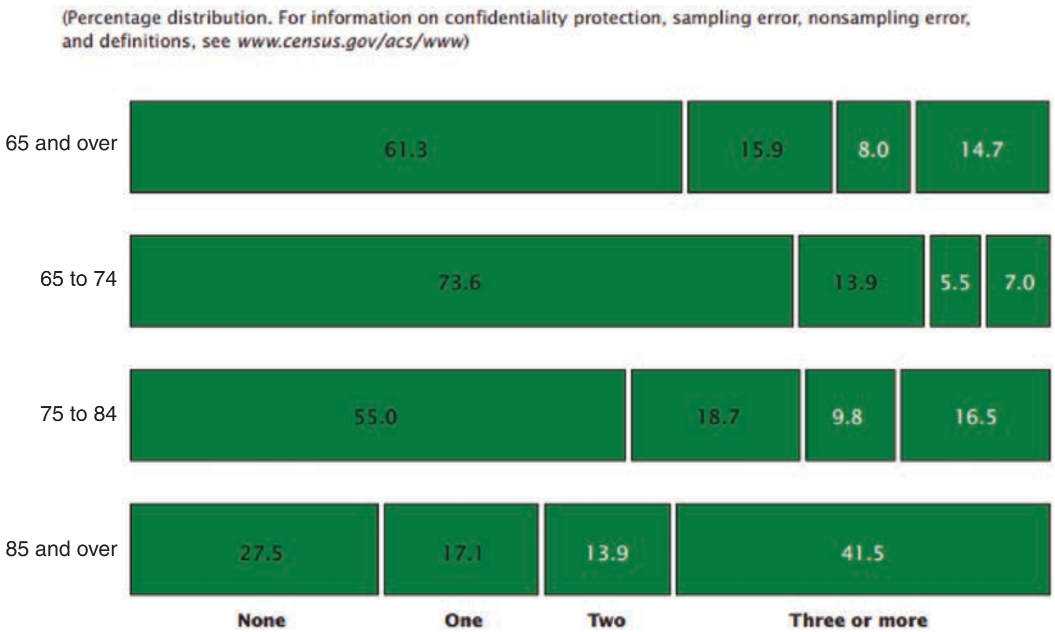
Sources: 1900 to 1940, and 1960 to 1980, U.S. Bureau of the Census,1983; 1950, U.S. Bureau of the Census, 1953; 1990, U.S. Bureau of the Census, 1992; 2000, U.S. Census Bureau, 2001; 2010, U.S. Census Bureau, 2011; 2020 to 2050, U.S. Census Bureau, 2012a; 1900 to 2010, decennial census; 2020 to 2050, *2012 National Population Projections*, Middle series.
Source: U.S. Census Bureau 2014b.

Figure 2-25. Population aged 65 and over: 1900–2050.

often the case with declines in hearing, vision, or cognitive ability. As a result, they will not have sought help to alleviate the effects of the disability such as training in O&M or acquisition of hearing aids or perhaps even a walking cane. After a lifetime of independence, it is also hard to admit that they need help or to accept help. For that reason, service personnel should not use the word "disability" when assisting older travelers as they may be offended by the suggestion that such a term applies to them.

Airports are, in any case, the most challenging environment that many older travelers will ever face. They may hear well enough to communicate in their own homes and neighborhoods, see well enough and have the mental capacity to navigate in familiar surroundings, and have the physical stamina to manage the tasks of daily living. Confronted, however, with a noisy, crowded, large, complex, and confusing airport that they may never have visited before, older travelers may not be able to cope. Most individuals who request wheelchair assistance in the airport never use a wheelchair elsewhere and, if their physical ability allows, would much prefer to use an electric cart or other people mover to transit the terminal.

Many older travelers are "ad hocs," i.e., request wheelchair assistance only once they arrive at the airport, when they suddenly realize that help is needed. As less frequent travelers, older people may not know what services are available or when to request them. The more airport and airline information available online, the better for older travelers and their adult children, who may be doing travel planning for their parents and also know little about accessible



Source: U.S. Census Bureau, American Community Survey, 5-year estimates, 2008–2012.
Source: U.S. Census Bureau 2012.

Figure 2-26. Population 65 and older by number of disabilities and age: 2008–2012.

facilities and service. According to the major U.S. wheelchair service companies, "ad hocs" currently run as high as 40 percent of total requests, making it very hard to plan staffing efficiently. This in turn leads to the high level of service failures and complaints mentioned in Chapter 1.

The earlier sections of this chapter on universal design and the wayfinding needs of customers with vision, hearing, mobility, and cognitive disabilities apply equally to older travelers. There is also a growing literature specifically on aging travelers, most recently *ACRP Synthesis 51: Impacts of Aging Travelers on Airports* (Mein, Kirchhoff, and Fangen 2014). This publication looks in detail at wayfinding for older adults and identifies three additional issues impacting their experience at the airport: fatigue, amenities, and technology and equipment. On the issue of technology and equipment, in particular:

> The study confirmed that there are different generations of "elderly" travelers, and that the youngest group is much more comfortable with technology than its predecessors. This should ease problems with self-service devices. The increasing use of smartphone apps for navigational purposes can be expected to assist future generations of tech-savvy older travelers (Mein, Kirchhoff, and Fangen, 2014, p. 21).

While baby boomers will undoubtedly be more "comfortable with technology" than older adults now in their 70s and 80s, much greater attention needs to be paid to how that technology is designed in order to accommodate the changes typically experienced in vision, hearing, memory, and motor control (Campbell 2015). (See Figure 2-27.)

2.8 Technology Usage

The 2012–2013 Survey of User Needs (SUN) by the Rehabilitation Engineering Research Center (RERC) for Wireless Technologies finds that "as a group, people with disabilities own and use wireless technology at rates similar to the general population" (Morris et al. 2013). The table

Source: https://www.smashingmagazine.com/2015/02/designing-digital-technology-for-the-elderly/ (Campbell 2015)

Figure 2-27. Font size preferred by 75-year-old user versus standard smartphone font.

shown in Figure 2-28, which compares SUN findings with a Pew study on the use of wireless devices by the general public, finds virtually no difference when SUN respondents who own or use only a tablet are added to those using a cellphone or smartphone.

Other key findings from the 2012–2013 SUN are that income plays a role in how sophisticated a person's technology is, with wealthier individuals more likely to own smartphones and tablets. There is also a divide based on age. Younger people have more advanced mobile devices; however, only after age 70 does the use of wireless devices show a steep decline. The type of disability also appears to impact the choice of wireless device, presumably because of differences in how well a particular device accommodates a particular disability. Thus, individuals with low vision are twice as likely to own a tablet as those who are blind (Morris et al. 2013).

Findings from the latest Open Doors Organization Market Study (Open Doors Organization 2015) also belie the myth that people with disabilities are not tech savvy. The 2015 study found that the Internet is, by far, the most common way individuals with disabilities book their trips. Six out of 10 travelers with disabilities booked online in the past 2 years (62 percent), up from 5 out of 10 in 2005 (51 percent). The Internet was also the primary source of information about accessible travel (58 percent).

Six out of 10 travelers with disabilities (58 percent) also use mobile devices to support their needs, most often to access hotel applications (32 percent) or airline and airport websites

Do you own or use a cellphone, smartphone or tablet?	SUN	Pew
Cellphone or smartphone	84%	91%
Cellphone, smartphone or tablet	91%	--
If you own or use a cell phone or tablet, what kind do you use? (Check all that apply)		
Basic cellphone (e.g., Motorola Razr, Pantech Breeze, Nokia 6350)	31%	35%
Smartphone (e.g., iPhone, Android phone, BlackBerry, Windows phone)	54%	56%
Tablet (e.g., iPad, Kindle Fire, Galaxy Tab, Google Nexus)	31%	34%
Other (iPod Touch, Nook, Kindle, netbook, laptop)	6%	--

Note: All respondents with a disability.
Sources: Wireless RERC, *Survey of User Needs*, 2012-2013. *Pew Internet Surveys*, 2006-2013.
Source: Morris et al. 2013

Figure 2-28. Wireless use and device type.

(27 percent). Many also use airline applications or text alerts, mobile boarding passes, ground transportation applications, video chat applications, and airport applications (Open Doors Organization 2015). Federal regulators are now focusing their attention on the accessibility of websites, but it is equally important for businesses to make their applications functional for all users.

2.9 Appropriate Language

Earlier sections of this chapter have modeled the terms and language currently considered appropriate and respectful to individuals with disabilities as well as older adults. Both groups are sensitive to the words used to describe them on websites, applications, or signage, as well as during interactions at the airport. This topic not only forms an important part of disability awareness training for front-line staff, but also is important for airport web developers, the individuals creating web and application content, and the public relations department writing press releases to announce the airport's latest advances in accessibility.

Person-first language is used throughout this guidebook, e.g., "a man who is blind" rather than "a blind man." By acknowledging the person first, one is recognizing that this individual is more than just their disability. One should also avoid referring to groups of people by their condition or disability, e.g., "the blind" or "the developmentally disabled." The word "handicapped" is particularly offensive to many individuals with disabilities (see Figure 2-29). Instead use "accessible" or "disability." Although government regulations use the word "impaired," this is considered pejorative by many in the disability community, especially those with hearing loss who use the term "hard of hearing" rather than "hearing impaired." When referring to older or aging adults, words that may offend include "seniors" and "elderly" or "the elderly."

While some airports and airlines use the term "special needs" for the section of their websites that provides information for travelers with disabilities, "accessibility" (used by Hartsfield-Jackson Atlanta International Airport, Boston Logan International Airport, Minneapolis-St. Paul International Airport, San Francisco International Airport, and Vancouver International Airport) is a better choice. In the United States, "special" is associated with developmental and learning disabilities because of the widespread use of the euphemistic term "special education" in our school systems. In addition, people with disabilities would prefer to not be considered "special," but just part of the community like everyone else.

Source: ACRP Project 07-13 Research Team

Figure 2-29. "Handicap" sign from an airport restroom.

DO SAY	DON'T SAY
✓ Person with/who has a disability	✘ The disabled, handicapped, physically challenged
✓ Non-disabled, able-bodied	✘ Normal, healthy
✓ Uses a wheelchair	✘ Wheelchair bound, confined to a wheelchair
✓ Birth injury, congenital disability	✘ Birth defect, deformity
✓ Person with a physical disability	✘ Crippled, lame, invalid
✓ Has a speech disability	✘ Has a speech defect, dumb
✓ Person who is blind, has low vision	✘ The blind, blind people, vision impaired
✓ Person who is deaf, hard of hearing	✘ The deaf, deaf people, deaf and dumb, hearing impaired
✓ Person with an intellectual, cognitive, or developmental disability	✘ Stupid, retard, retarded, slow, subnormal, mentally challenged
✓ Person with epilepsy, seizure disability	✘ Epileptic, has fits, spastic
✓ Person of short stature, little person, dwarf	✘ Midget

Source: Open Doors Organization 2014

Figure 2-30. Appropriate language table from Open Doors Organization.

Figure 2-30 is a list of terms to use and to avoid that was developed by Open Doors Organization with input from the wider disability community. Over time, the terms that are considered appropriate change, so this list is updated regularly.

2.10 Getting Started

The user needs explored in this chapter can adequately be addressed only if airports take the initiatives needed to make universal access a priority. In addition to the information in the Wayfinding Accessibility Audit Checklist, there are a number of other ways an airport can begin enhancing their services and facilities:

- **Conduct regular meetings with stakeholders.** Because the responsibility for accommodating customers with disabilities is shared among many different entities—the airport, airlines, airline service companies, ground transport providers, concessionaires, and security—the only way to address any gaps in services or facilities is to have regular face-to-face discussions, convened and led by the airport's accessibility coordinator. The input of the many entities responsible for accommodating customers with disabilities is also critical when planning new facilities, major renovations and investments in IT.

- **Create a disability advisory committee.** A growing number of airports invite community members with disabilities to meet with airport stakeholders to address accessibility of facilities and services (e.g., Hartsfield-Jackson Atlanta International Airport, Los Angeles International Airport, Minneapolis-St. Paul International Airport and San Francisco International Airport). Members can come from local chapters of national organizations such as Paralyzed Veterans of America, The Arc, American Foundation for the Blind, The MS Foundation, or from a local Center for Independent Living. Airports may also want to include professional experts such as O&M specialists.
- **Conduct surveys and crowdsourcing.** Gathering feedback and information directly from aging travelers and customers with disabilities is key to getting it right. Surveys, crowdsourcing, focus groups, complaint boxes, social media, and even mystery shopping are all methods currently used by airports to get feedback from these customers. If you are already conducting regular surveys, it's easy to add a few additional questions related to accessibility.
- **Attend educational conferences and expos.** Most mainstream aviation conferences now include a panel or speaker on issues related to accessibility, e.g., Passenger Terminal Expo and Future Travel Experience (FTE). The FAA Annual National Civil Rights Training Conference for Airports provides a good opportunity to network with other airport executives specializing in accessibility and catch up on new and upcoming regulatory requirements. Also of note is the Universal Access in Airports event, held biennially by Open Doors Organization since 2006, which brings together aviation stakeholders to learn about and discuss the latest technologies, best practices, customer service initiatives, and regulatory changes.
- **Train front-line employees and executives.** Education is key to effecting a positive change, both for front-line staff assisting customers with disabilities on a daily basis and executives setting policies to enhance accessibility and customer service at the airport. Airports Council International (ACI), in partnership with Open Doors Organization, is a good external source for training. An introductory disability awareness course is available at its eLearning Center. In 2016, ACI and Open Doors Organization also began offering classroom training for airport access coordinators and other executives. It is also vital to offer disability awareness training at the airport itself for everyone working with the public. For example, San Francisco International Airport and The Port Authority of New York and New Jersey develop and teach the classes themselves, while airports like Philadelphia International Airport put out a contract for bid each year. In either case, it is always important to include individuals with disabilities in order to break down attitudinal barriers.
- **Hire people with disabilities.** A good way to improve expertise in the field of accessibility is to hire individuals who themselves are living with disability. Unemployment rates in the community greatly exceed the national average due to those lingering attitudinal barriers. Many well-qualified individuals are out there waiting for an opportunity to make a difference and help *create a difference that creates change.* Hiring someone with a wheelchair, or a person who is blind or deaf, sends a positive message both within the airport and to the broader public.

CHAPTER 3

Wayfinding Strategies via Visual, Verbal, and Virtual Communication

3.1 Introduction

Chapter 1 is an introduction on what wayfinding is: *communicating information that helps customers find their way* and why it is important. Chapter 2 helps define the target audience and the needs of aging travelers and persons with disabilities based on the factors and challenges that affect their customer experience. Chapter 3 builds on that information by identifying the three "Vs" of communication (visual, verbal, and virtual) and how they apply to the target audience.

The following chapters outline how airports and airlines can utilize wayfinding strategies in each journey segment. Applying these vital strategies to each journey segment will help airports identify "information gaps" that can result when information is presented in only one mode. The diverse sensory and cognitive abilities of aging travelers and persons with disabilities require the provision of essential information in a variety of modes (e.g., written, symbolic, tactile, and verbal) to ensure effective communication. This benefits foreign travelers and others as well.

The backbone of the three Vs of communication is *consistency*. For an airport, this can be challenging because the responsibilities for the various forms of communication often reside in different groups. For instance, volunteers providing verbal communication at information booths may report to customer service, while full-time employees who staff ground transportation information counters may be contracted employees. Even though these key touch points are staffed and managed by different groups, the customer sees no distinction and expects a consistent level of service (LOS). Keeping a master composite-type list of terminology and symbology to share both internally and externally will help ensure *consistency* in all forms of communication with the airport customer. Disability awareness training that includes instruction in appropriate language and communication also helps create a consistent LOS.

What are the benefits of wayfinding, and why is communication so important? A survey of 1,000 customers conducted under ACRP Project 03-35 (published as *ACRP Research Report 161*) revealed that ease of wayfinding inside an airport ranked No. 1 out of the top 10 features measured among all passengers surveyed (see Figure 3-1). Alternatively, when the same respondents were asked to describe the best part of their airport experience, ease of wayfinding ranked last. The survey shows that while wayfinding is critical to the customer experience, in reality it has not received the attention it deserves and thus presents a major opportunity for improvement in many airports (Landrum & Brown, Inc. 2016).

As part of a wayfinding study conducted by Gresham, Smith and Partners in 2013, 1,782 customers were surveyed at a large-hub airport. The study showed that 10 percent of customers will ask for verbal assistance. At an airport with an annual volume of 10 million passengers, 10 percent equates to 1 million passengers looking for someone to assist them with verbal communication. The *ACRP Research Report 161* survey showed that "helpfulness of staff" ranked a very close

U.S. GATEWAY AIRPORTS

	CUSTOMER SATISFACTION FACTORS	1	2	3	4	5	6	7	8	Grand Total
VISUAL	Ease of finding their way inside airport	84%	81%	82%	79%	86%	81%	72%	89%	82%
VERBAL	Helpful staff	84%	80%	88%	83%	82%	82%	72%	80%	81%
VIRTUAL	Flight information screens	82%	77%	77%	75%	84%	81%	76%	82%	79%
	Cleanliness	77%	78%	82%	73%	81%	76%	70%	85%	78%
	Short lines at customs	70%	81%	78%	71%	67%	62%	68%	76%	72%
	Free Wi-Fi	62%	67%	72%	73%	70%	68%	76%	67%	69%
	Universal symbols	63%	55%	71%	69%	64%	44%	48%	59%	57%
	Short walking distance	36%	44%	50%	40%	49%	25%	38%	48%	41%
	Shopping & restaurants	31%	41%	49%	28%	40%	22%	32%	40%	36%

Source: Landrum & Brown, Inc. 2016

Figure 3-1. Survey results of top 10 factors that affect the customer experience (in alphabetical order: Atlanta, Boston, Chicago, Dallas Fort Worth, John F. Kennedy, Los Angeles, Miami and San Francisco).

second to "ease of wayfinding." These examples reinforce how important verbal communication remains, even in today's technology-driven world. The other point worth noting from the *ACRP Research Report 161* survey is that flight information screens were ranked third in importance to the customer experience (Landrum & Brown, Inc. 2016). The top three factors from the *ACRP Research Report 161* survey—ease of wayfinding, helpfulness of staff, and flight information screens—directly reflect the importance of the three Vs of communication to airport customers.

Figure 3-1 shows the results from eight U.S. gateway airports, with percentages that show the level of customer satisfaction for each factor surveyed.

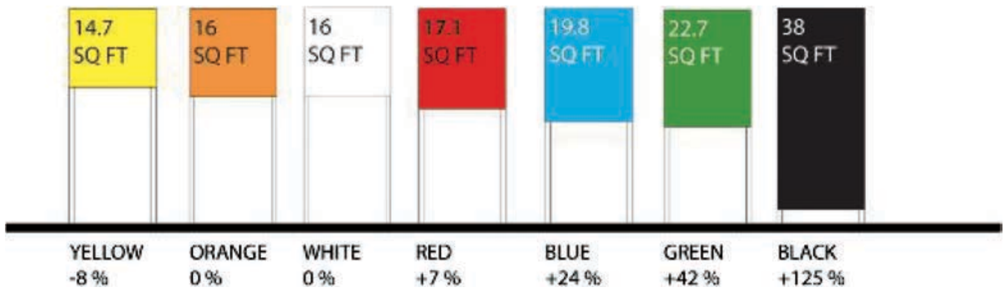
3.2 Visual

Visual wayfinding information, the most basic navigational tool, encompasses all static signage. It is the workhorse of the wayfinding world and does the heavy lifting. But what elements of visual information require particular consideration in relation to meeting the needs of aging travelers and people with disabilities?

Until airports are designed to be 100-percent intuitive, signage will remain the primary visual form of communicating information to passengers. There are two key signage characteristics that need to be reviewed and evaluated in relation to meeting the wayfinding needs of aging travelers and people and with disabilities: design and application. Design characteristics encompass, among other things, the visual appearance and physical construction of signage. Application is how the visual wayfinding system functions. This section includes a brief overview of these two characteristics and why they are important. For more detailed, in-depth information, please reference *ACRP Report 52* (Harding et al. 2011).

3.2.1 Design

Factors that should be considered in the design of signage include conspicuity, color, contrast, illumination, legibility, typography, symbology, arrows, and maps. Each of these factors is discussed below.



Source: *Architectural Signage and Graphics,* Copyright 1979, by John Follis and Dave Hammer Publishing Company.

Figure 3-2. The percentage of area by which a colored sign has to exceed the size of a white sign to be equally conspicuous.

3.2.1.1 Conspicuity

Color conspicuity is how well color stands out from its surroundings. Lighter colors tend to advance toward you, while darker colors tend to recede into the background. The eye also reads some colors more quickly than others; the eye reads yellow and orange the most quickly (see Figure 3-2). This information has functional value in the design of a sign system. An example of conspicuity in practice is the color-coded system used by the Port Authority of New York & New Jersey at John F. Kennedy International Airport shown in Figure 3-3.

3.2.1.2 Color

As a wayfinding tool, color can be effective. See Figure 3-4, where black on yellow is used for the most important information, i.e., time-sensitive elements such as check-in, ticketing, security, and gates. White on green is used for ground transportation, and yellow on black is used for amenities like restrooms. However, while color can be helpful in reinforcing wayfinding information, it should not be relied on to serve as the primary wayfinding strategy. A consideration for color-coded wayfinding is that as many as 8 percent of men and 0.5 percent of women with Northern European ancestry have the common form of red-green color blindness (National Institutes of Health [NIH]).

3.2.1.3 Contrast

The appendix of the original ADA Standards required a minimum contrast of 70 percent between signage background and the message. While this requirement is no longer in the ADA Standards, using a color combination that achieves a high contrast (light on dark or dark on light) is a best practice. Airport conditions can vary from area to area, but in principle, signage needs to be both conspicuous and legible. Signage with excellent contrast can help a person with low vision and aging travelers (who make up a large percentage of vacationing travelers).

Source: Airport Sign Standard Manual, The Port Authority of New York & New Jersey

Figure 3-3. Color-coded signing system at John F. Kennedy International Airport.

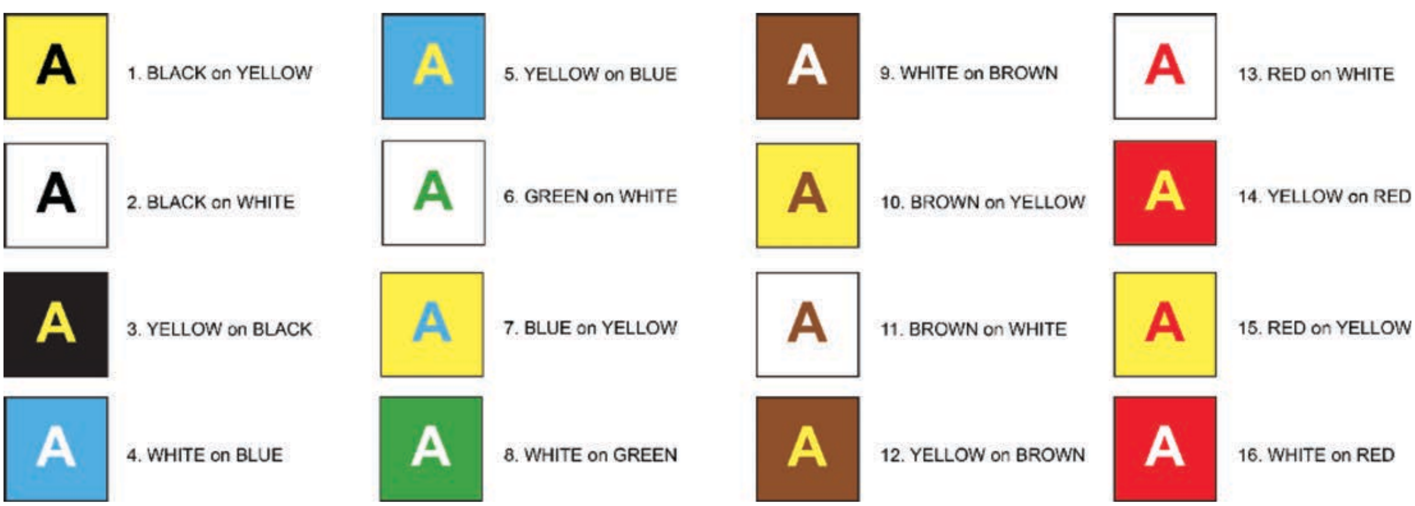
Source: Airport Sign Standard Manual, The Port Authority of New York & New Jersey

Figure 3-4. Color-coded sign at John F. Kennedy International Airport.

Research shows that certain color background and letter combinations (see Figure 3-5) provide higher contrast than others. It is important to be aware of these combinations when planning and designing a wayfinding system that will meet the needs of aging travelers and persons with disabilities. Figure 3-6 shows examples of airports with high-contrast color combinations.

3.2.1.4 Illumination

Illumination is a counterpart to conspicuity, contrast, and legibility design elements. There are three basic options when considering how to light a signage system. The first option is non-illuminated and uses the ambient light of the airport building (see Figure 3-7). This approach keeps the overall sign system simple, cost-effective, and easy to maintain, but requires effective planning on behalf of the architectural and lighting design team. A good light level with a minimum of 100 lux is recommended where non-illuminated signs are located. A good rule of thumb



Source: Karen E. Claus; R. James Claus; Visual communication through signage; Signs of the Times Publishing Company, ©1974

Figure 3-5. Best color combinations for legibility.

Source: Moniteurs GmbH Communication Design

Figure 3-6. Examples of high-contrast color combinations for airport signage.

is that if a person with normal vision can't read a newspaper next to the sign, then a person with low vision cannot read the sign.

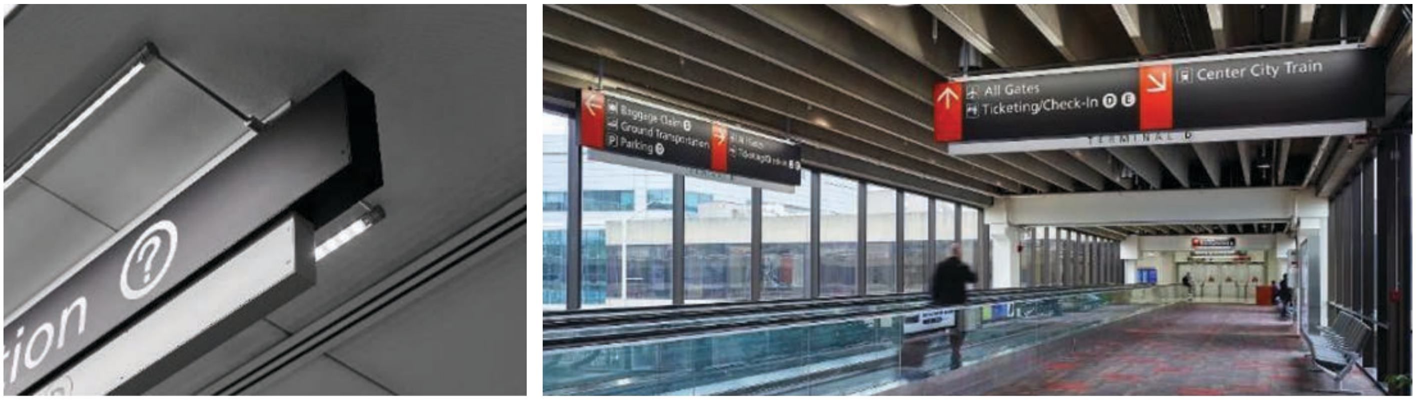
The second option is external illumination. While not commonly used, it does share the same benefits of a non-illuminated sign and is simple, economical, and easy to maintain. The advances in light-emitting diode (LED) lighting provide slim-line profiles that are both aesthetically pleasing and energy efficient (see image on the left in Figure 3-8). The image on the right in Figure 3-8 is a good example of how special consideration is needed to ensure that signs can be read equally well against day-lit windows and interior architecture, which can create legibility issues for customers with vision problems.

The third option is internal illumination. Compared to the previous two options, internal illumination typically generates a higher level of conspicuity and improves legibility for customers who have lost visual acuity due to age and/or other problems associated with loss of light (see Figures 3-9, 3-10 and 3-11). The trade-off is that this option typically costs more to install and maintain.

One note of concern with regard to any of the options listed above is sign surface glare. Even if all the design elements are good, surface glare may cause people with normal sight to have problems

Source: ACRP Project 07-13 Research Team

Figure 3-7. Non-illuminated sign at San Francisco International Airport.



Source: ACRP Project 07-13 Research Team

Figure 3-8. Externally illuminated signs at Philadelphia International Airport.

Source: ACRP Project 07-13 Research Team

Figure 3-9. Internally illuminated signs with a translucent background at Heathrow Airport.

Source: ACRP Project 07-13 Research Team

Figure 3-10. Internally illuminated signs with an opaque background at Changi Airport.

Source: *Typography and the Aging Eye: Typeface Legibility for Older Viewers with Vision Problems* by Paul Nini (01.23.06).

Figure 3-11. Vision simulated for persons aged 20 (**image on far left*****), 60 (*****image in the middle*****), and 75 (*****image on far right*****).***

reading the signs, and those with low vision will find it even more difficult to find and read the signs. Surface glare also applies to digital signage like FIDSs and can impact the legibility and visibility for short people and persons in wheelchairs; this needs to be considered during the planning process.

Another issue to be considered with regard to illumination is that human vision deteriorates with age, with older adults often experiencing significant vision problems in low-light environments. The images in Figure 3-11 show how much aging changes the relative transmission of light through the optic media for viewers of ages 20, 60 and 75. As people age, muscles that control the pupil size and reaction to light lose strength. This causes the pupil to become smaller and less responsive to changes in ambient lighting. Because of these changes, people in their 60s and older can need three times more ambient light for comfortable reading than those in their 20s.

Illumination can also apply to overall physical space. Older adults are more susceptible to being dazzled by bright sunlight and glare when emerging from dimly lit to brightly lit spaces. Safety-related concerns include pedestrian crossings that should have higher lighting levels. Navigation and circulation concerns include corridors and hallways that are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.

In summary, proper illumination of signage and wayfinding, as well as the overall space, is a vital part of a well-planned wayfinding system and airport environment.

3.2.1.5 Legibility

The next key design element is legibility. The simple default is to think about how big the text height is on the sign messages. However, it is important to first evaluate the context. Sign placement, viewing distance, typography, and visual acuity all factor into determining the correct letter height. While architectural space constraints can place limitations on sign size, which in turn impacts the letter height, a best practice is using 20/40 vision as a basis of design with regard to aging travelers and people with disabilities as shown in Figure 3-12. (Note: A minimum of 20/40 vision is required to obtain a driver's license.)

3.2.1.6 Typography

As noted in the previous section, large, easy-to-read lettering is a basic design element, but research has shown that simply increasing font size alone is not enough to improve legibility of sign content by older persons and persons with impaired vision. Other typographical attributes are also important. Using proportional fonts in lieu of fixed-width fonts can improve legibility. A font's x-height, which affects the lowercase letters, has a strong impact on legibility. Another attribute that enhances legibility is the letter stroke width where the counters (the gaps and holes in letters) remain clearly distinguishable. Wider letter spacing enhances legibility but requires more sign space (Arditi et al. 1995).

DISTANCE (Feet)	MINIMUM RESOLVABLE LETTER SIZE (INCHES)		
VISUAL ACUITY:	20/20	20/40	20/60
100	1.8	3.5	5.2
200	3.5	7.0	10.5
400	7.0	14.0	20.9
600	10.5	21.0	31.4
800	14.0	28.0	41.9
1000	17.5	35.0	52.4
1320	23.1	46.1	69.1

Source: *The Sign Users Guide*, Copyright 1988, by James Claus and Karen E. Claus and Sign of the Times Publishing Company.

Figure 3-12. Snellen Visual Acuity Chart.

Fonts that are proven to have high legibility factors are also an important consideration. Generally speaking, for large, primary, directional signs sans-serif fonts should be used for maximum legibility and fonts with serifs should be avoided. (See Figure 3-13.)

Word spacing and letter spacing are other design factors that impact legibility. Spacing is a critical component of legibility. The following are the four parts to spacing:

- Letter spacing, otherwise known as kerning
- Word spacing within a message
- Line spacing between messages
- Relational spacing within a sign grid

Sign real estate in airports is typically at a premium, so it can be tempting to condense font and/or spacing. Condensing either will have adverse effects on legibility. For roadway signs, there are kerning tables that are standardized by the FHWA. However, there is no such standard for pedestrian-based sign design. See Figure 3-14 as a letter-spacing guide for directional signage inside an airport terminal.

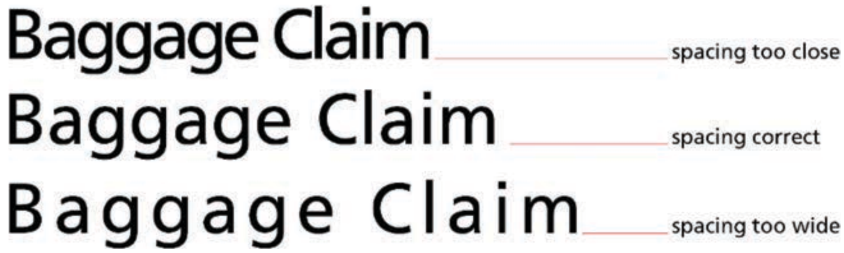
The ADA Standards establish criteria for ratios of (1) body width to height and (2) stroke width to height in typefaces in order to ensure uniform, legible type in signage systems. While these standards provide a good baseline, there are additional factors to consider in regard to typeface selection for the aging eye. Figure 3-15 shows the sans-serif font, Frutiger Bold, as it would be seen by a viewer with no vision problem and as it would be seen by a viewer experiencing a loss of light and focus. Despite loss of resolution, the sign remains legible.

The following characteristics are considered valuable for fonts viewed by older adults:

- Sans-serif
- Consistent stroke widths

Source: ACRP Project 07-13 Research Team

Figure 3-13. Comparison between sans-serif font and a font with serifs.



Source: ACRP Project 07-13 Research Team

Figure 3-14. Comparative letter-spacing guide.

- Open counter forms
- Pronounced ascenders and descenders
- Wider horizontal proportions
- More distinct forms for each character (such as tails on the lowercase letters "t" and "j")
- Extended horizontal strokes for certain letterforms (such as the arm of the lowercase letter "r" or the crossbar of the lowercase letter "t")

3.2.1.7 Symbols

Symbols can serve as a visual shorthand that is helpful for travelers with cognitive disabilities. However, there is no universal symbol standard for aviation. Therefore, the key to using symbols effectively is promoting comprehension and legibility.

While there is little documented research on symbol comprehension and legibility, research from *Traffic Control Devices Pooled Fund Study* (Katz et al. 2008) helped identify situations that were, or were not, appropriate for using symbols. Generally, participants in this study thought the use of symbols was a good idea since it can be faster to "read" symbols and thus they take less time to convey a message or direction. However, participants expressed a concern that symbols can also be confusing and misleading. Unless the symbol conveys a clear message, participants considered text to be a better choice. Comments from participants during this discussion included the following:

- It's complicated if there are too many words.
- Symbols are sometimes more confusing than words.

Source: Typography and the Aging Eye: Typeface Legibility for Older Viewers with Vision Problems by Paul Nini (01.23.06).

***Figure 3-15. Frutiger Bold font as seen by person with no vision problem* (top image) *and person experiencing a loss of light and focus* (bottom image).**

AIGA AMS LHR MUC PEK

Source: AIGA and ACRP Project 07-13 Research Team
Notes: AIGA = American Institute of Graphic Arts; AMS = Amsterdam Airport Schiphol; LHR = Heathrow Airport; MUC = Munich Airport; PEK = Beijing Capital International Airport.

Figure 3-16. Exit symbol comparison.

- Sometimes symbols are wrong.
- Symbols are quicker to understand if you're familiar with them.
- Symbols are universal.
- Symbols are good if they are tied to an international standard.
- Symbols are easier and faster to read as opposed to words.
- Symbols are great if they are obvious.
- Combine words and symbols on one sign.

It is a best practice to consistently use both symbols and words on a sign. However, certain symbols are essentially universally comprehended; e.g., the restroom symbol. By comparison, symbols that are poorly comprehended should be carefully evaluated before using. Figure 3-16 shows the inconsistency in "EXIT" symbols used at various airports.

All newly built or renovated multiuse restrooms in U.S. airports are required to be accessible. Furthermore, per ADA Standards, once all the restrooms in a facility are accessible, they do not need to display the symbol of accessibility. However, not everyone traveling through a U.S.-based airport is aware of this requirement and instead assumes that none of the restrooms have wheelchair access. Therefore, a recommended best practice is to include the symbol of accessibility as part of all restroom identification, as shown in Figure 3-17.

Source: Courtesy of Gresham, Smith and Partners

Figure 3-17. Restroom identification signs with the symbol of accessibility along with high-contrast colors and legible fonts at Philadelphia International Airport.

Inside of a restroom, it is not a requirement to identify the stalls that are accessible. However, given the various stall sizes, designs, and so forth, it is not always easy to discern which stalls are ambulatory and wheelchair accessible. Combinations of low-vision, cognitive, and mobility issues make the identification of which stalls are accessible a quick and easy recommendation to implement (see Figure 3-18).

3.2.1.8 Arrows

Arrows are powerful design elements that require careful planning and consistent application because if they are used incorrectly, they can take travelers out of their way and waste time and energy. In particular, it is important to evaluate when using plain language such as "straight ahead" might be more helpful than an arrow pointing up or down, such as when there is a risk of the arrow being confused with "upstairs" or "downstairs." Also, consider using the words "upstairs" or "downstairs" when vertical transitions are either non-intuitive or complicated vertical transition wayfinding scenarios.

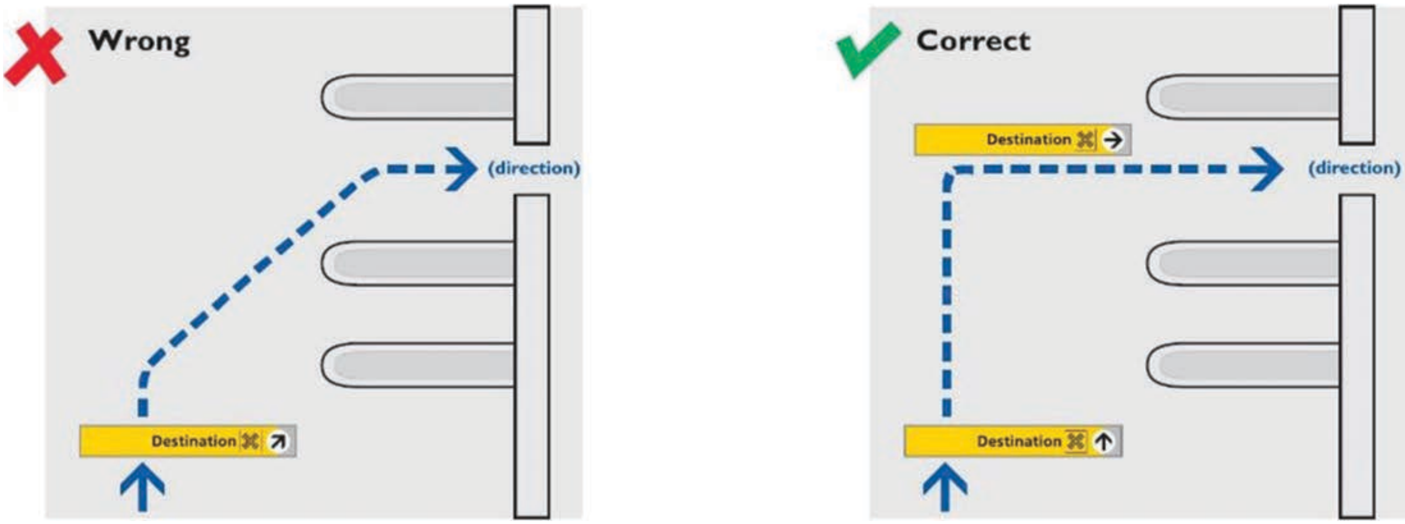
Avoid using diagonal arrows when possible, and place directional signs so either a simple "up" arrow or "left" or "right" arrow can be used to clearly communicate the proper decision. For example, do not combine two pieces of wayfinding information into one sign and use a diagonal arrow to try and communicate to a customer to continue forward for a distance and then turn. These scenarios require two signs: the first with a "straight ahead" arrow, and the second sign with a 90-degree "right" or "left" arrow as shown in Figure 3-19 and Figure 3-20. The result of proper planning and placement is clear, concise wayfinding that avoids using diagonal arrows that can create unnecessary confusion.

Similar situations can occur at transition points when a single directional sign with a diagonal arrow tries to guide customers to a destination that is actually beyond the transition point. The correct solution is to use two signs; the first sign uses a simple, straight arrow and the second sign uses a right or left arrow (Figure 3-20).

The other consideration when exploring the use of angled arrows is when the direction involves a change in level. Bundling the angled arrow along with the symbol for escalator, elevator, or stairs will visually help communicate the level change to customers (see Figure 3-21). This type of visual communication is especially important when the customer encounters a

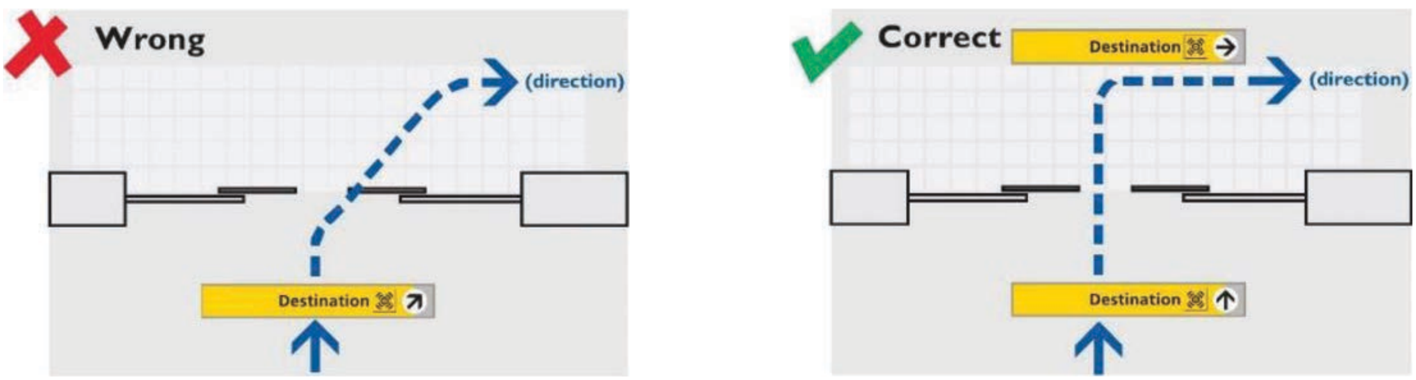
Source: ACRP Project 07-13 Research Team

Figure 3-18. Accessible stall signage.



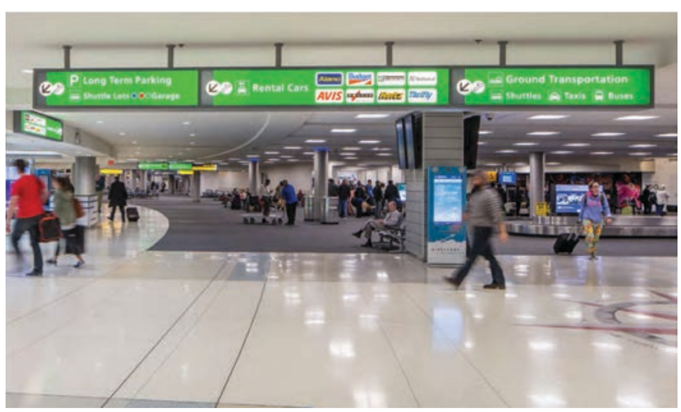
Source: The Port Authority of NY & NJ Signing and Wayfinding Airport Standards Manual.

Figure 3-19. Improper and proper placement of signs and use of arrows to guide customers to continue forward for a distance and then turn.



Source: The Port Authority of NY & NJ Signing and Wayfinding Airport Standards Manual.

Figure 3-20. Improper and proper placement of signs and use of arrows guiding customers to a destination beyond a transition point.



Source: AECOM

Figure 3-21. Angled arrows bundled with escalator symbol at Port Columbus International Airport.

non-intuitive scenario that may be contrary to expectations, e.g., having to navigate under or over a road to find services.

3.2.1.9 Maps

Well-designed maps, whether static, dynamic, or interactive, are an effective means of communicating wayfinding orientation and navigational content. Reference Section 3.4.1.3 for a detailed discussion of mapping strategies and best practices.

3.2.2 Application

Elements of applying signage include continuity, connectivity, and consistency; content and terminology; placement; intuitive architectural design; and landmarks. Each of these elements is discussed below.

3.2.2.1 Continuity, Connectivity, and Consistency

A primary goal of this guidebook is to help airports understand the need for and importance of developing a wayfinding strategy that supports a holistic solution for communicating information to aging travelers and persons with disabilities. The application of key sign characteristics begins with a review of the fundamental wayfinding and design principle concepts through the three Cs of wayfinding:

- **Continuity**—Is your wayfinding system the one common thread that provides continuity in a diverse and complex environment as your customers navigate from one place to another?
- **Connectivity**—Does your wayfinding system deliver the right message at the right location at the right time?
- **Consistency**—If there is one word to describe the mainstay of an airport wayfinding system, it is *consistency*. From the moment a traveler enters the airport until they board their plane, information must be presented in a consistent manner. Does your wayfinding system communicate information consistently throughout the customer's journey? *Consistency* becomes visible to your customers through the following design elements:
  - Content and terminology
  - Visibility and legibility
  - Typography and symbology
  - Format and color
  - Placement

Consistent presentation of information extends to other forms of communication like maps, directories, and websites. Information or messaging itself must be consistent across the various means of communication so the public does not become confused by the use of different terms for the same thing. The mainstay of *consistency* ties directly back to the primary objective, which is to achieve uniform application of the airport's wayfinding design standards.

3.2.2.2 Content and Terminology

The key concept for wayfinding content is to *simplify*. There is limited sign real estate, so it is imperative to use plain and simple language with as few words as possible. While this is especially important for persons with cognitive disabilities or literacy issues, keeping it simple will benefit all customers. It sounds obvious that signage should be legible, uncluttered, and easy to follow, but the complexity of spaces like an airport inevitably places pressure on a wayfinding system to include more signs with more and more information. Having too many signs with too much information will ultimately undermine the success and integrity of the signage, with adverse effects on customers. For example, over-signing can negatively affect comprehension for people with cognitive issues and impact legibility for persons who struggle with visual acuity.

When it comes to choosing words for the airport's wayfinding system, keep them as simple as possible and use plain language, not airline/airport jargon. The other essential consideration is *consistency;* in other words, do not use different terms for the same thing. Consistency in terminology must apply to all forms of communication.

Whether the wayfinding challenge is long distances, multiple decision points, non-intuitive circulation, or a combination thereof, continuity is critical if airports are to avoid creating gaps in information. For example, there will be multiple signs leading the customer from the origination to the destination. Once the customer begins following the "trail of breadcrumbs," the message for that destination needs to be present all along their route. Aging travelers and persons with cognitive disabilities, especially, need to be able to trust that the information they're being given is correct. If it disappears, doubt creeps in and they will begin to wonder if they made a mistake or missed something, raising levels of anxiety and stress.

The next key concept is to establish a clear message hierarchy for wayfinding content, with the goal of avoiding information overload. For example, prioritize what information to list at a given decision point in the route. In other words, what is the minimum amount of information necessary to move a passenger to the next decision point? A common wayfinding myth is that the best way to solve a wayfinding problem is to list every possible destination. In reality, this is rarely the best solution. Establishing primary messaging versus secondary messaging will help keep it simple and help enhance the wayfinding experience for aging travelers and persons with disabilities. While the lists below will vary from one airport to another, they are helpful in understanding the concept.

Typical primary messages in a terminal are related to

- Ticketing/check-in
- Baggage claim
- Gates
- Ground transportation

Typical secondary messages in a terminal are related to

- Concessions
- Elevators
- Information (desks or directories)
- Parking
- Restrooms

The content that many airports overlook is providing guidance to areas where aging travelers and persons with disabilities can find assistance.

3.2.2.3 Placement

Proper placement of information is directly related to connectivity—delivering the right message at the right location at the right time. The importance of placement has been noted in Section 3.2.1.8, which illustrates how poor planning can result in wayfinding disconnects by inadvertently encouraging customers to take shortcuts and not providing the right information at the right location. Additional placement considerations include posting information at eye level along the customer journey—at entry points, ticket counters, flight information displays, and directories, and so forth. Communicating at eye level is important to customers with poor visual acuity because they can walk up as closely as they need to read the information (see Figure 3-22)

Source: ACRP Project 07-13 Research Team

Figure 3-22. Information placed at eye level.

or even scan it with a mobile device (see Section 3.3.2, Figure 3-29). It is also important to those seated in mobility devices who may actually miss overhead signage altogether and not just have an uncomfortable experience trying to read it.

Placement also comes into play in the form of planned adjacencies at key decision nodes for information sources: virtual, e.g., FIDS; verbal, e.g., staff positions and information desks; and visual, e.g., airport directories, and so forth (see Section 4.1, P-PD.07).

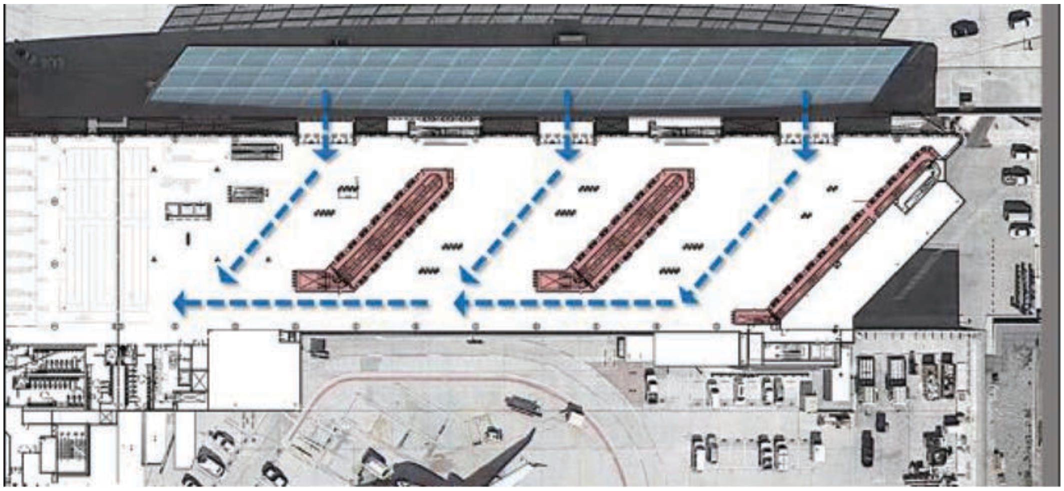
On an even larger scale, placement in the form of proximity of vertical transitions also has a significant impact on aging travelers and persons with disabilities. Vertical circulation devices such as stairs, escalators, and elevators should be in close proximity and in easy view from entries and major nodes (see Section 4.1, P-PD.16).

Lack of coordination and planning can result in the placement of obstacles that block the direct line of sight, which is an essential part of a customer finding their way through complex spaces such as an airport terminal. As shown in Section 5.1.2, D-AP.26, hiding essential vertical access like elevators places yet another wayfinding burden on customers, especially aging travelers and persons with disabilities who rely on elevators to change levels. *ACRP Report 67: Airport Passenger Conveyance Systems Planning Guidebook* notes how customers risk injury when they cannot find the elevators they need and resort to trying to use an escalator instead. The report also notes instances where the signage for the elevator does not indicate the same destination as the escalator, resulting in confusion among customers. Additionally, the report validates the importance of labeling the floors/stops inside the elevator to match the signage and/or clearly identify the passenger destination rather than just the floor numbers (TransSolutions, Clemson University, and Kimley-Horn and Associates, Inc. 2012).

Lines of sight that are blocked by retail and concessions encroaching into passenger circulation space and by advertising kiosks added to boost revenue are examples of how good planning can be undermined by poor placement of non-wayfinding elements.

3.2.2.4 Intuitive Architectural Design

The success of visual wayfinding is also tied strongly to intuitive architecture, which is an extension of placement as it relates to how the overall airport space is designed and the role of connectivity. Research has consistently shown that good wayfinding begins with architectural design



Source: Gresham, Smith and Partners

Figure 3-23. Blue arrows track departing passenger flow from curbside through angled ticket counters toward security.

(O'Neill 1991). An integral part of a holistic wayfinding approach is the idea of connectivity. In the new Maynard H. Jackson Jr. International Terminal in Atlanta, a facility of 1.2 million square feet, connectivity was achieved by considering intuitive wayfinding early in the architectural design and layout of the building. For example, the angled ticket counters, as shown in Figure 3-23 and Figure 3-24, push passengers *through* ticketing to the security checkpoint. This movement is reinforced by the floor pattern and ceiling movement, and is part of an intuitive wayfinding plan throughout the terminal.

Travelers also see airplanes parked on the tarmac through floor-to-ceiling windows in the ticketing lobby (Figure 3-25). This clear line of sight for customers toward the departure gates is good psychological reassurance they are headed in the right direction. The overall result simplifies this journey segment because very little directional signage is needed in Atlanta's new international ticket hall.

Source: © Chris Cunningham, Courtesy of Gresham, Smith and Partners

Figure 3-24. Visual wayfinding via architecture: diagonally situated ticket counters, floor patterns, and lighting provide intuitive wayfinding cues.

Source: ACRP Project 07-13 Research Team

Figure 3-25. Expansive views of the tarmac can inspire wayfinding confidence in travelers.

3.2.2.5 Landmarks

Navigation by landmarks is as old as humankind itself, predating the written word. In this report, a landmark is defined as a point of reference that helps one orient themselves in a familiar or unfamiliar environment. Multiple research studies show how visual landmarks can be very helpful for persons with cognitive issues, preventing unnecessary assistance and/or an over-dependence on technology. Landmarks with auditory features can help orient persons who are blind or have low vision.

Research also indicates landmarks can be more helpful than using cardinal descriptors or left/right instructions (Gerkensmeyer and Wenig 2013). Effective wayfinding landmarks in an airport environment have several traits in common:

- They are memorable
- They have a distinct shape
- They are easily described and understood in simple words
- They can be stylized or simplified for easy recognition on an airport map/directory

Airports should plan and locate landmarks at focal points and intersections so they are detectable from as many positions as possible without interrupting the path of travel. Also, as part of the planning effort, airports should develop a landmark system to make different parts of the airport as noticeable and memorable as possible. When and where applicable, set up key landmarks that are multisensory by including tactile, sound, and visual identifiers.

An effective landmark that illustrates these principles and characteristics is a fountain. It has a visual element that is memorable, easily described, and understood in simple words and also has an auditory component that is easily recognizable and therefore memorable. The combination of the movement of water and/or the fountain configuration creates a unique shape. Tactile identification of the landmark can be communicated through various means, such as a change in floor surface surrounding the landmark.

Sensory perception evokes emotion in a memorable way. The sight and sound of the animated water feature at Detroit Metropolitan Airport's McNamara Terminal is an excellent example of a wayfinding landmark (see Figure 3-26).

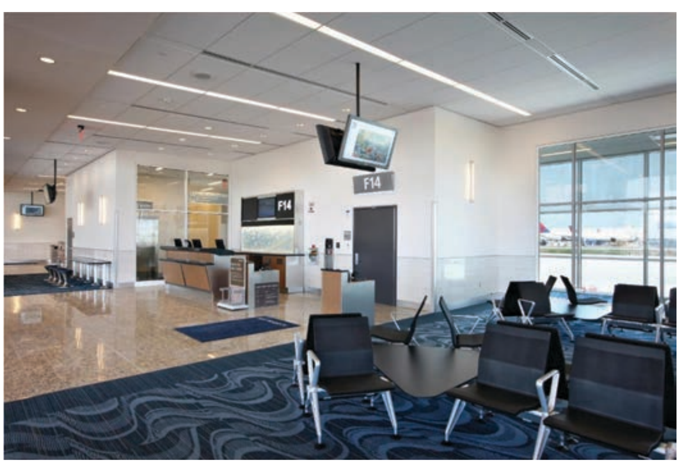
"Landmark" is also a technical term in O&M. One definition of landmark is "objects or a configuration of objects that are readily identifiable (visually, auditorially or tactilely) and unique to an area" (Jacobson, 1993). Fountains, as shown in Figure 3-26, are ideal across travel modalities.

Source: Photo courtesy of Vito Palmisano.

Figure 3-26. Water feature at Detroit Metropolitan Airport's McNamara Terminal.

The rumble of an escalator bank, for example, in a certain setting might be a landmark as might the carpeting along concourse edges, as shown in Figure 3-27. What constitutes an easily accessible tactile landmark for cane travelers, however, may be "invisible" to guide dog travelers; this includes tactile guide strips. The key point is that all landmarks do not work equally well for all types of disabilities and should be evaluated accordingly.

Landmarks can also be useful on a more granular level. Basic elements can help a customer with disabilities. A careful, standardized arrangement of basic elements can help a customer with disabilities navigate a functional area such as check-in, a gate, or a restroom. In the boarding gate shown in Figure 3-27, the gate podium serves as a landmark for the boarding door to its right. This is reinforced by the use of different floor surfaces for the boarding area versus seating (to the right) and charging station (to the left). In addition, a small color patch of carpet lines up directly with the boarding door, which itself is painted to contrast with the wall. If all gates have a similar arrangement, then customers, including those with vision loss, immediately know where the boarding door, charging stations, and seating areas are located once they identify the podium.



Source: © Chris Cunningham, Courtesy of Gresham, Smith and Partners

Figure 3-27. Boarding gate area at Atlanta's Maynard H. Jackson Jr. International Terminal.

For a person who is blind, just knowing their surroundings enriches the travel experience. For persons with cognitive disabilities, using a mobile application with a photo of where they are, e.g., the boarding gate, will confirm that they are in the right place.

3.3 Verbal

Verbal communication refers to audible, spoken communication, often in the form of live, person-to-person conversation, announcements, or recordings, and is another critical piece of the puzzle. Customer survey research about wayfinding conducted by Gresham, Smith and Partners (October 2013) has shown that approximately 10 percent of people who are not helped by signage depend on verbal assistance. At an airport with 10 million passengers, this equates to 1 million passengers who need verbal assistance each year.

It is very important to offer verbal assistance to aging travelers and passengers with disabilities who need further instruction on how to reach their destination. This section will address who should provide verbal information, how it should be provided, and where it should be provided. It is important for airports to have a wayfinding strategy that ensures travelers who are deaf or hard of hearing have equal access to information that is communicated verbally.

3.3.1 Customer Assistance

Customer service agents (CSAs), whether volunteers or full-time employees, should be trained to speak clearly and always look the customer in the eye when communicating. Visual eye contact can often yield clues as to whether the person understands what is being communicated or not. CSAs should also be aware of the need to speak slowly and distinctly when talking to people who are deaf or hard of hearing and be careful not to cover their mouth. Those working at a computer must remember to look up in order to be understood.

Additionally, the design of the space should avoid casting shadows on the face of a CSA, which causes problems for lip readers. Airports wishing to provide an exceptional customer LOS will extend disability awareness and verbal communication training to all employees that come into contact with the public. Note pads or digital tablets should also be kept handy to help persons with hearing and speech disabilities communicate with CSAs. A face-to-face communicator called an UbiDuo, which features two keyboards and screens, is now being piloted by TSA at its security checkpoints to help communicate with customers with hearing loss (see Figure 3-28).

Source: Microlink.pc

Figure 3-28. UbiDuo communication device.

Some U.S. airports (e.g., Cincinnati/Northern Kentucky International Airport, Minneapolis–St. Paul International Airport, and San Francisco International Airport) are now providing video remote American Sign Language (ASL) interpreting on iPads or laptops. It is worth noting that most countries have their own national sign languages. They are quite distinct from spoken languages and generally do not follow the same geographic distribution. For example, British Sign Language is very different from ASL.

Finally, CSAs should bring an attitude of understanding and empathy to these customers, who are often shy about asking for help. Once again, disability awareness training is imperative in giving CSAs the confidence to communicate without fear of saying or doing the wrong thing, thus ensuring an equal level of engagement and service for these customers.

3.3.2 Hybrid Communication

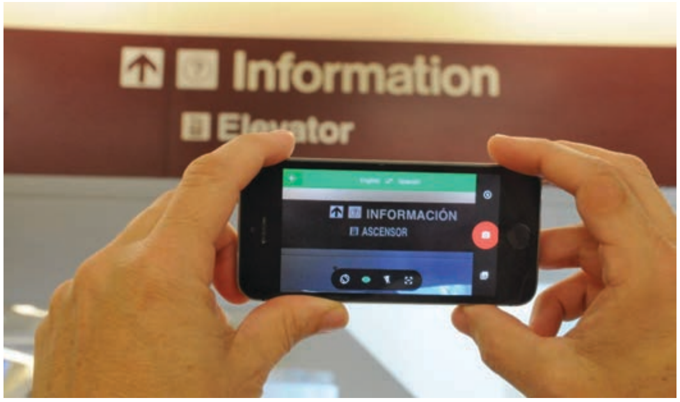
There are multiple examples of communicating information that blend two or more of the three Vs of communication. One such example is the Google Translate application, which can translate 90 languages using voice input conversation mode and translate written information on real-world objects such as signs in 27 languages via real-time video in *augmented reality mode* by using a mobile device's camera (see Figure 3-29).

The Google Translate application is virtual communication that is driven by technology—visual in that it can translate wayfinding information and verbal using live voice conversations. Equipping airport frontline staff with training and tools like the Google Translate application is part of an overall wayfinding strategy to help meet the communication needs of an increasingly diverse traveling public.

Access to verbal information should be made available on both the landside and airside using either stationary information booths and/or roving CSAs. Whether stationed at a fixed information desk or roving, CSAs can now access real-time, airport-wide information at their fingertips, with tablets that create a blend of verbal and digital communication to assist customers (see Figure 3-30).

A less obvious means of communication is audible cues. A good example is auditory identification cues used both inside and outside of elevators that can help persons with vision loss. Note that when the elevator is located in an especially noisy area, e.g., next to a security checkpoint, the volume of the exterior audible cue may need to be increased.

Audible cues can also indicate the beginning or end of moving walkways. This information is an excellent example of universal design, as it not only helps persons with disabilities but also



Source: ACRP Project 07-13 Research Team

Figure 3-29. Mobile Google Translate application in use at Nashville International Airport.

Source: Changi Airport

Figure 3-30. Roving customer service agent equipped with tablet.

other travelers who may be preoccupied with their mobile device or handling luggage. Consistency here is important for safety reasons.

Remote interpreting (at an airport information desk or Traveler's Aid) is another example of how verbal and virtual communication are blended to help assist travelers who are deaf when no staff member is versed in sign language. When this service can be applied to more than just sign language, it can help make the technology worth the investment. An example might be using this service for foreign language communication in addition to helping customers with disabilities. (See Chapter 4, P-CC.08.)

3.3.3 Text Maps

Maps are a proven and effective way to deliver orientation and navigational content, as well as providing information about services and amenities within a specific area (see Section 3.4.1.3 for additional details). However, information contained in visual map form is not accessible to a person who is blind or has low vision. One alternative to better serve those individuals is the use of text maps.

Simply put, a text map puts the information contained in a map into words. A text map is a description of an environment or space that can be delivered in an audible format to someone with visual loss to help them develop a general understanding of what to expect when they are physically present in the space and what cues they can use to orient themselves and navigate from one point to another. This is referred to as developing a cognitive map of a given space. Research shows that without access to an accurate, global spatial representation in the form of a cognitive map, it is much harder to perform tasks such as making a detour, determining shortcuts, and reorienting if lost (Long and Giudice 2010). The ability for a traveler who is blind or has low vision to match audible and/or tactile cues in the airport with their own cognitive map is a critical part of useful, nonvisual wayfinding.

This type of audible communication is typically very economical to create. Once developed, an audible text map may be accessed as a stand-alone resource, either prior to arriving at the space or once there. It may also be used with, or incorporated into, a mobile wayfinding application. Individuals who are blind could access the information from an airport's website, for instance, using a computer or mobile device with screen-reading or enlarging software. With a mobile device, they could download the text and read it while in flight.

The same content can also be leveraged as scripted information used by CSAs stationed in the airport to communicate verbal directions more effectively. Furthermore, these same text maps can be translated into multiple languages for airport customers who do not speak English or speak only limited English.

3.3.3.1 Text Map Principles

When developing a text map, it is important to consider the audience and that it consists of multiple groups of individuals with different needs and agendas. At a typical airport, departing, arriving, and connecting passengers intermingle in many of the same areas, and each group has very specific circulation patterns and service access needs. The following are some basic principles to serve as guidelines for the development of text maps:

1. Begin with a high-level, contextual overview of the building or area. Starting with a broad description of a building and its surroundings offers persons with vision loss an understanding of where they are spatially. For example, knowing whether the property is one building or separate buildings connected by passageways is highly useful in understanding why one needs to travel along certain pathways. A big-picture orientation enables a person to better understand where buildings and elements are in relationship to one another.
2. Include signage information. While it is obvious that people who are blind can't read signs, the information contained on them often cannot be found easily in other places. Mapmakers assume that sighted people will have a general understanding of locations by looking at a map and then obtain more specific information or reinforcement by reading signs. Blind people need this additional guidance and direction included in the text map itself. Usually, it is not enough to simply describe a building and the objects within it. A text map should also include information about the destinations and services within each terminal including airline locations at check-in and gates.
3. Be descriptive. Include specific information that is useful to someone trying to navigate or locate services or amenities. Offering general statements is typically not helpful. Saying that restaurants are world-class is not as useful as identifying them by name or cuisine. If someone is seeking a full-service restaurant, then clearly identifying a cinnamon bun eatery is more useful than describing it generally. Similarly, knowing that the rail station at the airport operates 24 hours a day and travels through the downtown business district is more useful than labeling it clean, efficient, and reliable.
4. A text map should describe the routes to be followed by each category of passenger and should include descriptions of elements encountered along each route. Two different methods of describing environmental navigation for persons who are blind predominate. The first involves offering specific directions from point to point in a sequence. This method is useful in guiding people to major areas of an airport, such as TSA checkpoints, ticket counters, baggage claim areas, and ground transportation, and it is most effective when focused on a particular passenger type and sequence (e.g., departing, arriving, or connecting passengers). While there is a practical limit to the number of destinations that can be accommodated with this method, it should include routes to/from all major modes of ground transportation, including parking.

   A second method of description spells out the locations of major items in an environment, enabling an individual who is blind to locate these items and understand their location in relation to other items. It is highly useful for a person who is blind to learn about all the different elements in an environment. For most airports, a successful text map will include a combination of these two descriptive methods, describing routes and sequences while also providing descriptions of landmark elements to help the listener understand the overall layout of the space.
5. Once a preliminary text map has been developed and formatted so it can be accessed by individuals who are blind, it is most important to conduct a testing phase in which test subjects who are blind are provided with text map information for various sequences and allowed

to use it for orientation, navigation, and exploration of the mapped space. This will help to identify any gaps, inconsistencies, or inaccuracies in the text map and improve its overall effectiveness for the targeted user groups. Periodic retesting at regular intervals will also help maintain the text map's usefulness.

3.3.3.2 Text Map Example

This section provides a text map developed for Austin-Bergstrom International Airport by the ACRP Project 07-13 research team as an example. The text map does not include step-by-step route descriptions as these were included instead in a prototype mobile application. Visual maps of Austin-Bergstrom International Airport are provided (see Figures 3-31, 3-32, and 3-33) for comparison with the text map.

Airport Overview. Austin-Bergstrom International Airport has one terminal which lies on an east-west axis, with the terminal entrances facing north. The terminal has two main levels: departures for departing flights on the upper level and arrivals for arriving flights on the lower level. Each level is accessed by a roadway called Presidential Boulevard that approaches from the west. Doors are numbered from west to east. Door 1 is furthest west.

Garage and Parking. Directly across the roadway on both levels is a parking garage. Level 3 of the garage, currently used for rental car pick-up and drop-off, connects to the terminal departures level via two raised pedestrian crossings. Level 1 of the garage connects to the terminal arrivals level via five crosswalks, three of which are raised pedestrian crossings at sidewalk level. There are no traffic signals or truncated domes to warn that one is entering the roadway. There is a traffic island at the midway point on both roadways. SARAs or dog parks are located in front of the garage at both ends on the ground level close to pedestrian entries. Accessible parking spaces

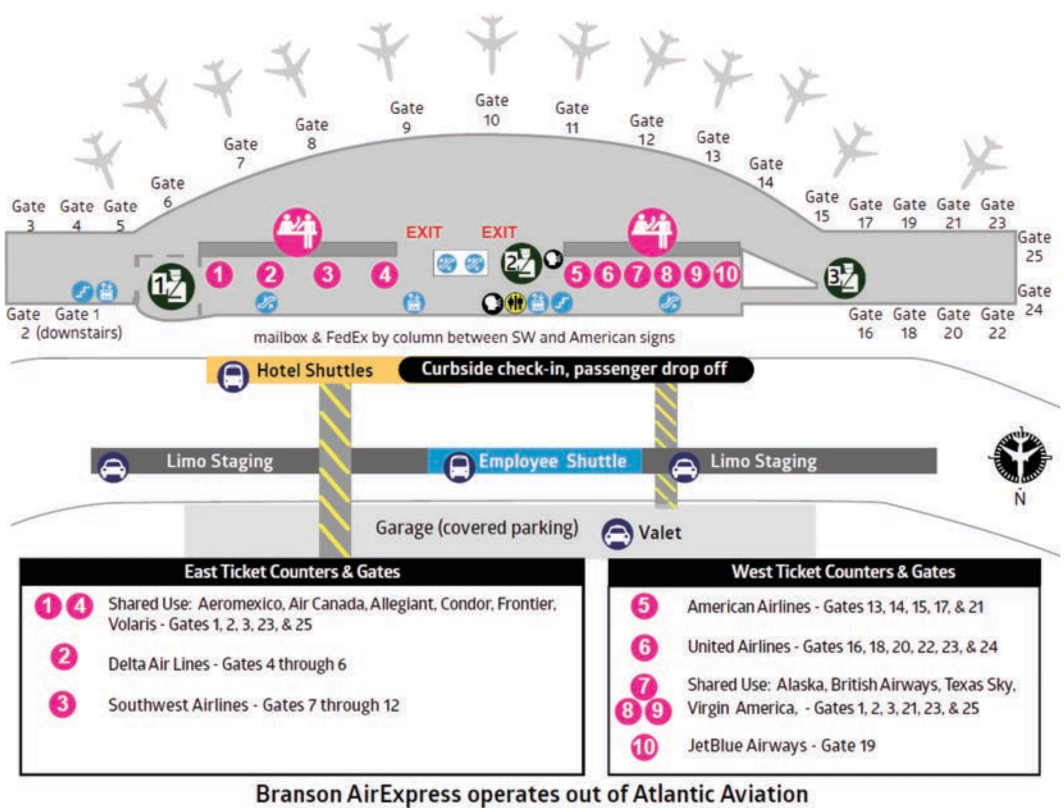


Figure 3-31. Austin-Bergstrom International Airport terminal map—airline ticket counters.

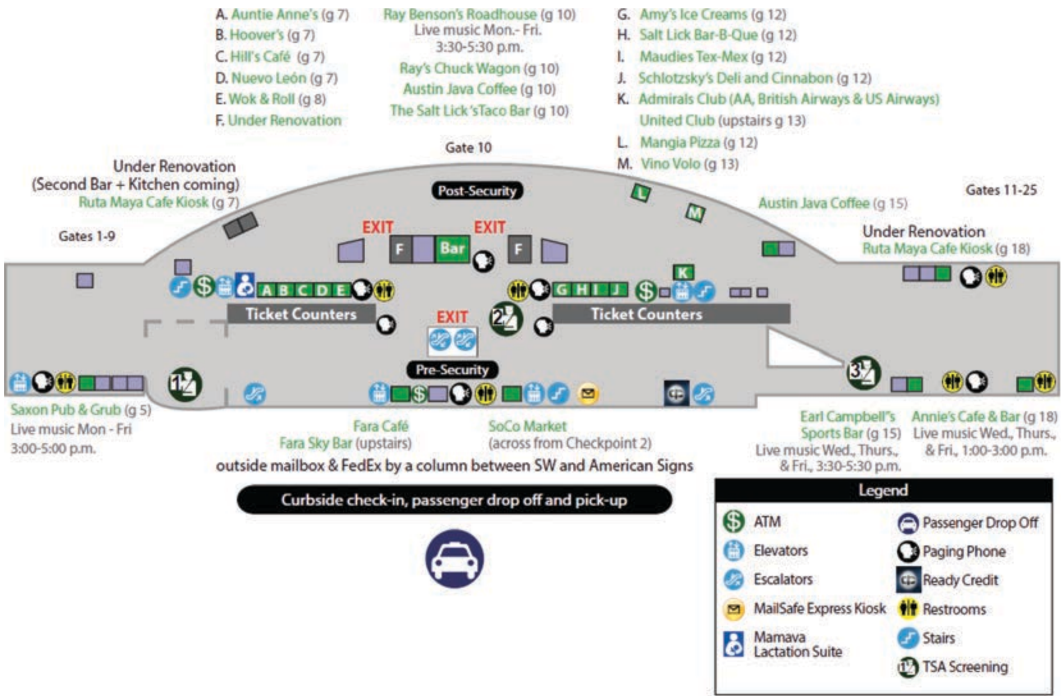


Figure 3-32. Austin-Bergstrom International Airport terminal map—food and beverage.

Figure 3-33. Austin-Bergstrom International Airport terminal map—baggage claim and ground transportation.

are adjacent to east and west pedestrian entries on Levels 1 and 2 of the garage, i.e., closest to terminal entrances and the elevator. Other on-site parking facilities include Lot A for short-term parking and Lots B to G for long-term parking located north of the garage. Each lot is served by lift-equipped parking shuttles, with accessible parking spaces situated next to the covered shuttle stops. Not all shuttles are wheelchair accessible, but the driver will call for one as needed. Valet parking is also available.

Ground Transportation—Departures or Upper Level. The curbside area along the terminal is used for passenger drop-off by automobile. Hotel shuttles stop at the far east end. Drop-off by parking shuttles and for valet parking is on the garage side of the traffic island. Only three airlines offer curbside check-in: United Airlines, Southwest Airlines, and Delta Airlines.

Departures Level—Pre-Security. The departures level is the upper level of the terminal. On elevator buttons, the departures level is labeled "T" for Terminal. This long, relatively narrow area before security is aligned east to west, or left to right, as one enters the space from passenger curbside drop-off. The seven sets of entry doors from the roadway are numbered from west to east, with Door 1 furthest west and Door 7 furthest east. Curbside check-in locations are as follows: United Airlines outside Door 2, Southwest Airlines outside Door 4, and Delta Airlines outside Door 5.

There are two main security checkpoints, numbered 1 and 2, that are centrally located in the terminal on the south side of the space. Checkpoint 1 is located east of Checkpoint 2. At the far west end is an additional checkpoint, number 3, to provide access to Gates 15 to 24 at that end of the terminal. Those taking international flights may be directed to Checkpoint 4 at the far east end.

Ticket counters located east of Checkpoint 1, listed from east to west, include Allegiant Air, Air Canada, Virgin America, Delta Airlines, and Southwest Airlines. Ticket counters located west of Checkpoint 2, listed from east to west, include American Airlines, United Airlines, British Airways, US Airways, Texas Sky, and JetBlue. For the most part, airline gates are located at the same end of the terminal as their ticket counters.

Other pre-security facilities and services are located along the wall with entry doors. On the east side across from Checkpoint 1 is the Fara Café. On the west side across from Checkpoint 2 is the SoCo Market, which also has a seating area with tables and chairs. Located between the café and the market, situated from east to west, are the following: a staircase leading up to the Fara Sky Bar, a self-service kiosk for flowers, a Bank of America ATM machine, a paging phone, a mailbox, an automated external defibrillator (AED) machine, a men's restroom, bi-level drinking fountains, a women's restroom, and an accessible family or companion restroom, identified by a sign that says "Special Needs."

To move between terminal levels, there are escalators and elevators on the east and west sides of the building as well as one set of stairs just west of the SoCo Market. All are located along the wall with entry doors. The west elevator is perpendicular to the main path of travel and located past the entrance to the SoCo Market, across from Checkpoint 2. The east elevator bank, which has two elevator cars, is parallel to the main path of travel and located behind the table area at the Fara Café, across from Security Checkpoint 2. A second elevator there is perpendicular to the main path of travel and located past the café's service counter. It provides access up to the "M" or mezzanine-level Fara Sky Bar and down to the arrivals level, labeled "B" for "Baggage" on elevator buttons.

Terminal Concourse—Post-Security. The terminal concourse is made up of a long, curving central section with straight extensions at each end. Gate numbers run from east to west. In the straight section at the far east end, Gate 1 is on the north side of the concourse, Gates 2 and 3 are along the east wall, and Gates 4 and 5 are on the south side. Gates 6 to 15 on the curved portion of the concourse are all located on the south side. In the straight extension at the far west end, odd number Gates 17, 19, 21, and 23 are on the south side, and even number Gates 16, 18, 20, and 22 are on the north side. Gates 24 and 25 are along the west wall. All gates have jet bridges except Gate 1, which is on the lower or ground level and reached via stairs or an elevator.

Security entry points into the concourse are as follows: Checkpoint 1 enters between Gates 8 and 9, and Checkpoint 2 enters between Gates 11 and 12. Checkpoint 3 enters next to Gate 16. Checkpoint 4, which is used for international flights only, enters between Gates 6 and 7. Exits from the concourse are located between Checkpoints 1 and 2. One can either take escalators or stairs down to baggage claim or walk past the escalators to the departures pre-security area and use the elevators there.

In emergencies, passengers may exit the concourse at all checkpoints. If terminal elevators are out of service, those who cannot use steps may then exit the building on the upper or terminal level. Alternatively, passengers may be directed to external stairs or elevators leading down to the tarmac. Emergency exits with external elevators are located at Gate 7 behind Ruta Maya and Gates 13 and 21. Most other gates, from 4 to 23, have stairs for emergency egress.

Post-security facilities and services such as restrooms, drinking fountains, ATMs, restaurants, bars, retail stores, and kiosks are located primarily along the north side of the concourse. There are two food courts with dining areas opposite Gates 7 and 12. Clustered with them are men's and women's restrooms, a companion restroom, drinking fountains, and a paging phone. Additional facilities and services are located at the far east and west ends of the concourse. Recharging stations are available in each gate area. In addition, there are two premium lounges opposite Gate 13: the Admirals Club and the United Club. These are on the mezzanine level and accessed by stairs or elevator.

Arrivals or Baggage Claim Level. The arrivals level, labeled "B" for "Baggage" on elevator buttons, is the lower or ground level of the terminal. The central south portion of the space is occupied by five baggage carousels numbered from west to east. Dividing them are two sets of double escalators, each with a central flight of stairs, that bring passengers down from the terminal concourse above. These escalators are located between Carousels 1 and 2 and Carousels 4 and 5. To the rear of the baggage carousels along the south wall are men's and women's restrooms, drinking fountains, and paging phones as well as Smarte Carte machines. These are located behind Carousels 1 and 2 and Carousels 4 and 5. The only companion restroom is between Carousels 1 and 2. At the east end of the arrivals level on the south side is customs and international baggage claim. At the west end on the south side are counters for rental cars and SuperShuttle as well as the airport security office and lost and found.

Along the north wall are six sets of automatic doors leading to the lower roadway and ground transportation. Also on this side of the space, to the east and west, are elevators and escalators to the departures level. An information counter with a seating area is centrally placed opposite Carousel 2.

Ground Transportation—Arrivals or Lower Level. The curbside area along the terminal is used for passenger pick-up by automobile. It is labeled from the west by letters A to K. Charter buses pick up at Section K at the far east end. All other types of pick-ups are on the garage side of the traffic island, which has sections numbered from 1 to 4. Off-airport parking shuttles and SuperShuttle are in Section 1 at the far west end. Airport parking shuttle pick-ups are in Section 2 in the central part of the traffic island. Taxi pick-up is in Section 3 to the east. The Capital Metro Bus stop is in Section 4 at the far east end. This is also where paratransit picks up and drops off. Valet parking return is at the far east end of the garage, across from Section 4.

3.3.4 Illumination

Illumination is not an obvious consideration associated with verbal communication. However, it is very important to maintain optimum lighting levels throughout the airport at all times of the day to support lip reading and reading signs, etc. Proper illumination is also important at verbal touch points throughout customer journey segments, e.g., at the ticket counter with the airline agent, at security checkpoints with TSA agents, and at information desks with customer service representatives.

3.4 Virtual

When the term "virtual" is used with regard to wayfinding, it describes dynamic, non-static navigational tools—in essence, digital tools ranging from computers used at home for pre-trip planning, to out-of-house tools like mobile devices, to airport-provided digital information such as dynamic directories, interactive kiosks, and flight information displays that enhance the travel experience for all customers, including aging travelers and persons with disabilities. Virtual tools offer an opportunity to improve wayfinding at the airport when they are deployed using a connected, consistent, and continuous methodology. Virtual tools can also be deployed to offer the benefits of a wayfinding system to a larger and more diverse group of travelers by supplementing wayfinding with personalized systems, adaptive systems, and integrated systems—for example, visual notification synchronized with audible notifications or interactive systems designed to meet the needs of users with specific disabilities.

3.4.1 Dynamic Non-Interactive Wayfinding

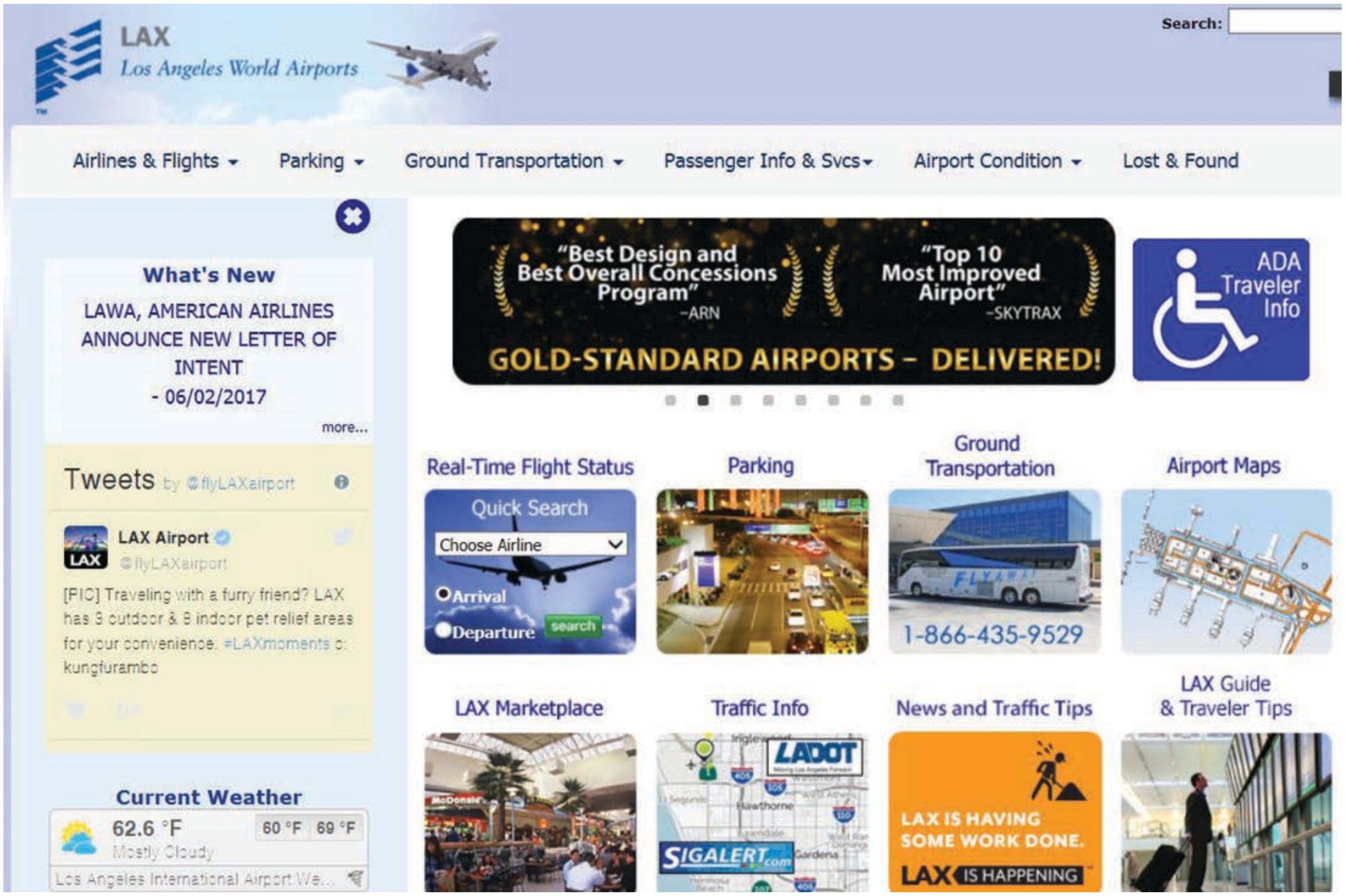
To provide wayfinding—maps and directions—for travelers, most airports are turning to digital signage as a more efficacious solution than the traditional printed signage. Dynamic, non-interactive wayfinding signs provide information that may change based on content management systems (CMSs), database updates, or other triggers, such as locations/directions for scheduled events. However, being "non-interactive," they do not provide a way for individuals to query a display. Dynamic, non-interactive wayfinding solutions should follow the same criteria as static wayfinding systems. Contrast, color, legibility, symbology, and intuitive-use concepts should be applied to technology solutions. A consistent design across wayfinding systems, visual and virtual, provides confirmation to travelers as they move from decision point to decision point.

3.4.1.1 Pre-Trip Planning

The ability for travelers to plan in advance via digital media is becoming more and more effective. For older adults and passengers with disabilities, advance knowledge can greatly enhance the wayfinding experience that is part of their overall customer experience. The Wayfinding Accessibility Audit Checklist recommends including a link on an airport's website for disability-related information and resources. The preferred LOS is to locate this link on the home page. A higher LOS would be to have the link visible above the scroll (see Figure 3-34).

Website information should be developed in a format that allows easy, accurate conversion to other formats by persons with disabilities. It is also important for an airport to include a text version of their airport map on their website (see Section 3.3.3).

Research shows that connecting passengers experience greater wayfinding difficulty than either departing or arriving passengers. Pre-trip planning can be an excellent tool to help older adults and persons with disabilities. London Heathrow Airport's website has an excellent, easy-to-use tool that helps travelers understand the transfer process and establish expectations for



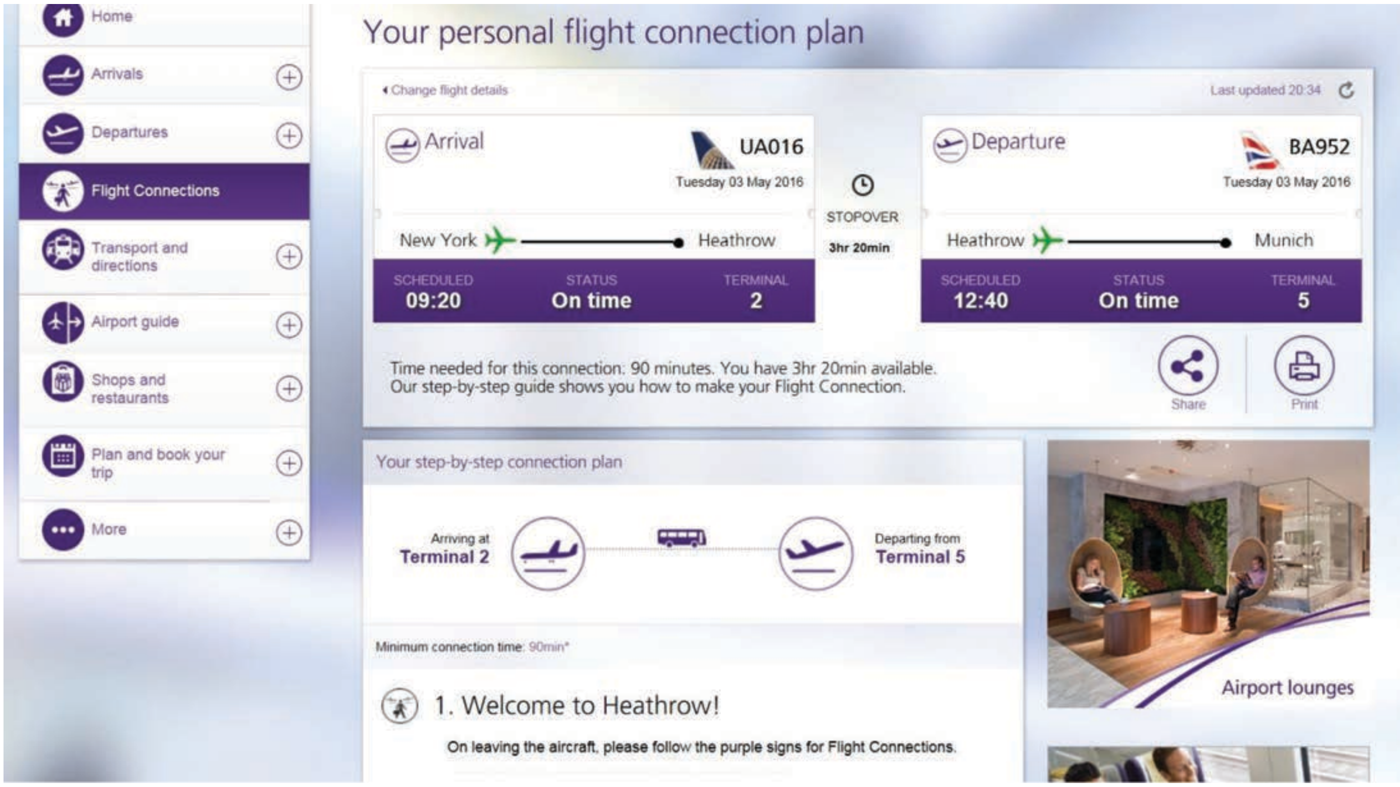
Source: LAWA

Figure 3-34. Los Angeles International Airport website with link to disability-related information on the home page above the scroll.

what can be one of the more complex airport environments for passengers to navigate, with travel times as long as 90 minutes to connect from Terminal 3 to Terminal 5 (see Figure 3-35).

This type of communication is very useful to older adults and passengers with disabilities. However, while a passenger who is blind can access the information on London Heathrow Airport's website, it does not help them travel independently because they cannot see the "breadcrumb trail" of purple signs that guide connecting passengers through the airport. Nevertheless, a mobile wayfinding application could provide the necessary information for a passenger who is blind to benefit from this pre-trip planning tool.

Airline websites can also be a good source of pre-trip planning information. Similar to airport websites, the airline websites vary significantly in where a customer finds this information as well as what level of information is offered. Some airlines have information available at the time of booking a flight (see Figure 3-36). Other airlines provide even more detail when checking in online for a flight. As of December 12, 2015, ACAA regulations require all airline websites marketing to customers in the United States to provide similar accommodation request forms and to meet accessibility requirements (WCAG 2.0 Level AA) on webpages providing core travel information and services. As of December 12, 2016, the remaining pages must also be accessible.



Source: London Heathrow Airport

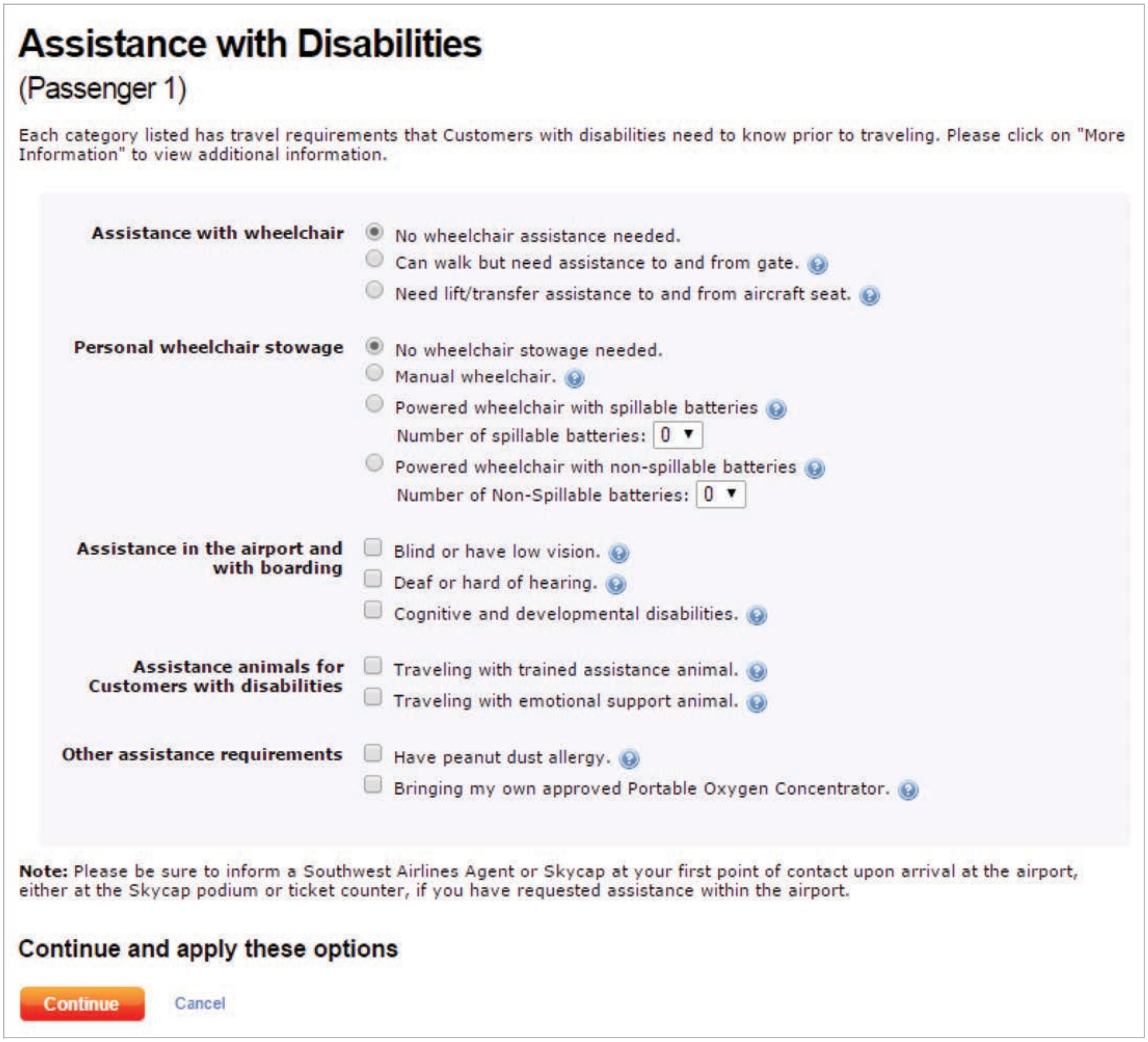
Figure 3-35. Screenshot from London Heathrow Airport's website showing connection time and simple step-by-step instructions.

Airport websites will also typically offer a map, directory, or wayfinding tool. Such tools should be consistent with what a passenger will experience at the airport, thus reducing or eliminating the need to relearn directions, landmarks, colors, or terminology at the airport. Figure 3-37 and Figure 3-38 show the level of consistency between the types of virtual communication offered to passengers for pre-trip planning, on-site navigation, and mobile use at Boston Logan International Airport.

Augmented reality is another feature being added to airport website maps and directories for pre-trip planning. The site will typically feature a digital map of the airport facilities as well as a video, which may be captioned and audio-enabled, detailing the experience with an actual virtual look at that location in the airport. Figure 3-39 shows a page from Munich Airport's website with a digital map in the primary navigation area and the virtual look-in to that actual point in the airport. Figure 3-40 shows the virtual look-in in the primary navigation area and the digital map minimized on the bottom right of the screen. To create a continuous, consistent, connected experience, users may download their desired wayfinding route using the Munich Airport application, and the application will enable the same views once the user arrives on-site at the airport. This illustrates the consistency from website to on-site navigation using technology. While the website and navigation maps offer highlighted services which are accessible, they do not include all of the selectable elements of the Wayfinding Accessibility Audit Checklist.

3.4.1.2 Accessible Help/Call Points

Accessible help/call points are easy-to-use communication devices that provide means for arriving travelers needing accessibility information or assistance from a remotely located service



Assistance with Disabilities

(Passenger 1)

Each category listed has travel requirements that Customers with disabilities need to know prior to traveling. Please click on "More Information" to view additional information.

Assistance with wheelchair
- No wheelchair assistance needed.
- Can walk but need assistance to and from gate.
- Need lift/transfer assistance to and from aircraft seat.

Personal wheelchair stowage
- No wheelchair stowage needed.
- Manual wheelchair.
- Powered wheelchair with spillable batteries
  Number of spillable batteries: 0
- Powered wheelchair with non-spillable batteries
  Number of Non-Spillable batteries: 0

Assistance in the airport and with boarding
- Blind or have low vision.
- Deaf or hard of hearing.
- Cognitive and developmental disabilities.

Assistance animals for Customers with disabilities
- Traveling with trained assistance animal.
- Traveling with emotional support animal.

Other assistance requirements
- Have peanut dust allergy.
- Bringing my own approved Portable Oxygen Concentrator.

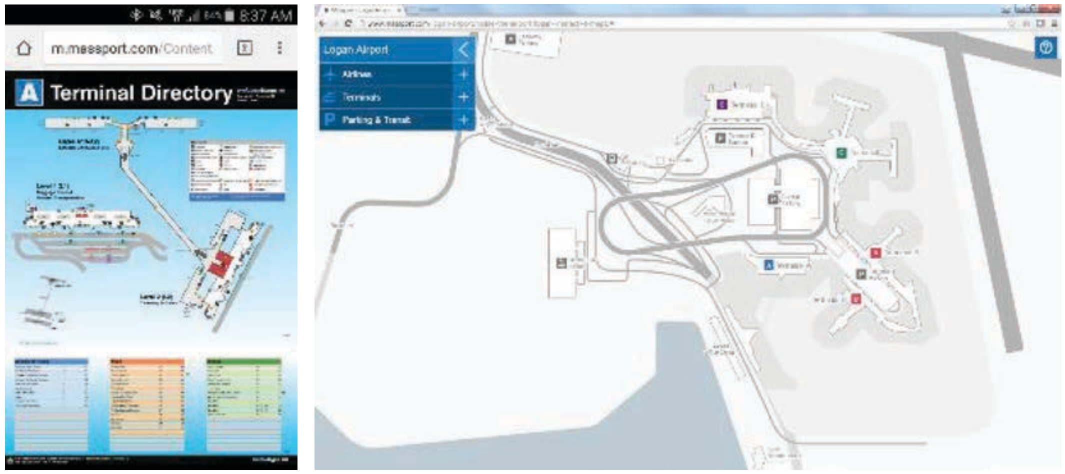
Note: Please be sure to inform a Southwest Airlines Agent or Skycap at your first point of contact upon arrival at the airport, either at the Skycap podium or ticket counter, if you have requested assistance within the airport.

Continue and apply these options

Continue Cancel

Source: Southwest Airlines

Figure 3-36. Screenshot from Southwest Airlines website of page to assist passengers with disabilities when making a flight reservation online.



Source: Boston Logan Airport

Figure 3-37. Mobile map for Boston Logan International Airport application and airport website.

provider (see Figure 3-41). These devices help provide convenient points for people with disabilities to initiate their wayfinding experience upon their arrival at the terminal.

Usually in the form of totems or kiosks, and typically positioned near main airport terminal entrances (or sometimes even in accessible car parking facilities), they can be used by those with functional limitations to announce their arrival at the airport and to request wheelchair, electric cart, escort, or other such assistance to further their journey into the terminal and eventually to their departure gate.

Help points should be identified with international accessibility symbols to clearly indicate their specific purpose and should be placed so that they are easily accessed by travelers with mobility issues (wheelchairs, walkers, canes, etc.) yet do not present an obstruction to normal pedestrian traffic flow when in use.

3.4.1.3 Directories and Maps

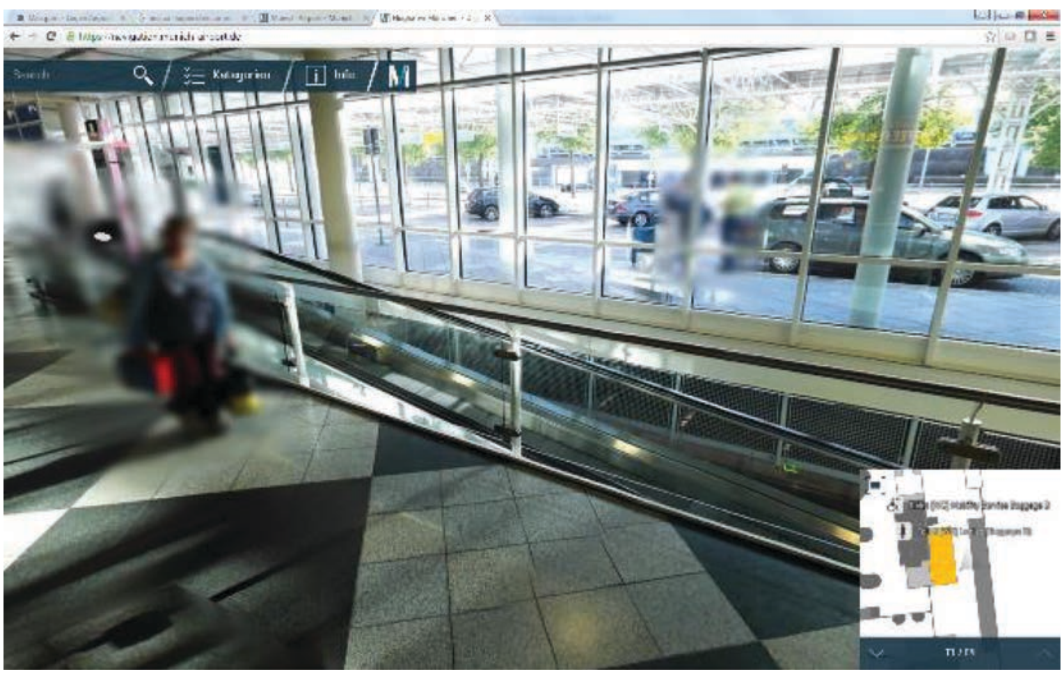
One of the traveler's first encounters in the wayfinding experience is usually a directory sign or airport map. The traveler may experience this even before beginning their journey to the airport during pre-trip planning at home using the airport's website.

Source: Arora Engineers

Figure 3-38. On-site interactive directory at Boston Logan International Airport.

Source: Munich Airport

Figure 3-39. Munich Airport website digital map with virtual reality at bottom right.



Source: Munich Airport

Figure 3-40. Munich Airport website with virtual reality as primary view and digital map at bottom right.

Source: Arora Engineers

Figure 3-41. Examples of accessible curbside help/ call points at London Gatwick Airport, Paris Charles de Gaulle Airport, and Adolfo Suarez Madrid–Barajas Airport.

Directories and maps present a plethora of names, labels, categories, and/or geographical information in an organized way that can be interpreted in an intuitive manner. Their purpose is to provide the user with relevant information that will assist them in the wayfinding decision-making process.

Adaptive technologies can be incorporated into directory design to allow those with physical, sensory, or cognitive disabilities to process the directory information to help them navigate to their desired destination. These adaptive technologies may include intuitive interactive features such as a simple boarding pass reader or more advanced feature sets such as video analytics, which can determine age, gender, accessibility (mobility limitations such as seated versus standing), and interactivity.

Figure 3-42 shows one of a series of directories at Detroit Metropolitan Airport that allows users to scan a boarding pass and receive information tailored to their journey with minimal

Source: ACRP Project 07-13 Research Team

Figure 3-42. Dynamic directory with boarding pass scanner at Detroit Metropolitan Airport's McNamara Terminal.

interaction with the technology. The directories were designed employing the ease-of-use universal design criteria. Customers with disabilities receive walk versus ride information and a "breadcrumb trail," as well as text directions to their gate. The directory can also be used by other passengers, and the overall primary navigation areas do not change during use.

These types of directories do not help people who are blind. However, proper map orientation is helpful for those with cognitive disabilities, and the boarding pass scanner can help people with Attention Deficit Hyperactivity Disorder (ADHD) or other attention deficits. The large map also uses landmarks such as air train stops and water features to guide travelers. All may help people with cognitive disabilities.

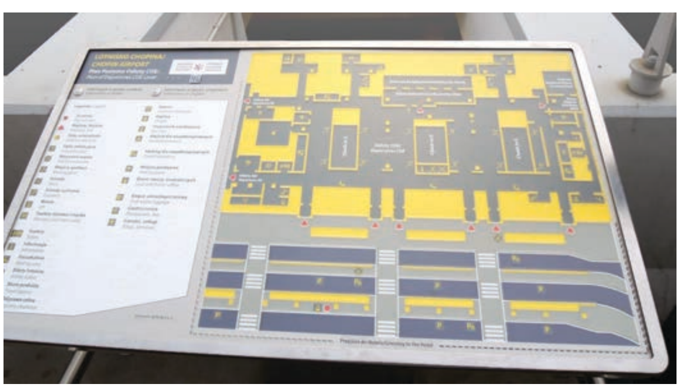
Adaptive technologies that offer audio-based information triggered by the user could also be helpful to travelers who are blind or have low vision. Map information that can be communicated in more than one form can have additional benefits. For example, there are sighted travelers who prefer listening to directions versus deciphering a visual map.

Warsaw Chopin Airport currently has four interactive terminal maps that provide both tactile and audible information (see Figure 3-43). These maps, designed in cooperation with the Chance for the Blind Foundation, can be found in front of the departure hall, at the bus stop at the departure hall, in front of the arrivals hall, and at the Warsaw Chopin Airport train station. In addition to raised lines representing walls, paths, symbols, and objects, the "typhlographic" maps have labels in Braille and buttons to trigger descriptions and navigational directions in Polish and English. Each map is fitted with a beacon that allows a customer who downloads the airport's "Your Way" mobile application to locate the typhlographic directory maps by using a smartphone. The maps and voice messages are also available on the application.

Maps used in airport directories can be extremely dense with information. Therefore, it is important to keep in mind several basic design requirements to leverage their usefulness to aging travelers and persons with disabilities.

For travelers with mobility issues:

- Locate maps appropriately at major decision points and interspace to minimize distance to find information.
- Locate maps near information desks when possible. Not all customers will find what they are looking for on a directory. This applies to the other types of disabilities also.
- Use a scale that gives a sense of place and distance.



Source: Altix

Figure 3-43. Interactive airport map for people who are blind at Warsaw Chopin Airport.

- Include all accessible features such as accessible drop-off and pick-up points and accessible parking as well as SARAs for those using service animals.
- Place information at eye level to help persons in wheelchairs or electric scooters or include an option on digital directories to lower information to the bottom of the screen.

For travelers with cognitive issues:

- Locate maps near an asymmetrical part of the building that is discernable on the map.
- Include memorable features, architecture, art, etc.
- Locate maps near a landmark that is recognizable—both in the airport and on the map.
- For large spaces and/or airports with multiple terminals, include a big-picture map (key plan) that conveys the overall layout of the airport as well as a detailed map of the specific area around the directory location. This is especially important for connecting passengers who need to change terminals.
- Align the map in a heads-up orientation so it is forward facing, and make sure the map is aligned with the airport's layout.
- Include handout maps that customers can take with them to help remember routes, decision points, level changes, etc.
- Use terminology and symbols that are consistent airport-wide.
- Check that online maps are consistent with airport directory maps.

For travelers who are blind, check displayed and printed maps with text maps for consistency (reference Section 3.3.3).

For persons with limited vision:

- Use large, easy-to-read fonts and color contrast for good legibility.
- Highlight the location of SARAs both landside and airside.
- Provide proper levels of illumination.
- Place information at eye level for close approach.

For travelers with hearing issues:

- Design maps and directories to meet the third and fourth principles of universal design, i.e., simple, intuitive use and perceptible information, so that those with hearing loss can understand and make use of the information independently without asking for additional assistance.
- Provide training and technology to enable communication for individuals with hearing loss at nearby information desks, e.g., ASL remote interpreting, hearing loop, tablet, or UbiDuo.
- Include on maps the hearing loop symbol to denote where loops have been installed.

Developing an airport map involves thoughtful dissemination and packaging of multiple layers of information. As noted above, it is essential that every directory map be correctly oriented in a forward-facing manner. In other words, when a customer is viewing the directory, straight ahead in front is at the top of the map, and areas behind the customer are at the bottom of the map.

The physical placement of the directory itself is subject to different conditions, customer circulation, and key decision points that all impact the actual orientation, e.g., east-west versus north-south. Various placements and orientation can require the map itself to be rotated 90 degrees, or 180 degrees as shown in maps from T.F. Green International Airport in Figure 3-44 that demonstrate how two directories, both located on the airside, but on opposite ends, can require two different orientations of the same map.

The other factor to consider is whether the directory is one-sided or two-sided, because even a single directory location that is two-sided requires the same map to be rotated 180 degrees. In the case of large airports with multiple terminals and geographic configurations, the map artwork can require an extensive effort. For example, at San Francisco International Airport, which has

Source: Courtesy of Illium Associates and T.F. Green International Airport

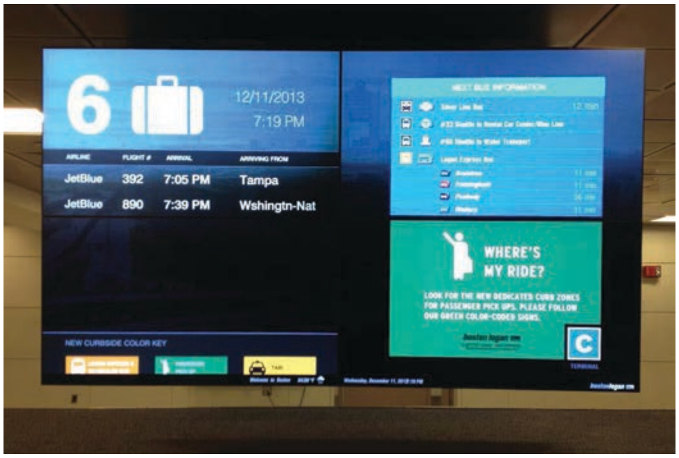
Figure 3-44. Example of the same map rotated 180 degrees to maintain correct forward-facing orientation.

four terminals in a circular ring and uses two-sided directories, as many as 16 unique maps must be developed to maintain the correct forward-facing orientation at every location.

3.4.1.4 Dynamic Directional Displays

Dynamic directional displays present information to assist the user in navigating their way to a specific destination. Typically, they utilize maps to orient the user to their current location—"You Are Here"—and then to direct them to their intended destination using maps and/or step-by-step directions. Dynamic directional signage is generally used to provide people with information on where a path goes and how far it is to a given destination.

Directional displays can be combined with auditory guidance or Tactile Ground Surface Indicators (TGSIs) to assist in the wayfinding process for passengers with vision loss. (Note that TGSIs are not used in the United States. See discussion in Section 3.5.) Opportunities for applying dynamic



Source: ACRP Project 07-13 Research Team

Figure 3-45. Baggage claim display with real-time next bus information at Boston Logan International Airport.

displays extend beyond directories to other key touch points. For example, in the baggage claim area, dynamic information can be used to educate customers about what is next in their wayfinding journey, such as access to next bus information displayed in real time (see Figure 3-45).

3.4.1.5 Walk versus Ride Decision

Airport circulation consists of many destinations and the pathways that connect them. Connecting passengers need to find their way from one gate to another (which may be in another concourse or terminal). The "walk versus ride" decision occurs when a passenger has a choice between walking the entire distance from one point to another (which can be a long way in some airports) or using some form of alternative transportation—usually a tram, shuttle, automated people mover, light-rail transit, or a similar form of transportation. Appropriately planned and designed digital wayfinding signage can indicate estimated times for the walk versus ride options to assist in the decision-making process. This can be included as part of the FIDS (see Figure 3-46) or part of a stand-alone display (see Figure 3-47). Older adults and people with disabilities are especially likely to utilize the ride option, if available, to assist in their navigation between points.

Source: ACRP Project 07-13 Research Team

Figure 3-46. FIDS with walk or ride information at Detroit Metropolitan Airport's McNamara Terminal.

Source: ACRP Project 07-13 Research Team

Figure 3-47. Dynamic display on how to connect from one terminal to another at Boston Logan International Airport.

3.4.2 Dynamic Interactive Wayfinding

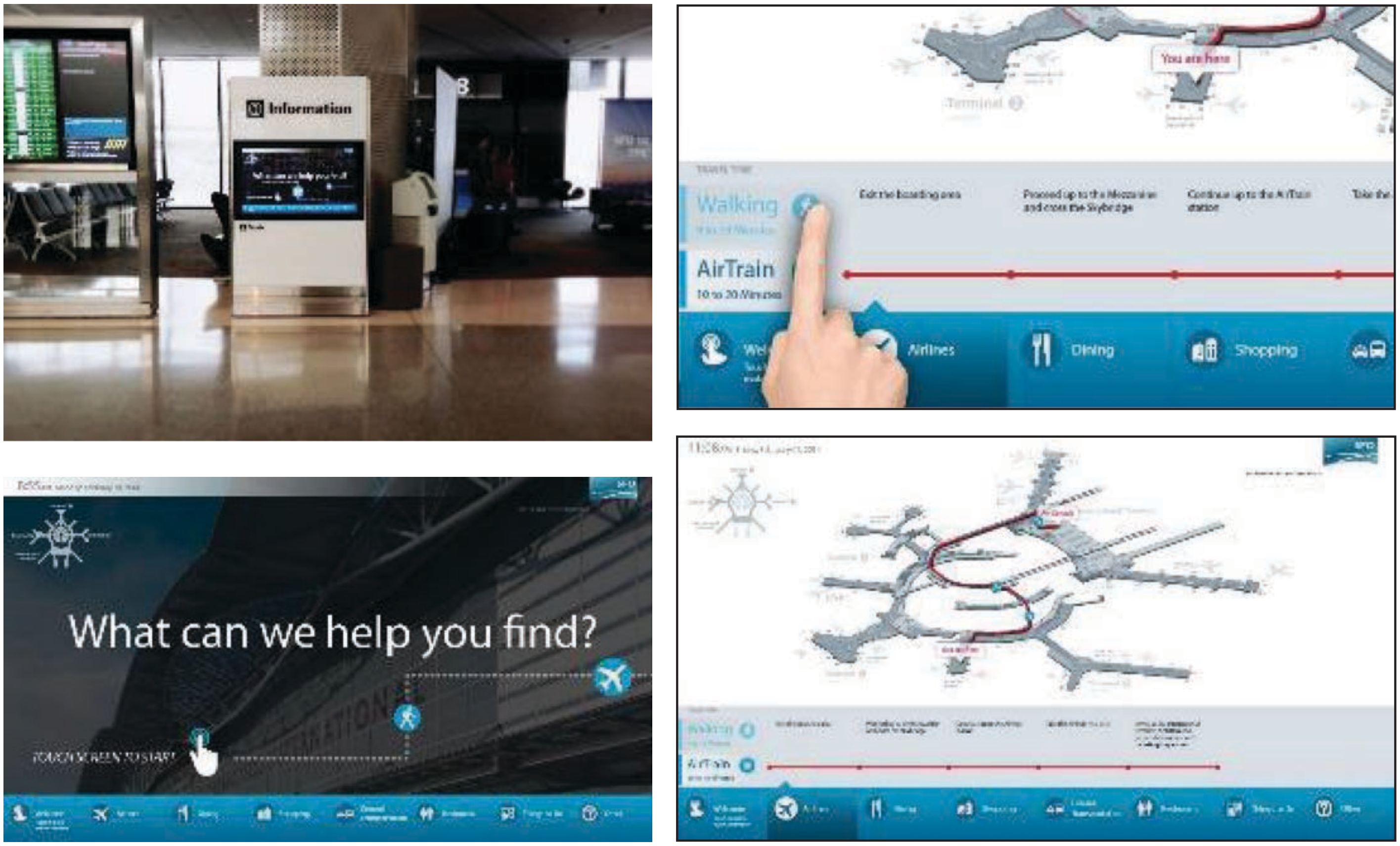
Dynamic, interactive wayfinding allows users to select, drill down, and zoom to select their destination and get paths and directions. The interaction typically uses a touch-enabled display, although older systems may still have physical buttons, and even a mouse or trackball. For example, a touch-interactive display lets someone select an event or query a departmental directory and then touch a "Directions" icon, which in turn can display a routing map and/or step-by-step directions (see Figure 3-48). The maps and directions, similarly, can simply highlight "You Are Here" and "Here's the Destination You Specified," or, like the GPS application or device used in a car, provide point-to-point directional path drawings and step-by-step directions.

3.4.2.1 Information Display Systems

Information display systems (IDSs), according to the research conducted for *ACRP Research Report 161,* are the third-most important factor in the airport experience (Landrum & Brown, Inc. 2016). IDSs use technologies such as liquid crystal display (LCD), LED, and projection to display content such as digital images, streaming media, and text information. Various hardware and software options exist, providing a range of different ways to schedule and play back content. FIDSs, GIDSs, and BIDSs are at the heart of every airport, providing vital information to passengers, visitors, airport operators, and other consumers across the terminal and at other locations (see Figure 3-49). IDSs also provide visual paging for persons with hearing loss and support the display of weather, promotional, and advertising information.

Although ADA Standards do not yet specifically address digital signage, providing access to users with disabilities is not just a good idea, it's becoming the law. These guidelines will help all users:

- Ensure that text is easily visible at a reasonable distance from the sign.
- Use text colors that have high contrast with the background color.
- Avoid dark backgrounds with neon colors and white characters.
- Keep font sizes large, especially for main messages. To test size, create a test screen with lines of different font sizes and have people view the screen at the farthest practical distance.
- Use sans-serif fonts. Serif fonts work well for long text passages in reading material, but for digital signs sans-serif fonts are preferred.



Source: Omnivex

Figure 3-48. Interactive directory at San Francisco International Airport.

Source: COM-NET a SITA Company

Figure 3-49. Flight information displays at Cincinnati Northern Kentucky International Airport.

Remember, too, that passersby may also view the screen. The exception to this would be for screens meant for interaction, where the user is standing directly in front of the sign. But in this case as well, the needs of viewers with older eyes or low vision should be kept in mind.

3.4.2.2 Interactive Kiosks

An airport kiosk provides information, goods, or services. In many airports, individuals can purchase tickets, check baggage, and monitor the status of arriving and departing flights at either a specific airline's computerized kiosks or at CUSS kiosks shared by multiple airlines (see Figure 3-50). Airlines increasingly rely on kiosks to ease congestion and prevent long lines at check-in counters. Self-service kiosks are some of the most widely adopted and well-proven applications for interactive kiosks.

As part of the U.S. DOT's effort to ensure equal access to air transportation for all travelers, it is requiring that automated airport kiosks be accessible to passengers with disabilities. Under the new rule, automated kiosks installed at U.S. airports for services such as printing boarding passes and baggage tags must be accessible to passengers with disabilities until at least 25 percent of all kiosks at each airport location are accessible (14 CFR Part 382.57). The CUSS kiosk shown in Figure 3-50 includes a document scanner, Trace EZ Access keypad, Braille markers, and a headphone jack so that customers who are blind can access audio instructions. It is designed for use from a seated and standing position. See Figure 3-51 for an illustration of the common components of an ADA-compliant interactive kiosk.

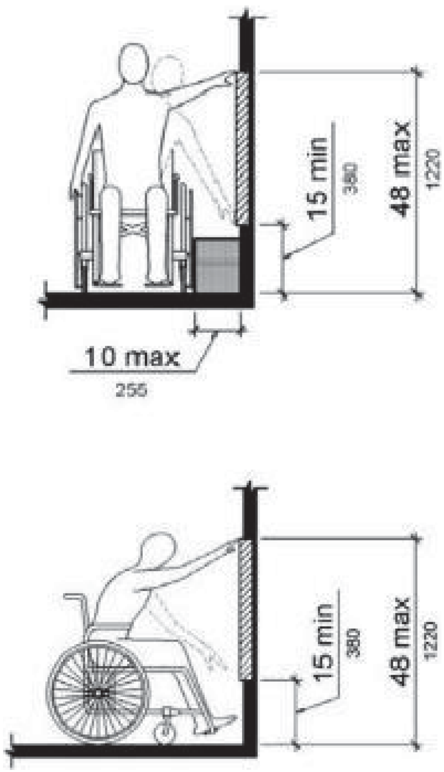
3.4.2.3 Virtual Concierge

A virtual concierge is a form of interactive touch-screen display that can provide a multitude of information services (including interaction with a real person such as a CSA at an off-site location) through the use of video conferencing technology and can acknowledge and respond to user requests. Some of the services that can be accessed from a virtual concierge include the following:

- Flight check-in and boarding pass printing
- Flight arrivals and departures information
- Weather forecasts

Source: ACRP Project 07-13 Research Team

Figure 3-50. CUSS check-in kiosk at San Francisco International Airport.



Common Components		
Component	Details	Image
Phone Set	Phone sets can be added to aid individuals with disabilities who have difficulty seeing the screen.	
Braile	Braille is added with the graphics application.	
Access Keyboard	The keypad has EZ Access buttons to support accessibility features. The colors and shapes make them readily identifiable by both sight and touch. The buttons are spaced so people who have difficulty with reach and motion can use them.	
Phone Jack	Standard audio head phone jack will disable the speakers on the kiosk when it is plugged in	

Source: Section 508 of the U.S. Government Rehabilitation Act

Figure 3-51. Common components of an ADA-compliant interactive kiosk.

- Wayfinding maps
- On-site amenities
- Restaurant reservations
- Hotel reservations
- Rental car reservations
- Daily event schedules
- Local areas of interest (restaurants, events, and attractions)

Virtual concierges are becoming more common in airport facilities and can be a positive addition to the wayfinding experience. As with other interactive technologies, virtual concierges can be designed with accessibility features and ways of accessing information that benefit those with disabilities.

Munich Airport has implemented an innovative approach for providing information services at key locations other than the departures hall where departing passengers may need assistance. The InfoGate counter allows for interaction between customers and customer service personnel via life-size video conferencing, as shown in Figure 3-52. These are placed in areas with high volumes of customer traffic that departing customers regularly pass through before they reach the departures hall.

3.4.3 Auditory Systems

Auditory announcement systems traditionally convey audio voice messages or audible alerts to loudspeaker systems in a certain area. Understanding these messages may be difficult for persons with hearing problems and also for many other persons when the system is inadequate

Source: InfoGate

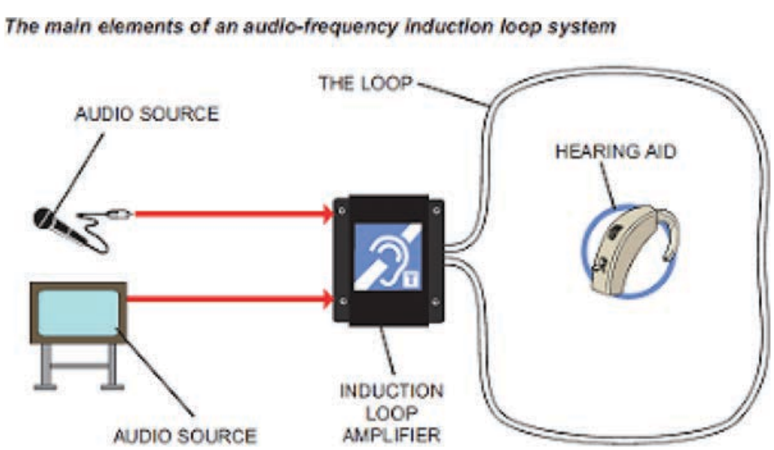
Figure 3-52. InfoGate counter at Munich Airport, Terminal 2.

due to the presence of competing background noise, poor environmental acoustics, poor system performance, or other factors.

The ADA Standards require local and state government entities, such as airports operated by the local government, to provide auxiliary aids to ensure effective communication with individuals who are deaf or hard of hearing. To achieve equal access in airports, the most important auxiliary aids for persons with hearing loss will be videotext displays or assistive listening systems.

The ACAA does not require airlines to provide a visual display of their audio messages. Instead, 14 CFR Part 382 specifies simply that airlines "must ensure that passengers with a disability, who identify themselves as persons needing visual or hearing assistance, have prompt access to the same information provided to other passengers at each gate, ticketing area and customer service desk that they own, lease or control" (382.53). Nonetheless, a growing number of airlines are now installing GIDSs that provide real-time information that matches verbal announcements made by gate personnel, such as which rows are currently boarding.

One solution for helping passengers who are hard of hearing to gain access to public announcements is installation of hearing loops. A hearing loop is a wire (induction loop) that circles a room or a smaller area with the ends of the wire connected to a special audio amplifier (see Figure 3-53). The wire is installed under the floor or carpet or in the ceiling. The amplifier can



Source: www.c-tek.uk

Figure 3-53. Typical hearing loop system.

be connected to a microphone or any sound system that is to be heard in the area defined by the loop wire. The audio signal traveling through the wire creates an electromagnetic field around the wire. This magnetic field can be "heard" inside of the loop with any hearing aid set to the "T" (telephone) position or other loop listener such as a cochlear implant. Other room sounds and echoes are virtually eliminated due to the direct wireless connection, and sound clarity and speech intelligibility are greatly improved.

3.4.3.1 Public Address

A public address system (PA system) is an electronic sound amplification and distribution system with a microphone, amplifier, and loudspeakers, used to allow a person to address an audience in a large public space. Per the ADA Standards for Transportation Facilities (ADA Standards Section 810.7), terminal information systems that broadcast information to the general public through a PA system must provide the same or equivalent information to persons with a hearing loss, or who are deaf, in a visual format. In airport environments, it is fairly common for the PA system to have visual paging capabilities so that voice announcements can be converted to text and displayed on information display monitors (see Section 3.4.3.4) to allow those with hearing impairments access to the announcement information. Hearing loops, an assistive listening technology more common in Europe than the United States, greatly improve the audibility of PA announcements for passengers using hearing aids (see description in Section 3.4.3).

Large, open spaces in airports often include many hard surfaces. Therefore, a key architectural consideration is the design of PA system acoustics to mitigate or compensate for acoustically active spaces.

3.4.3.2 Emergency Notification

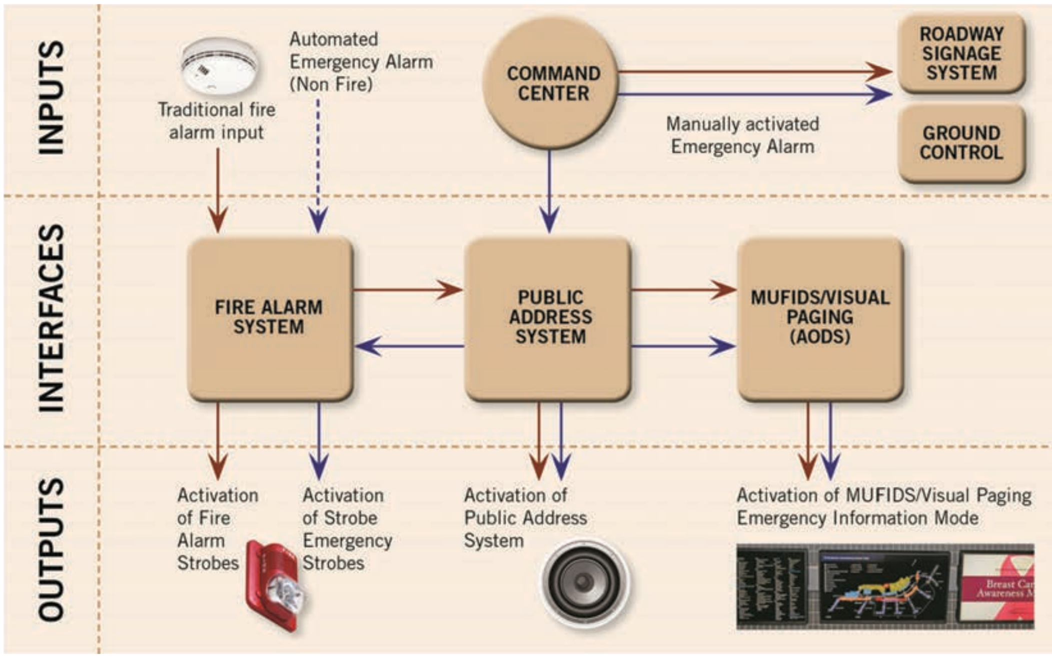
An emergency notification system is a method of facilitating the one-way dissemination or broadcast of messages to one or many groups of people, alerting them to a pending or existing emergency. There are established guidelines and policies for making emergency notifications accessible to people with disabilities (mobility, visual, hearing, and cognitive).

The National Fire Protection Association (NFPA) *Emergency Evacuation Planning Guide for People with Disabilities* was developed in response to the emphasis that has been placed on the need to properly address the emergency procedure needs of the disability community (2016). This guide addresses the needs, criteria, and minimum information necessary to integrate the proper planning components for the disabled community into a comprehensive evacuation planning strategy. The guide includes government resources and text based on the relevant code requirements, and ADA criteria.

3.4.3.3 Mass Notification

The term "mass notification system" (MNS) refers to a system that manages people's actions during and after an emergency. These systems are designed to provide information and instructions to people in a building, facility, campus, or larger geographic area using intelligible voice communications, visible signaling, and textual and graphical information. (Figure 3-54 shows a diagram of an airport MNS.) These systems can be used to send alerts and notifications system-wide or to specific zones or coverage areas, as required by the event or events taking place to inform those in the affected area. Events that would utilize these systems include fire, terrorist attack, biological and hazardous chemical release, weather or other acts of nature, or any other event requiring control of the movement of a large group of people.

The PA system is normally used for the audio component, while the fire alarm system will be used as the visual signaling component. The ADA Standards specify that emergency preparedness and response programs be accessible to people with disabilities, including emergency mass



Source: Airport Consultants Council

Figure 3-54. Typical integrated airport MNS diagram.

notification and access to information. Modern MNSs meet accessibility requirements by sending out a given message in multiple formats at the same time: SMS text, email, social media, web, recorded voice messages, or text to speech, etc. (Reference http://www.omnilert.com/mass-notification-systems/). They can also integrate existing emergency investments, such as beacons, digital signs, loudspeakers, fire alarms and PA systems.

3.4.3.4 Visual Paging

Visual paging systems, widely used at U.S. airports, reproduce content of voice pages in a text format and are displayed on the information display system monitors. While visual paging benefits all customers, it is particularly important to customers who are deaf or hard of hearing. Visual paging displays can be located anywhere in the airport where there is a need or desire to relay information in a visual format. The trend at many U.S. airports is to dedicate one screen of each FIDS to visual pages. Such messages may also scroll at the bottom of TV monitors in holding rooms. Visual pages can also be displayed on the airport website, as at Minneapolis St. Paul International Airport, and on airport applications. It is also important to enable customers with hearing or speech disabilities to send a page, whether through an interactive visual paging kiosk, as at Phoenix Sky Harbor International Airport (see Figure 3-55), or by email or text to the airport call center.

Visual paging displays can show these and other types of messages:

- Security checkpoint instructions
- Terminal-wide informational messages
- Courtesy announcements
- Final call messages
- Emergency messages
- Advertisement media
- Public service messages

Source: Phoenix Sky Harbor International Airport

Figure 3-55. Paging assistance location at Phoenix Sky Harbor International Airport.

3.4.3.5 Automated Boarding

Automated boarding announcements are generated by integrated voice/visual paging and a FIDS (see Figure 3-56). This information can be directed to the specific zone of the associated gate or on as many screens as necessary.

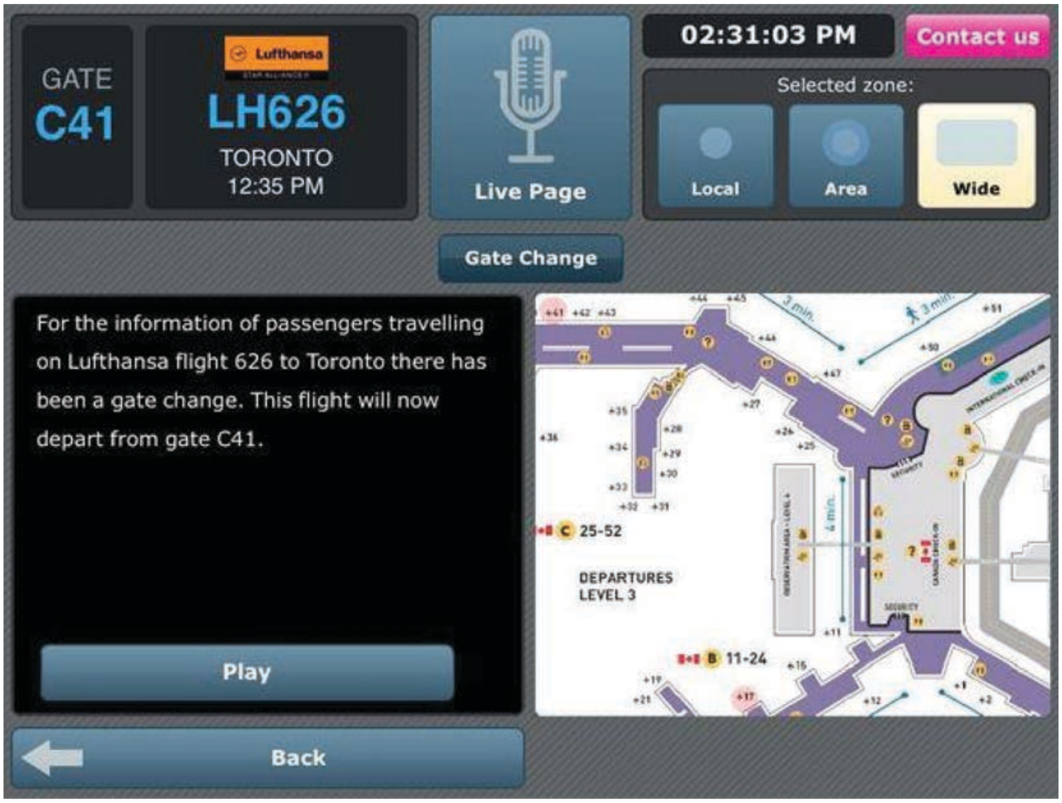
3.4.3.6 Audio Messaging

Some systems have been developed to assist people who are print-disabled, are blind, or have other visual impairments to navigate the environment with less dependence on others. Audio messaging systems utilizing remote infrared audible signage (RIAS) provide a repeating, directionally selective voice message, which originates at the sign and is transmitted by infrared light to a hand-held receiver some distance away. The directional selectivity is a characteristic of the infrared message beam. The intensity and clarity of the message increases as the sign is "pointed at" or approached. This ensures that the people using the Talking Signs® system can choose to get feedback about their relative location to the goal as they move toward it.

RIAS assists people who are print-disabled, blind, or have other visual limitations to navigate the environment with less dependence on others. The Step-Hear Ltd. website (www.step-hear.com) provides additional technical information and video on how RIAS works. Note that this type of system is being superseded technologically by mobile applications using indoor geolocation, but there may be facilities where RIAS is still an appropriate accommodation.

3.4.4 Mobile Applications

Mobile applications are software applications that run on mobile devices and tablets and have further revolutionized the way individuals use their smartphones and mobile devices.



Source: Frankfurt Airport

Figure 3-56. Visual paging/automated boarding.

Applications can be downloaded to the user's smartphone or tablet PC to provide a particular service or allow the user to interact with their device in a specific way. "Wayfinding" applications are part of a growing trend among airlines and airports to use smartphones along with other technologies to make the airport experience smoother and less stressful.

The two most predominant technologies utilized along with mobile devices to aid in indoor wayfinding are Wi-Fi and Beacon Localization. Regardless of which technology is used, airport and airline applications should be fully accessible for smartphone users who use VoiceOver, most notably those with vision loss.

For additional information on mobile applications, reference Chapter 8.

3.4.4.1 Wi-Fi Localization

Wi-Fi localization is one approach to providing accurate mobile application wayfinding. As evidenced in the prototype mobile application studied as part of the research for this report, accurate user location data are required to guide users of all disabilities and particularly those with low vision or who are totally blind. Wi-Finding, or localization via Wi-Fi, requires, at a minimum, two devices: (1) a Wi-Fi access point and (2) a user with a Wi-Fi-enabled device.

The accuracy of localization using strictly Wi-Fi access points is based on two factors: (1) the number of access points a device can see from a given location and (2) the frequency at which a user's device searches for Wi-Fi when not connected to a Wi-Fi system with a device or via the device's application. In order to accurately determine a device's position, the device must be visible to three Wi-Fi access points. This allows the location-determining algorithm to determine an X, Y, and Z location point on a map based on the signal strength from three points.

In the case where a single access point is available, the location can only be determined in a radius based on signal strength. When only two access points are available, the location can be determined in the intersection of two radii. Only when three access points are available (see Figure 3-57) can the convergence of three radii be used to determine an exact location. When a user is attempting to use features or applications that require a high accuracy of localization, for example, a user with low vision or blindness, the minimal levels of acceptable location error cannot be achieved by accessing fewer than three access points. Research has demonstrated that airport Wi-Fi networks rarely have enough access points deployed for devices to recognize three or more points at any given location in the airport, as it is not feasible or necessary for the primary function of the Wi-Fi network, which is to provide airport users with connectivity to the Internet.

The benefits of Wi-Fi localization are the following:

- It can leverage existing airport Wi-Fi access points.
- Existing access points typically gather information to allow localization services by applications without additional cost or integration.
- Wi-Fi access points can serve dual roles, allowing access to Internet services and providing device location data.

The limitations of Wi-Fi localization are that

- It requires a high number of access points for accurate location services.
- The triangulation process may be too slow for effective use given typical Internet speeds available in airports.

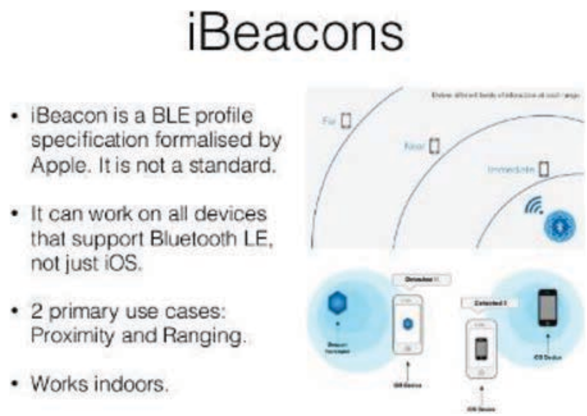
3.4.4.2 Beacon Localization

Public areas are introducing beacons to buildings (see Figure 3-58) as a way to bring indoor mapping and real-time interactive navigation to the mainstream. The beacons, which run on Bluetooth technology and cost about $20 each (if battery operated) to install, sync with a smartphone application that pushes information to users as they walk by locations where beacons are installed.

A beacon-based application uses voice technology to tell users to make a left or right turn or highlights key points as users walk by, bringing attention to everything from gates and restaurants to power outlets, ATMs, and restrooms. This type of mobile application aims to help travelers, including those with vision loss, get from the curbside drop-off area all the way to their gates.

Source: Apple

Figure 3-57. Wi-Fi localization.



Source: Apple

Figure 3-58. iBeacon graphic.

One limitation of beacon-based systems is that when there are walls, vegetation, furniture, or other items in the vicinity, the radio signal will be affected by reflection, absorptions, and other factors. As a result, inaccuracy can be twice the radius of the circle around the beacon, which can be up to 50 to 100 meters. To provide adequate coverage, an airport may need hundreds, if not thousands, of beacons. Filling all the gaps requires intensive, iterative geo-analysis.

The benefits of beacon localization are the following:

- Beacons are relatively inexpensive and easy to install (battery operated).
- Beacons have multiple power options giving flexibility in the range of accuracy.
- Beacons are available as hardwired for power, requiring no changes in battery.

The limitations of beacon localization are the following:

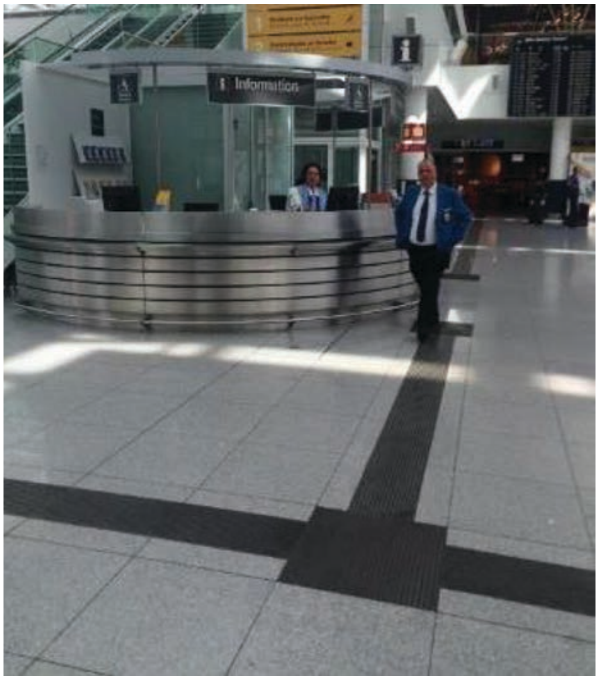
- It requires a high number of beacons for accurate location services.
- Beacons do not gather data/information.
- Locating and maintaining failed devices is time consuming.

3.5 Tactile

The 2010 ADA Standards include specific tactile requirements for signage, both Braille and raised print. North American airports are typically lacking in other types of tactile information that can aid those with vision loss to find their way independently. For example, there is no requirement in the ADA Standards for directional signage to be tactile. TGSIs have only limited usage in the United States, typically in the form of truncated domes to alert passengers to areas of danger such as crosswalks and platform edges.

In European airports such as Munich Airport, TGSIs, more commonly known as "guiding tiles," guide customers to the information desk where they can request assistance and help them to find the accessible ticket counter or continue on to the security checkpoint area (see Figure 3-59). Tactile routes can also lead to key points of interest including vertical transitions in the customer journey such as elevators. In French SNCF rail stations, TGSIs are used in conjunction with Talking Signs. Use of "guiding tiles" is also a common practice in Asian airports.

Other uses of tactile information can be less obvious. For instance, clear delineation between a hard surface floor in the main concourse and a soft, carpeted surface in a hold-room seating area creates a shoreline that can provide a detectable, navigable path. A similar concept can also be applied to the boarding gate area. For those with low vision, contrasting light and dark colors



Source: ACRP Project 07-13 Research Team

Figure 3-59. Tactile routes leading to the information desk, elevator, and accessible ticket counter at Munich Airport.

provide an additional cue (see Figure 3-60). Contrasting color and texture can also be used to delineate a path across a large, open space or alert customers that they are approaching a set of stairs, an escalator, or a moving walkway. In the latter instance, such cues improve safety for all customers, including those with vision and cognitive disabilities (see Section 2.2, Universal Design Principle 5).

Visual and tactile signage is required for all permanent rooms and spaces, e.g., restrooms, placed at the height and location specified under the ADA Standards. Other tactile signage

Source: © Chris Cunningham, Courtesy of Gresham, Smith and Partners

Figure 3-60. Detectable floor edges in the gate area at Atlanta's Maynard H. Jackson Jr. International Terminal.

Source: ACRP Project 07-13 Research Team

Figure 3-61. Tactile and Braille sign at Philadelphia International Airport.

requirements include elevator controls and signs, exit doors (including exit passageways, discharge, and stairways) and emergency two-way communication systems. An airport may choose to install additional tactile signage that is necessary to the wayfinding experience of travelers with vision loss (see Figure 3-61). It is important to have the Braille on signs proofread by a person who can read Braille.

3.6 Wayfinding and Services Gap Analysis

As noted previously, applying the three Vs of communication to each journey segment will help airports identify information gaps that can result when information is presented in only one mode. Applying the three Vs of communication to wayfinding involves the same information being presented and accessed in different ways because people with and without disabilities process information differently. For example, when visual signage might be insufficient for a passenger, verbal wayfinding can fill in the gaps. When virtual information isn't enough for a passenger, architectural cues can help guide the passenger.

However, applying the three Vs of communication to providing wayfinding information can be a major challenge for an airport. This is because personnel responsible for managing different types of information often work in different departments. Consequently, buy-in from an airport's senior management is an essential step to developing intra-departmental coordination that achieves the optimum level of *consistency* across all forms of communication.

There are "reactive" and "proactive" approaches to analyzing wayfinding problems. Regardless of the method used, the analysis should result in a recommended plan of action for improving an airport's wayfinding system. Note that U.S. airports are required by the ADA Standards (28 CFR § 35.105) and Section 504 [49 CFR § 27.11(c)(2)] to conduct self-evaluations and to take appropriate remedial action. Additional information on this requirement is available from the FAA Office of Civil Rights—Airport Disability Compliance Program.

3.6.1 Reactive Approach

A reactive approach is typically inspired by customer complaints. A key step in analyzing a customer complaint regarding wayfinding is to determine the true nature of the problem. Often, the assumption is that the problem is with the signage, but this is not always the case, as in the following example:

> An airport employee works on the third level of one of several terminals. Ground transportation services operate on Levels 1 and 2 of the roadway (there is no Level 3 roadway). The employee keeps running into passengers near his/her office on the third level who are looking for a particular shared-ride van company. Curious as to why this was happening, the employee checks with one of the passengers, who mentions that the reservation clerk directed him to the "upper level." Terminal A has only two terminal levels, and the clerk's instruction to go to the "upper level" would be correct there, but not in Terminal B, which has three levels. In this instance, the problem was a verbal communication issue rather than a signing issue.

The key point here is the importance of taking the time to track down the source of the problem in order to determine its true nature. Without this type of effort, the temptation is to try and solve the perceived wayfinding problem by adding more signs. In truth, adding more signs in an attempt to fix the problem rarely solves anything, and in most cases makes the problem worse by creating visual clutter and information overload. These types of solutions only serve to undermine the clarity that a well-planned wayfinding system should provide.

When investigating a comment where the problem is the signs, the airport should first seek to understand the circumstances under which the problem occurred. Consider where the person was, where they wanted to go, the time of day, and what their actions were at that time (Were they talking on the phone? Were they walking and talking with others?). Next, investigate the site and assess the environment. Are there potential distractions around the signs such as floor objects or advertising that competes for attention? Is there insufficient lighting? Also, check to see if there were other passengers who had a similar problem by asking people who work in the area.

Observation is also an excellent tool in assessing a problem. Simply observe the problem area for an extended period of time, and when a customer appears confused, ask them why. Doing this can provide valuable insight into how people navigate through the space. Finally, review the signing in the area and take note of any factors that may have led to the customer's complaint.

3.6.2 Proactive Approach

A proactive approach is based on evaluating the current wayfinding system. Physically walk each journey segment evaluating what information is needed (visual, verbal, or virtual) from the point of view of an older adult and a person with vision loss, hearing loss, cognitive disability, or reduced mobility. Walking each wayfinding segment with these perspectives in mind will help reveal the diverse communication needs of aging travelers and persons with disabilities, and how often backup is required, i.e., more than one mode of communication to meet the needs of customers who may be sighted and customers who may be blind.

In addition to an airport staff review, contact local community disability advocates to have persons with each specific disability visit the airport to participate in a proactive evaluation of each journey segment. Consulting disability organizations is specifically mandated under the ADA Standards and Section 504 (See FAA Advisory Circular 150/5360-14A, Section 2.2.4 Self Evaluations). If the airport has a disability advisory committee, its members will often help.

This report provides tools designed to help an airport conduct a Wayfinding and Services Gap Analysis, including a Wayfinding Accessibility Audit Checklist and virtual airport models with illustrated narratives of each journey segment (see Appendices A and C). There are details on how to use these tools to apply the different forms of communication covered in each of the subsequent journey segment chapters for arriving, departing, and connecting customers. A brief overview of several ways of communicating information is listed below.

3.6.3 Other Important Considerations

Wayfinding and the ways in which information is communicated should be part of every planning effort associated with airport growth and expansion. The goal should be to strive for consistent application of the sign standards airport-wide. All too often, a new terminal will generate a new look for the wayfinding system without considering the current wayfinding system in the existing airport area. The result conveys an inconsistent visual message to the customer.

Whether it is part of an overall planning project or an effort to correct a problem, it is very important to take one final step and evaluate how the change affects the overall wayfinding and communication chain before implementing any new signage or other forms of communication. Frequently, a change will focus only on the extent of construction or too closely on a specific decision point without proper consideration of the impact on the wayfinding experience that leads into, through, and past the change(s) being considered. It is critical that all messaging remains consistent throughout the customer's journey because you do not want to inadvertently create a new problem while trying to fix the original one.

3.7 Summary

Airport wayfinding information can be

- Visual
  - Directories.
  - Informational signage.
  - Flooring.
  - Landmarks.
  - Lighting.
  - Wayfinding signage.
- Verbal
  - Auditory cues at key transition points like entry and exit vestibules, elevators, etc.
  - Auditory instructions from mobile applications.
  - Emergency notification.
  - Mass notification.
  - PA systems with improved sound quality throughout all areas of the terminal.
  - Hearing loops.
  - Talking signs or signals.
  - Verbal person-to-person communication that is consistent with all other forms of communication, e.g., signage reads: "Train to . . ." and person says: "Take the automated people mover to . . ."
- Virtual
  - BIDSs.
  - FIDSs.
  - GIDSs.
  - Interactive directories and kiosks.

  - Mobile applications.
  - Virtual concierge.
  - Visual paging/automated boarding.
- Tactile
  - Tactile pathways leading from primary origination points to key destinations, e.g., from the terminal entrance to an information booth, accessible ticket counter, elevators, etc. (Not applicable for North American airports).
  - Tactile and Braille signs for permanent room identification, elevators, and key touch points such as floor-level directories for the interior and exterior of elevator cabs.
  - Tactile markings at all transition areas, such as stairs and escalators.

In summary, an important takeaway from this chapter is that applying a holistic approach so the three Vs of communication can work in tandem is critical to establishing a successful wayfinding system that communicates information *consistently* in all forms. Using this strategy enables airports to reach the greatest percentage of their customer base, including aging travelers and persons with disabilities, and helps these passengers reach their goal of traveling independently.

CHAPTER 4

Airport Planning and Design Considerations

Planning is the foundation for successful implementation of the recommendations and requirements in this guidebook. The guidance on airport planning and design provided in this chapter presents (and in some cases elaborates on) recommendations/requirements listed in the Wayfinding Accessibility Audit Checklist presented in Appendix A of this guidebook.

The Wayfinding Accessibility Audit Checklist is a checklist of recommendations/requirements to be considered in an assessment of an airport's wayfinding accessibility. All of the recommendations/requirements in the checklist are numbered and labeled to correspond to a particular chapter and section in this guidebook.

Six sections in this chapter have a corresponding two-letter section code. This two-letter code is combined with a letter "P" prefix for "Planning" and a numerical suffix to create a unique label for each recommendation/requirement (see Figure 4-1). These recommendations/requirements are presented and discussed in the appropriate section throughout this chapter. (Section 4.7 does not have a code because it does not include recommendations or requirements.)

In the Wayfinding Accessibility Audit Checklist, each labeled recommendation or requirement is grouped according to chapter and section and characterized according to form of communication (visual, virtual, and/or verbal), the types of disabilities accommodated (vision, hearing, cognition, and/or mobility), and any known standards or additional guidance available (see Figure 4-2).

To help provide a visual reference for the recommendations/requirements in the Wayfinding Accessibility Audit Checklist, the research team developed virtual models of different journey segments at an airport with the recommendation/requirement labels embedded (see Figure 4-3). Virtual models of journey segments are compiled in Appendix C.

4.1 Planning and Design (PD)

As noted in the introduction in Chapter 1, the key objective of this guidebook is to help airports successfully *communicate* information to aging travelers and persons with disabilities to help them *find their way* using the *principles of universal design.* Positive results will be realized through understanding and consistent application of these three components by airports, planners, and designers in every project.

Research has proven time and again the number one factor impacting wayfinding in airports is the physical design of the airport itself. Universal Design Principle 3 is simple, intuitive use; this means that the design is easy to understand regardless of the user's experience, knowledge, language skills, or current concentration level.

It is easy to assume that airport terminals with a symmetrical design are a simple and logical solution, but in reality they can create orientation difficulties for passengers because too many

Section #	Section Description	Section Code
4.1	Planning & Design	PD
4.2	Staff Training	ST
4.3	Database Environment/Management	DB
4.4	Website	WS
4.5	Mobile Application	MA
4.6	Call Center	CC

P-PD.01

Source: ACRP Project 07-13 Research Team

Figure 4-1. Chapter 4 matrix and example of a recommendation/requirement label.

spaces and circulation paths look the same. Hartsfield-Jackson Atlanta International Airport's domestic terminal, Denver International Airport, and Tampa International Airport are notable examples featuring dual curbsides and a symmetrical terminal in between. All three of these terminals rely on red/blue color coding to differentiate between the two sides (see Figure 4-4). Spaces with unique and memorable features tend to be easier to navigate and should be a primary consideration during the planning and design process for all new renovation and expansion projects.

P-PD.01 The needs of populations with special needs are addressed during project planning and design, and persons with these disabilities are included in the planning and design process.

Chapter 4

Wayfinding Audit Checklist

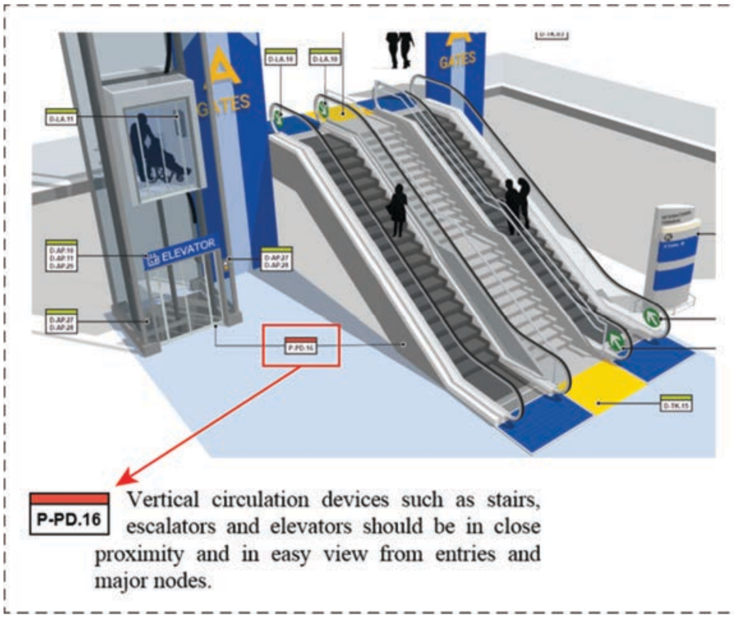
PLANNING (P)

REF #	Recommendations & Requirements	3V's	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
Section 4.1: Airport Planning & Design (PD)								
P-PD.01	The needs of populations with special needs are addressed during project planning and design and persons with these disabilities are included in the planning and design process.	Visual Virtual Verbal	X	X	X	X	*Canadian Transportation Agency, 2007*	
P-PD.02	When developing new facilities (or technologies) or upgrading them, universal design principles are used to ensure their use by all travelers to the greatest extent possible without needing specialized design.	Visual Virtual Verbal	X	X	X	X	*Canadian Transportation Agency, 2007*	
P-PD.03	Airports are designed intuitively to minimize reliance on signage; spatial organizations and architectural features support good wayfinding.	Visual Virtual Verbal	X	X	X	X	*Canadian Transportation Agency, 2007; Salmi, 2007; Levine, 2003*	

P-PD.03 Airports are designed intuitively to minimize reliance on signage; spatial organizations and architectural features support good wayfinding. (Reference section 3.2.2.4)

Source: ACRP Project 07-13 Research Team

Figure 4-2. Excerpt from Wayfinding Accessibility Audit Checklist, Chapter 4.



Source: ACRP Project 07-13 Research Team

Figure 4-3. Example of recommendation/requirement labels embedded in a virtual airport model and recommendation/ requirement text.

The first step is reaching out to local advocacy groups and engaging aging travelers and persons with disabilities. Experience has shown that these groups welcome and appreciate the opportunity to be involved in either the planning process for new design projects or the evaluation of existing conditions. There will be times when an airport cannot make every accommodation, but experience has also shown that when the reasons are explained along with what can be done, local advocacy groups bring a spirit of cooperation to working with the airport. The result is a win-win for both the airport and customers. Every airport is required to have an Americans with Disabilities Act (ADA) Coordinator (required by ADA Section 504/§ 27.13) who can help

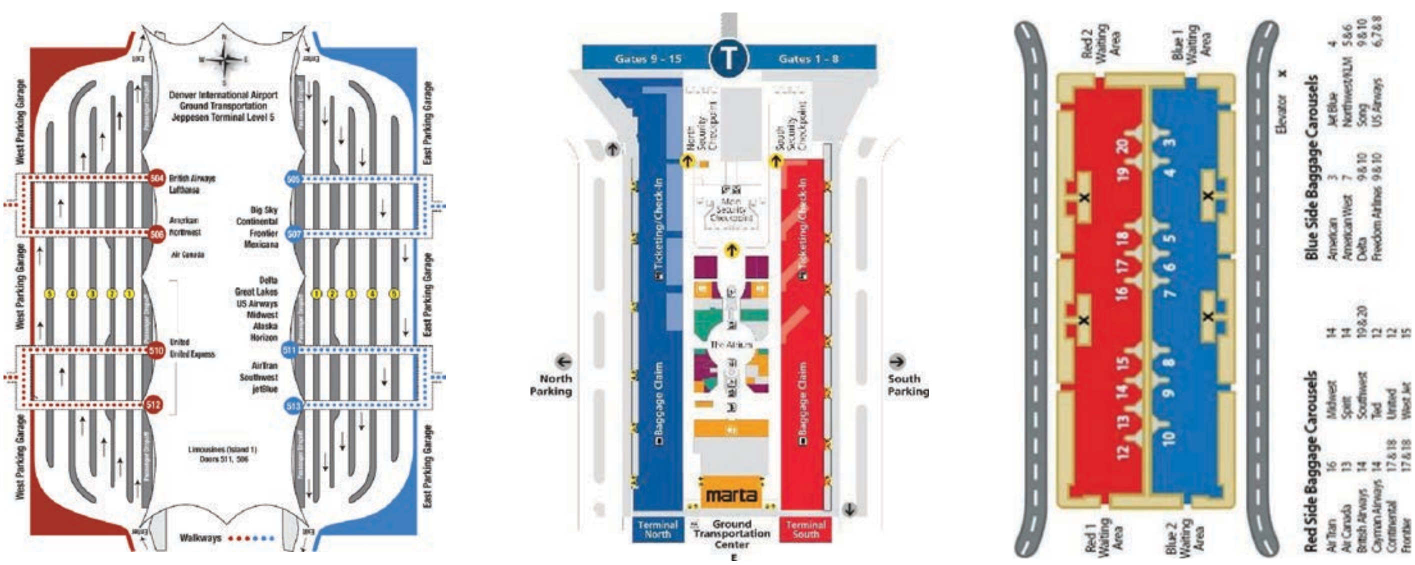


Figure 4-4. Comparison of symmetrical airport terminals: Atlanta, Denver, and Tampa airports.

facilitate this process. Airports with a disability advisory committee (see Section 2.10) can easily reach out to members whenever changes to a facility or technology are being considered.

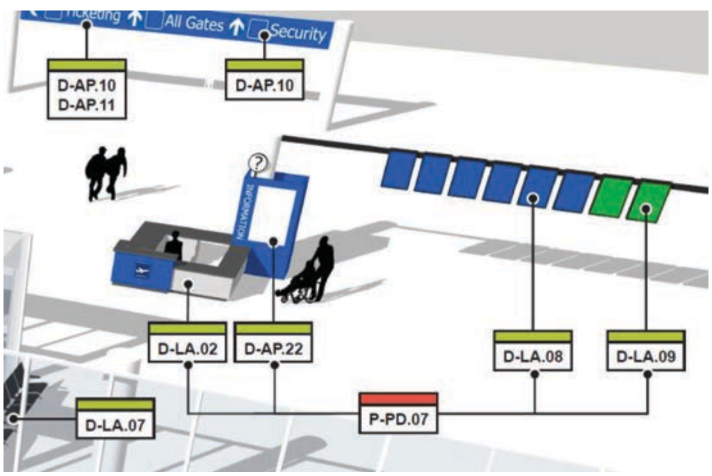
P-PD.02 When developing new facilities (or technologies) or upgrading them, universal design principles are applied to ensure their use by all travelers to the greatest extent possible without needing specialized design. (See Chapter 2 for more information on universal design principles.)

P-PD.03 Airports are designed intuitively to minimize reliance on signage; spatial organizations and architectural features support good wayfinding. (See Section 3.2.2.4.)

P-PD.04 Optimum lighting levels are provided throughout the airport at all times of day to support lip reading, reading signs, etc. (See Section 3.2.1.4.)

P-PD.05 A comprehensive wayfinding system is implemented to minimize the need for asking for directions (based on the three Vs of Communication). Key elements covered in this guidebook are planning, as described in this chapter, and placement, as described in Section 3.2.2.3 of Chapter 3. See *ACRP Report 52* for additional information (Harding et al. 2011).

P-PD.06 Background noise levels are reduced by providing soundproofing in some areas, such as information desks, and through the selection of building materials.



P-PD.07 There are planned adjacencies at key decision nodes for information sources: Virtual, e.g., FIDS; Verbal, e.g., staff positions and information desks; Visual, e.g., airport directories, etc. (Also reference D-LA.02)

As noted in previous chapters, people in general perceive and process information differently, which is similar in practice to the communication needs of aging travelers and persons with disabilities. Therefore, having the same information available in different forms of communication helps all customers.

In large, complex environments, adjacency of the various forms of communication is very important, especially at key decision points in the customer journey (see Figure 4-5). For example, a person who is blind or has low vision cannot access information from the airport directory, so having an information desk nearby is key to their staying on track. Similar redundancy of information is needed for customers with other types of disabilities.

P-PD.08 Landmarks are incorporated during the planning and design process using distinct, recognizable shapes. Landmarks are located at key decision points so they are detectable from as many positions as possible without interrupting the path of travel. Landmarks are developed as part of a system to make different parts of the site as noticeable and memorable as possible. Where possible, primary landmarks incorporate tactile, sound, and visual indicators. (See Section 3.2.2.5.)

Source: ACRP Project 07-13 Research Team

Figure 4-5. Adjacency of different types of communication at Amsterdam Airport Schiphol.

P-PD.09 Signage is legible (see Section 3.2.1.5), uncluttered, and easy to follow with no gaps or disconnects, and signage inventories are developed to remove redundant signs and reduce visual clutter. (See Section 3.2.2.1.)

P-PD.10 Color is used to reinforce wayfinding but not as a primary wayfinding strategy. (See Section 3.2.1.2.)

P-PD.11 Sign messaging uses plain language, not airline/airport jargon. (See Section 3.2.2.2.)

As an example of the importance of plain language, consider the use of the word "gate" versus the word "concourse." Concourse is an architectural term that is not always well understood. It can be particularly confusing for connecting passengers who arrive in an unfamiliar airport at an "A Gate" and need to find a "B Gate." All they are looking for is their connecting gate, and the word concourse has no real value in communicating information in the simplest terms. Use terms like A Gates, B Gates, etc.

P-PD.12 Large, unadorned, illuminated fonts are used for directional signs. (See Sections 3.2.1.4, 3.2.1.5, and 3.2.1.6.)

P-PD.13 Symbols are used consistently with messaging on signs. Familiar or easy-to-learn pictograms are used to reinforce text and bypass language-based information. (See Section 3.2.1.7.)

P-PD.14 Pictures are used on signs to help persons with intellectual disabilities navigate.

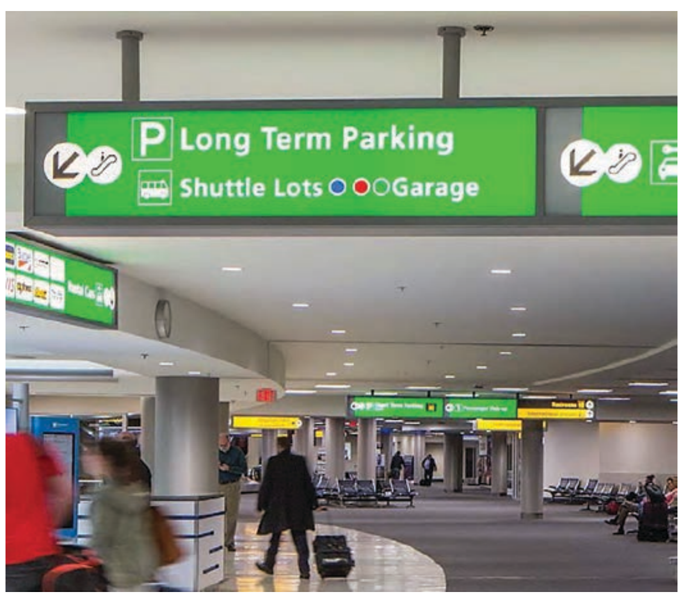
As shown in Figure 4-6, a pilot program at Dallas Fort Worth International Airport used pictures on signage explaining the divestment process. Efforts like this can help persons with intellectual disabilities navigate their way through a security screening checkpoint, as well as reduce anxiety during one of the most stressful parts of traveling.

Source: Dallas Fort Worth International Airport website – www.dfwairport.com

Figure 4-6. Security screening information presented using pictures—Dallas Fort Worth International Airport.

P-PD.15 Arrows are consistently applied. Plain language is used: "straight ahead" instead of an arrow pointing up or down when there is risk of being confused with "upstairs" or "downstairs." Conversely, the words "upstairs" or "downstairs" are used when communicating guidance through non-intuitive vertical transition wayfinding scenarios. Use of diagonal arrows is avoided when possible. (See Section 3.2.1.8.)

Bundling of a diagonal arrow with a symbol representing the method of vertical transition, as shown in Figure 4-7, can add visual clarity in potentially confusing areas.



Source: AECOM

Figure 4-7. Angled arrows bundled with escalator symbol.

P-PD.16 Vertical circulation devices such as stairs, escalators, and elevators are in close proximity and in easy view from entries and major nodes.

P-PD.17 In multistory buildings, elements such as restrooms, elevators, and exits are organized in the same location on each floor.

To help make the vertical circulation more intuitive at locations with more than one elevator, program the elevator to "home" at the most important level and have the doors open. Enhance lighting around the elevator to help persons with disabilities find hard-to-see locations.

P-PD.18 "You Are Here" maps are designed with correct, forward-facing orientation to match the direction the viewer faces when using the map.

Very few airports will be able to get by with only one map orientation; therefore part of the planning and design of "You Are Here" maps is to account for the number of ways the location of each map will face (See Section 3.4.1.3).

P-PD.19 Maps and graphic information are used to communicate and emphasize the form of circulation at primary nodes rather than secondary nodes.

4.2 Staff Training (ST)

Research from a report from the UK Department for Transport (Department for Transport [UK] 2008) showed how staff attitudes toward aging travelers and persons with disabilities were often cited as the single most important aspect determining satisfaction with a service. The report goes on to emphasize the importance of good training to ensure that these customers are likely to receive a high level of customer service, to travel more easily, and to take away a favorable impression of the airport.

P-ST.01 Staff are trained to speak clearly and face customers directly. (See Section 3.3.1.)

To communicate with persons who are deaf or hard of hearing in a one-to-one situation, here are some things hearing staff can do to make lip reading easier for people with hearing loss:

1. Get the other person's attention before attempting to talk or communicate. Making eye contact is a good way to do this. If needed, you can use a small wave or light touch to get the person's attention. While you should be considerate and not poke people, generally it is not considered rude in deaf communities to lightly touch people you do not know to get their attention. The shoulder is a good place to touch someone you don't know well; use a couple of short taps.
2. Speak slowly and clearly, but do not yell, exaggerate, or over pronounce. Exaggeration and overemphasis of words distort lip movements, making speechreading more difficult. Try to enunciate each word without force or tension. Short sentences are easier to understand than long ones.
3. Do not place anything in your mouth when speaking. Mustaches that obscure the lips, pencil chewing, and putting your hands in front of your face all make it difficult.
4. Maintain eye contact with the person who is deaf. Eye contact conveys the feeling of direct communication. Even if an interpreter is present, continue to speak directly to the customer. He/she will turn to the interpreter as needed.

5. Do use a lot of facial expressions. Visual cues like a facial expression or a gesture can go far in helping a person with hearing loss to make sense out of what they are trying to lip read.
6. Provide good lighting or stand or sit where there is good lighting. Avoid standing in front of a light source such as a window or bright light. The glare and shadows created on the face make it almost impossible for a person who is deaf to lip read.
7. Use gestures and visual cues. Point to or hold up any items that you are talking about and wait until the person is looking at you again before you resume speaking. You can also mimic actions like drinking or jumping or eating to illustrate your words. Hold up fingers to indicate numbers, scribble in the air to show you're writing a letter, and similar gestures.

P-ST.02 Public announcements to support successful trip execution are made in both visual and audible formats. Staff training—audible formats include plain language, spoken clearly and slowly, so as to be more easily understood. (See also D-GA.49.)

4.3 Database Environment/Management (DB)

P-DB.01 Data environment, data management tools, and information management policies to manage all accessibility-related information for the airport are in place.

Here is an example of why this is important: in case of an elevator outage, alerts will be sent to airlines, airline service companies, ramp agents, and information desks with details on alternate routes. Alerts could also be sent to the airport website and airport application.

Performing an ADA audit of the physical features of the facility and storing those assets with accessible features in a geographic information system (GIS) database is one way to catalogue, maintain, and manage these assets. GIS databases can also be leveraged by other virtual systems for wayfinding, such as interactive displays, websites, and mobile applications. Various technologies that provide wayfinding information to passengers should be set up, and the user should be able to query them to select accessible routes. When querying the GIS database, the technology (web, mobile, or interactive wayfinding kiosk) can look for key criteria such as ACCESSIBLE and return a route to a user using only wayfinding points associated with the database entry ACCESSIBLE. More information on the database interaction can be found in Chapter 8.

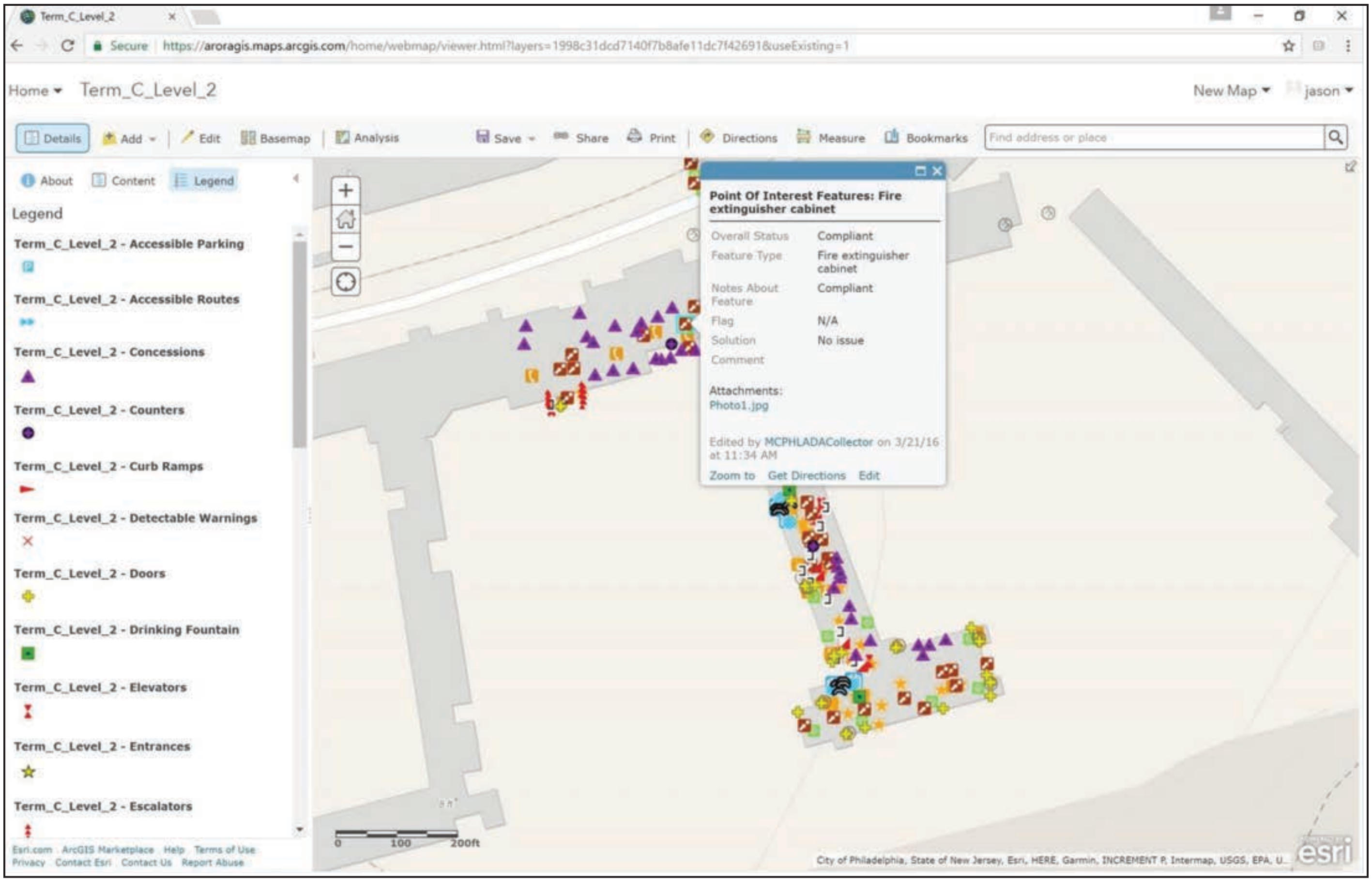
An example of collecting accessible feature data in a GIS database can be found in Figure 4-8. In the example, each feature is identified by a different symbol (e.g., elevator, ramp, public phone, drinking fountain, etc.) as well as a description of specific characteristics. The GIS database can also link photos of the assets as well as historical construction data, drawings, maintenance data, and age.

4.4 Website (WS)

Aging travelers and persons with disabilities will often seek out information as part of their pre-trip planning process. An airport's website is an excellent means of communicating with these customers.

P-WS.01 The airport website meets Web Content Accessibility Guidelines (WCAG) 2.0.

WCAG2.0 cover a wide range of recommendations for making Web content more accessible. Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities,



Source: ACRP Project 07-13 Research Team

Figure 4-8. Example of ADA facility data collected in GIS database.

cognitive limitations, limited movement, speech disabilities, photosensitivity, and combinations of these. Following these guidelines will also often make Web content more usable to users in general. The "Web Content Accessibility Guidelines (WCAG) Overview" (http://www.w3.org/WAI/intro/wcag.php) addresses the following topics:

- Perceivable information and user interface
  - Text alternatives for non-text content
  - Captions and other alternatives for multimedia
  - Presentation of content in different ways
  - Making content easier to see and hear
- Operable user interface and navigation
  - Functionality is available from a keyboard
  - Users have enough time to read and use the content
  - Content does not cause seizures
  - Users can easily navigate, find content, and determine where they are
- Understandable information and user interface
  - Text is readable and understandable
  - Content appears and operates in predictable ways
  - Users are helped to avoid and correct mistakes
- Robust content and reliable interpretation
  - Content is compatible with current and future user tools

P-WS.02 The website is tested for functionality by users with a variety of disabilities.

Testing should be applied to both airport and airline websites. Testing involves outreach to disability organizations on a local, regional, or national level.

P-WS.03 Where airports provide online visual maps for pre-trip planning, they are accompanied by text maps for travelers with print disabilities including vision loss. (See Section 3.3.3.)

P-WS.04 Directories give specific locations for points of interest: restaurants, stores, and services.

As an example, on Dallas/Fort Worth International Airport's website, under "Accessibility," the following information is provided regarding the location of SARAs:

Terminal D

- **Inside Security**—Designated area located inside security at Gate D18 (please note that for this location, you will not need to exit the terminal or re-enter through security).
- **Outside Security**—Designated area located on the lower level, outside security at gates D15 and D29.

P-WS.05 The airline terminal directory gives exact locations for check-in and ticketing counters and whether curbside check-in is available (and its specific location), as well as for baggage claim carousels.

P-WS.06 The home page includes a link for disability-related information and resources.

Preferred location of the link is above the scroll so it is quick and easy to find (See Figure 4-9). However, research on the websites for top U.S. airports shows this link well below the scroll on most airport websites.

P-WS.07 There is a complete list of accessible airport services and facilities.

Source: LAWA.org

Figure 4-9. Home page with easy-to-find link for disability-related information.

P-WS.08 Telephone numbers (including TTY or relay service) where travelers with disabilities can receive assistance or get additional information are posted along with hours of service.

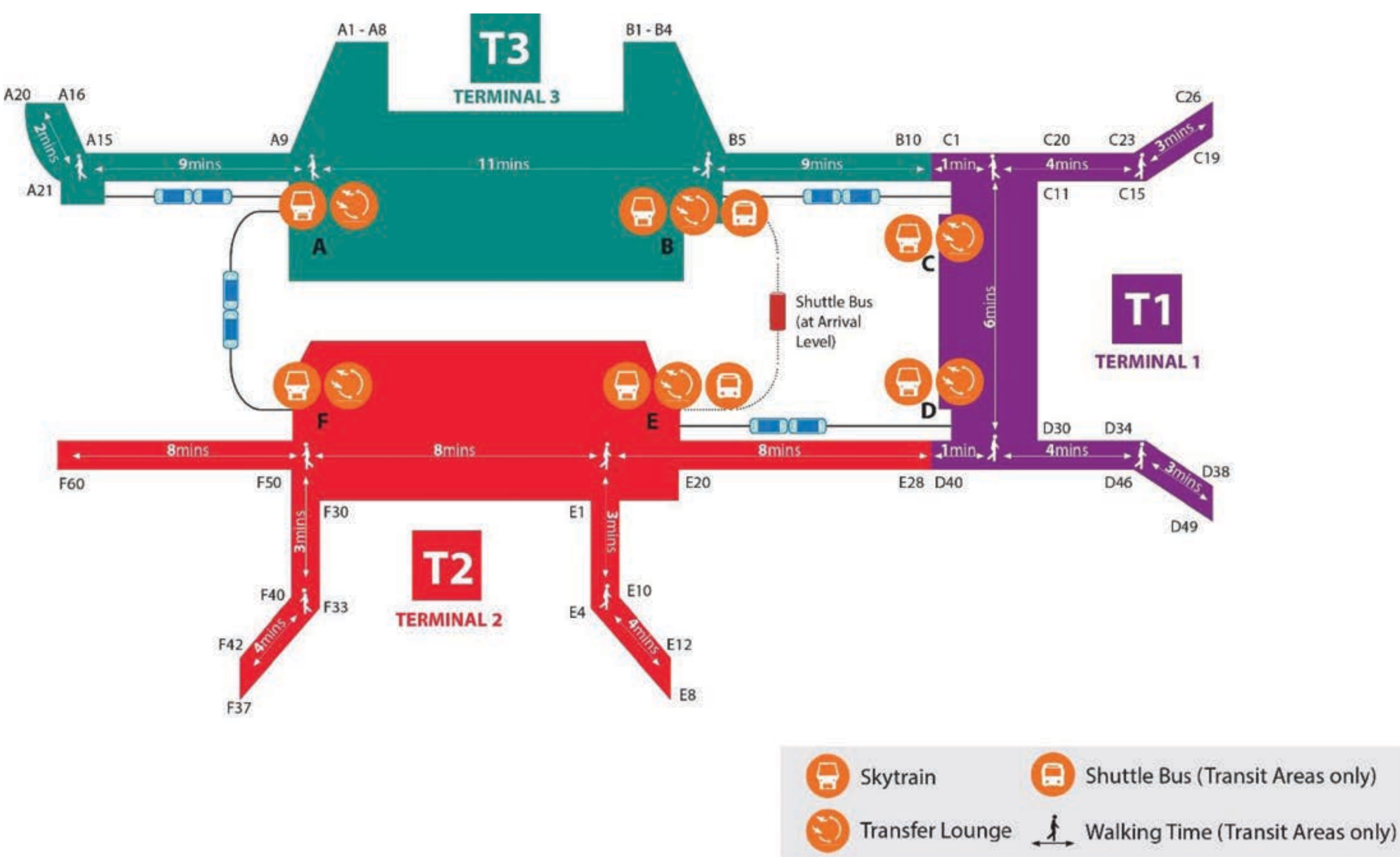
P-WS.09 Information on ground transportation options (public and private) includes details on accessibility and links to accessible providers.

P-WS.10 Where arrival points for ground transportation are remote from terminal entrances, distances or average walking times are listed and availability of moving walkways is indicated. The website also notes whether assistance and means to call for assistance (courtesy phone or kiosk) are available at these arrival points. (See Figure 4-10.)

P-WS.11 Information on airport transportation options (between terminals, on-site parking, etc.) includes details on accessibility.

P-WS.12 Information is provided on whether connections between terminals (domestic or international) are located inside or outside of security and estimated travel times.

P-WS.13 Where terminals or concourses within a terminal are connected by walkways only, distances or average walking times are listed and whether moving walkways are available.



Source: Changi Airport Singapore

Figure 4-10. Online map that shows walk times as well as ride options.

Source: ACRP Project 07-13 Research Team

Figure 4-11. Area of rescue assistance signage and emergency call button at Tampa International Airport.

P-WS.14 Distances/average walking times are provided from check-in to the furthest gate on each terminal concourse.

P-WS.15 Evacuation plans are included on the website: emergency exits and routes, evacuation elevators, areas of safe rescue, airport procedures in case of evacuation, staff training, etc.

Figure 4-11 shows ADA-compliant signage for an Area of Rescue Assistance in a parking garage at the Tampa International Airport adjacent to the emergency call button.

P-WS.16 Online virtual tour for pre-trip planning is captioned as shown in the example in Figure 4-12 that uses both captioning for those who cannot hear as well as audio for persons who are blind or have low vision.

Source: Wayfinder on Massport's Boston Logan website

Figure 4-12. Online virtual tour with both captioning and audio at Boston Logan International Airport.

4.5 Mobile Application (MA)

P-MA.01 The airport mobile application follows “Mobile Web Best Practices.” (See Chapter 8 for mobile application best practices and lists of “Do’s and Don’ts.”)

P-MA.02 The application is tested for functionality by users with a variety of disabilities.

Testing should include an evaluation phase and an execution phase. The evaluation plan includes a review of the customer’s needs and experiences during airport journey phases (planning, arriving, entering, finding, confirmation, and waiting), with a variety of human subjects who are older adults and/or those who have various disabilities (vision, hearing, mobility, and cognitive).

- The **evaluation phase** should include paper and mobile prototypes that explore how mobile wayfinding applications can take into account individuals’ mobility level and information preferences (profile)
- Employ intelligence in directions and route guidance by taking into account the user’s mobility level and information preferences in route development, and
- Display directions and route guidance in different ways to support individuals’ information preferences (resulting from varying abilities).

The **execution phase** should develop prototype test paths for a set of departure journeys relevant to persons with varying abilities. In developing the test paths include level changes and varying scenarios that would be involved in all phases of air travel (departure, arrival, and connecting) and covering five main types of disability:

- Deaf/hard of hearing
- Reduced mobility/wheelchair
- Reduced mobility/ambulatory
- Intellectual disability

During the execution phase, participants should use the mobile application prototypes during a test journey in the airport.

P-MA.03 The application can detect device/passenger location, provide filtered information by proximity or category, create accessible route guidance and help the passenger navigate the airport. Location detection can be achieved through GPS, Wi-Fi, beacons, or other techniques.

P-MA.04 The application provides a mechanism to filter information relevant to the passenger’s disability and specific needs.

P-MA.05 The application provides a “Help Me” function that enables the user to immediately communicate with airport accessibility staff or the call center (and staff can be notified of their communication preferences).

P-MA.06 Airport and airline applications are fully accessible for smartphone users who use VoiceOver (iOS) or TalkBack (Android).

4.6 Call Center (CC)

The role of the airport call center is to provide assistance to customers with information they need using forms of communication they can understand.

P-CC.01 Staff has computer access to the accessibility database as well as real-time data on irregular operations (IROPS/emergencies).

Referencing Section 4.3 regarding the database environment, it is undesirable for airport call center employees to have direct access to the GIS database; however, database translation services are a good method by which to provide call center employees an easy-to-use graphical user interface of the accessibility database.

P-CC.02 The call center has TTY or other means to communicate with people with hearing loss or speech disability such as a relay service, texting, or chat room.

Call center should also have the ability to generate voice and visual announcements that are synchronized in the terminal facility. The voice announcements are also made via looped systems. (See Chapter 8, Section 8.8.)

P-CC.03 The staff is trained in use of the TTY, relay service, etc.

P-CC.04 The staff has disability awareness training.

Basic disability training should provide an introduction to U.S. disability rights legislation, architectural accessibility standards, adaptive information technology, and guidance on how to appropriately accommodate a wide range of customers with disabilities. Training should also include demographic information and findings on U.S. travelers with disabilities as well as instruction in appropriate language and customer service skills. A tour of the airport that focuses on accessible design and technology and how travelers with disabilities function and navigate within a complex environment should be included as part of the training. In summary, disability training should provide the following:

- The definition of disability.
- Understanding of the importance of the disability travel market and its growing impact on airports.
- Knowledge of how to communicate with and assist customers with disabilities in an appropriate manner, including appropriate language and common courtesies.
- An introduction to regulatory requirements, awareness of the federal agencies and regulations governing airport programs, and structural accessibility for people with disabilities as well as administrative requirements.
- Understanding of the "building blocks" of accessibility that underlie the ADA Standards that cover all physical aspects of the airport including parking, doors, elevators, counters, restrooms, and signage.
- Familiarization with the adaptive technology used to provide equal access to information for people with sensory disabilities.

P-CC.05 The staff is trained on how to correctly give directions to people with vision loss.

Using gestures, or verbal directions such as "It's around the next corner," is not helpful. Practice and having pre-scripted messages that have been reviewed and tested will help provide a positive customer experience.

Here are four basic steps to remember when giving directions to a customer who is visually impaired:

1. Identify yourself—"Hello, my name is John"—and confirm how you can help.
2. Always refer to a specific direction—right or left—as it applies to the person you're advising. What is on your right is on the left of the person facing you.
3. Indicate the approximate distance as well as the direction to a requested location. For example: "The elevator is directly in front of you about 20 feet away. When you reach the second floor, proceed straight ahead for 20 feet to the security checkpoint."
4. If possible, provide information about other sensory cues along the way such as the sound of a water feature, rumble of a tram (see Figure 4-13), or smell of a coffee shop.

P-CC.06 Standardized directions for commonly requested routes are available in the accessibility database.

Develop pre-scripted text that has been reviewed and tested first by disability needs and then for accuracy and comprehension to provide information that is consistent with all other forms of airport communication.

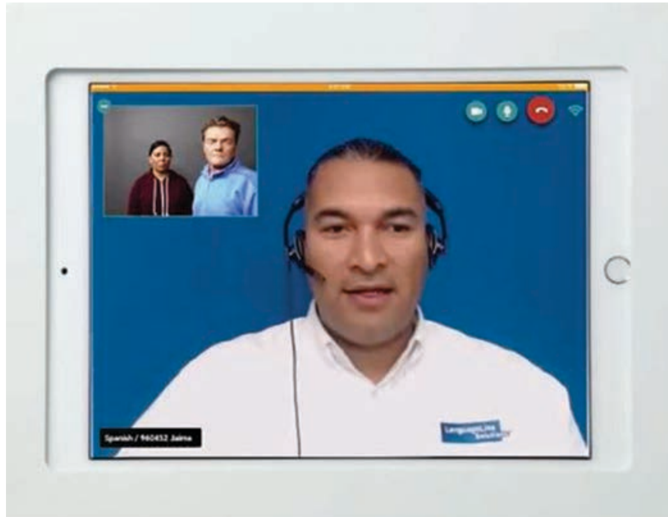
P-CC.07 The staff can assist/provide instructions to individuals using the website and mobile application.

For personnel that staff a fixed information booth or desk, provide a direct connection to the airport's website where they can access information that customers need. Roving staff who have access to the same information through tablets or mobile phones can also assist customers.

P-CC.08 The staff is fluent in English and other local languages and has access to interpreters for many languages through services like the AT&T Language Line.

Source: Atif Chaudhr

Figure 4-13. Water feature and tram at Detroit Metropolitan Airport.



Source: Language Line

Figure 4-14. Example screen of real-time video interpretation.

The AT&T Language Line enables cellphone users to connect to interpreters in seconds. Powered by Language Line Services, this simple over-the-phone audio interpretation service in 240 languages allows users to reach professionally trained interpreters 24/7. Technology also offers other no-cost options like the Google Translate mobile application (see Section 3.3.2).

Language Line now provides InSight, which offers both on-demand video (see Figure 4-14) and audio interpretation in a single mobile solution. The application replaces the need for phone lines and specialized equipment. Communication is available in 35 languages, including ASL, which represents 98 percent of the U.S. interpreting demand. The InSight application also enhances the interpreting experience by including visual cues and facial expressions in situations involving persons who are deaf or hard of hearing.

P-CC.09 Airport brochures or other print information for distribution to the public are available in alternate formats (large print, Braille, digital via email, and digital via the website) as preferred and on request.

4.7 Irregular Operations (IROPS)

As defined by *ACRP Report 65,* IROPS are exceptional events that require actions and/or capabilities beyond those considered usual by aviation service providers (Nash et al. 2012). Generally speaking, an impact of these events is the occurrence of passengers experiencing delays, often in unexpected locations, for an undetermined amount of time; see example shown in Figure 4-15.

Per *ACRP Report 65,* IROPS are caused by the following (Nash et al. 2012):

- Extreme weather
- Natural disasters
- Airport facilities
- Mechanical problems
- Labor issues

Source: ACRP Project 07-13 Research Team

Figure 4-15. Example of IROPS conditions at an overcrowded ticket area.

These events have impacts on an airline in the following ways:

- Delays
- Cancellations
- Diversions
- Crew time expiration

Impacts on the airport include the following:

- Capacity issues
- Off-hours operations
- Extended stay for customers

The impacts listed above result in passenger needs that are different from passenger needs during normal operations. During IROPS conditions, passengers may need lodging, food and water, facilities, and special services. All passengers need special attention during IROPS. However, aging travelers and persons with disabilities require a higher level of service. Experience suggests that the most important service for all passengers in these situations is communication. While it is not a written regulation in the United States, customers with disabilities should be given priority status, particularly with tasks like rebooking during IROPS conditions. When there is any delay, it is essential that communication is maintained with the customer to ensure that they understand the cause of the interruption and do not feel abandoned.

Often, the airport and/or the airline does not possess the hindsight needed to forecast future events. However, that cannot prevent those entities from communicating what they know and what efforts they are making to return to normal operations.

The myriad of IROPS situations combined with the variety of special needs for aging travelers and persons with disabilities suggests that the most effective course of action during IROPS is to first identify those with special needs and make a concerted effort to communicate directly with them, understand their individual needs, and make every effort to address those needs. While there is no recipe that will work to address the needs of those passengers, CSAs should be trained to listen to the special needs of these passengers and provide solutions as available and appropriate (see Section 4.2).

A number of airports were interviewed to determine what steps, if any, are taken to accommodate aging travelers or persons with disabilities during IROPS. Most airports already have plans in place to accommodate the needs of these passengers and provide more staffing, more busing, and more communication. The general consensus among airport operators is that these normal accommodations, enhanced with greater frequency and additional staffing, are all that is really required.

While IROPS, by definition, do not include emergency situations like terror attacks, many of the same needs must be addressed. For example, if flights are suspended overnight or longer and weather conditions necessitate sheltering in place, then a supply of cots, personal care items such as adult diapers and catheters, and so forth, may be needed. During the airport interview process, it was interesting to learn about one particular airport that faced unusual passenger needs in terms of accessing luggage during an active shooter scenario. In this case, passengers were forced to evacuate the facility without their carry-on luggage, and a number of them soon required access to medicines like insulin, which were contained in their carry-on belongings.

Mass notification systems can be a powerful and useful tool for coordinating and integrating airport systems and technology to enhance the visibility, legibility, and execution of instructions during IROPS. Mass notification systems provide coordinated messaging, both audible and visual, to passengers, depending on the notification being provided and the area of the airport being impacted. This is critical in emergency situations where it may be necessary to evacuate one area of a facility and have passengers shelter in place in other locations. Within a given area or zone, mass notification ensures the same instruction is given to passengers both visually and audibly so that no one is left out due to a sensory disability (see Section 3.4.3.3 in Chapter 3 and Section 8.10 in Chapter 8).

CHAPTER 5

Departing Customer Journey

This chapter is focused on the departing customer journey and presents and elaborates on recommendations/requirements listed in the Wayfinding Accessibility Audit Checklist presented in Appendix A of this guidebook (see below for a description of the Wayfinding Accessibility Audit Checklist).

Each of the sections in this chapter has a corresponding two-letter section code (see Figure 5-1). This two-letter code is combined with a letter "D" prefix for "Departing" and a numerical suffix to create a unique label for each recommendation/requirement. These labels are also used in the Wayfinding Accessibility Audit Checklist in Appendix A. These recommendations/requirements are presented and discussed in the appropriate section throughout this chapter.

The Wayfinding Accessibility Audit Checklist is a checklist of recommendations/requirements to be considered in an assessment of an airport's wayfinding accessibility. All of the recommendations/requirements in the checklist are numbered and labeled to correspond to a particular chapter and section in this guidebook. Each labeled recommendation or requirement is grouped according to chapter and section and characterized according to form of communication (visual, virtual, and/or verbal), the types of disabilities accommodated (vision, hearing, cognition, and/or mobility), and any known standards or additional guidance available (see Figure 5-2).

To help provide a visual reference for the recommendations/requirements in the Wayfinding Accessibility Audit Checklist, the research team developed virtual models of different journey segments at an airport with the recommendation/requirement labels embedded (see Figure 5-3). A model view of the arrival point journey segment is shown in Figure 5-4. All the virtual models of journey segments are compiled in Appendix C.

The departing customer journey involves a wide range of experiences for aging travelers and persons with disabilities. It is important to understand the mindset associated with the various journey segments and how the requirements and recommendations in this guidebook can be used to enhance customers' travel experience. A research study conducted by the United Kingdom's Civil Aviation Authority (CAA) in 2009 evaluated air passengers' experiences and the expectations of persons with disabilities or reduced mobility when traveling by air. Based on insights gleaned from the research on persons with reduced mobility (PRMs), the CAA identified six dimensions of the PRM passenger "mindset." These passengers want to feel

1. Equal
2. In control
3. Clear
4. Listened to
5. Treated as individuals
6. Reassured

Section #	Section Description	Section Code
5.1	Departure Arrival Points	AP
5.2	Parking	PK
5.3	Rental Car	RC
5.4	Lobby Area	LA
5.5	Ticketing	TK
5.6	Security Checkpoint	SC
5.7	Vertical Transition	VT
5.8	Gate Area	GA
5.9	Airline Support	AS
5.10	International Flights - Passport Control	IN

D-AP.01

Source: ACRP Project 07-13 Research Team

Figure 5-1. Chapter 5 matrix and example of a recommendation/requirement label.

The other noteworthy aspect of the research is how these six dimensions appear in each of the PRM journey segments, as shown in Table 5-1. For the purposes of the CAA research, "Transit" was defined as a process beginning at check-in, including passport control and security, and concluding as the passenger moves from the gate to board the aircraft. The shaded cells represent the areas of the customer journey where particular dimensions of the PRM mindset currently manifest themselves most acutely.

As discussed in Chapter 3, communication is a critical part of the customer experience. The importance of communication is validated in the CAA's research—PRMs shared how

Chapter 5

Wayfinding Audit Checklist

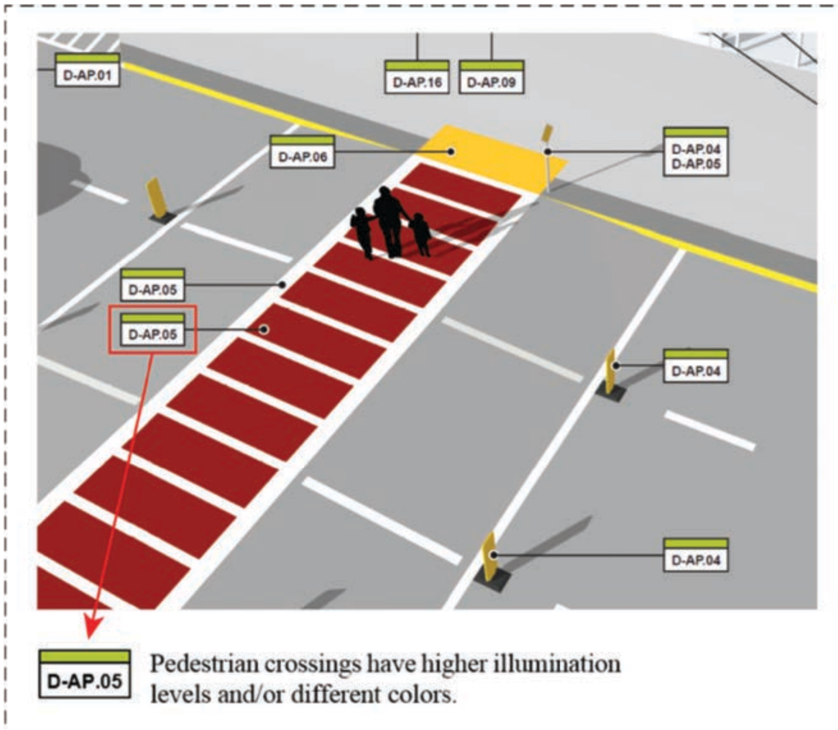
DEPARTING PASSENGER (D)

REF #	Recommendations & Requirements	3V's	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
Section 5.1: Arrival Point - Curbside (AP)								
D-AP.01	Accessible drop-off points for people with disabilities have been designated by the airport, appear on web, mobile and terminal maps and directories and are appropriately signed for easy viewing from roadways.	Visual Virtual	X	X	X	X	Passenger loading zones scoping and design: 2010 ADAAS 209 and 503	
D-AP.02	Walking surfaces are stable, firm and slip resistant, inside and outside terminals and parking garages, and have no openings more than 1/2".	Visual	X	X	X	X	2010 ADAAS 302.3	
D-AP.03	Visual and auditory signals are in place at pedestrian crossings with traffic lights, with adequate crossing time for those who move more slowly.	Visual	X	X	X	X		

D-AP.03 Visual and auditory signals are in place at pedestrian crossings with traffic lights, with adequate crossing time for those who move more slowly.

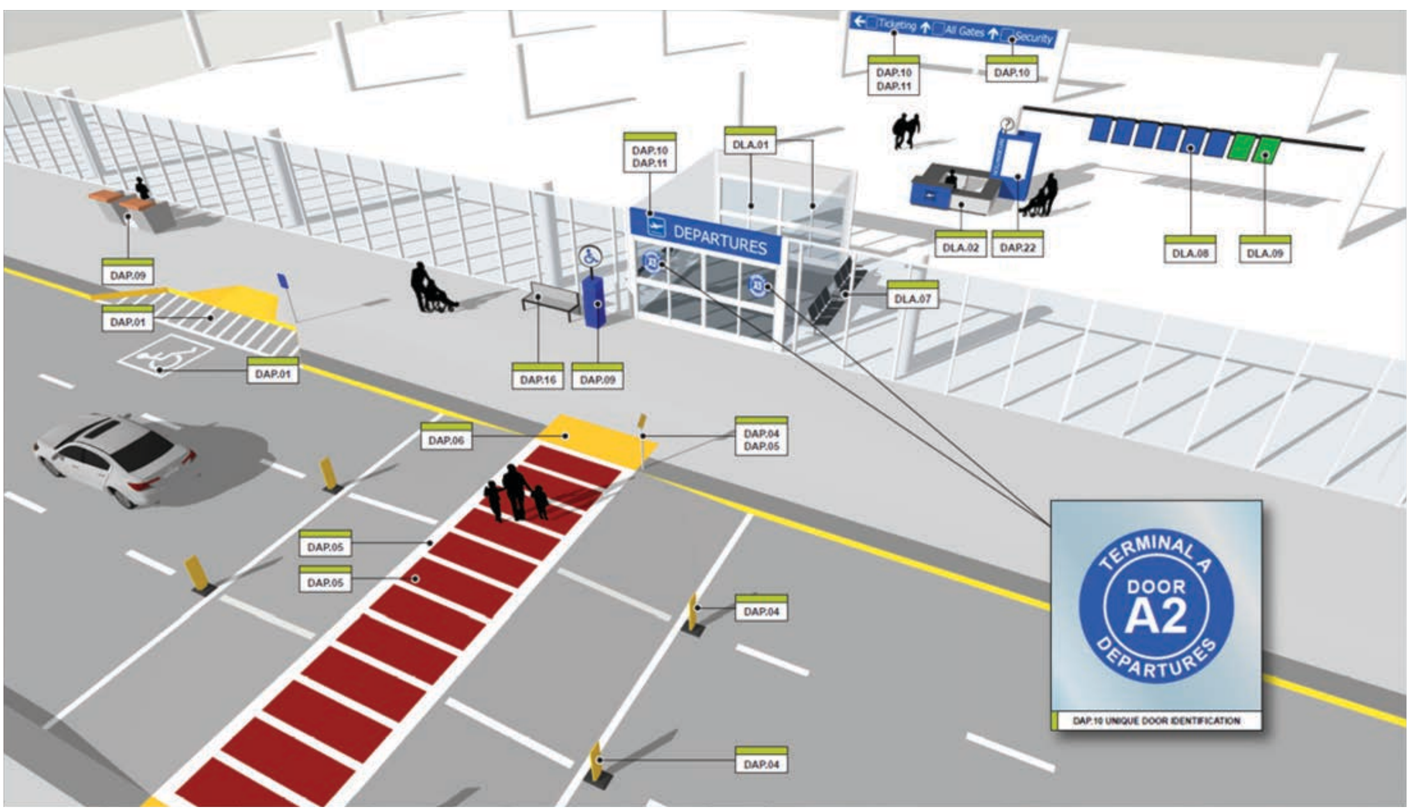
Source: ACRP Project 07-13 Research Team

Figure 5-2. Excerpt from Wayfinding Accessibility Audit Checklist, Chapter 5.



Source: ACRP Project 07-13 Research Team

Figure 5-3. Example of recommendation/requirement labels embedded in a virtual airport model and recommendation/ requirement text.



Source: ACRP Project 07-13 Research Team

Figure 5-4. Model view of the arrival point journey segment.

Table 5-1. How the different dimensions of the PRM mindset are involved in each segment of the customer journey.

		BOOKING	ARRIVAL & CHECK-IN	TRANSIT	BOARDING	IN FLIGHT	DISEMBARKING
1	PRM passengers want to feel *equal*						
2	PRM passengers want to feel *in control*						
3	PRM passengers want to feel *clear*						
4	PRM passengers want to feel *listened to*						
5	PRM passengers want to feel *treated as individuals*						
6	PRM passengers want to feel *reassured*						

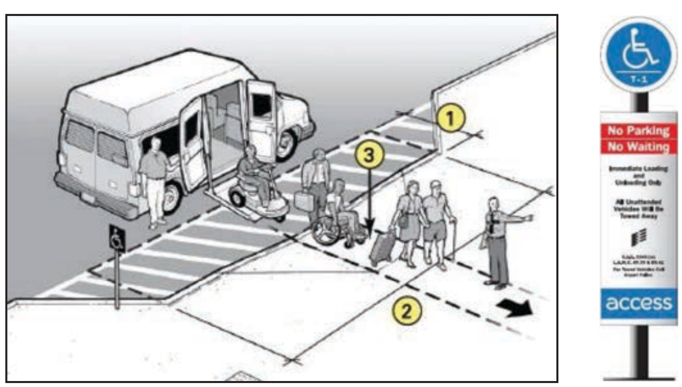
Source: CAA, United Kingdom

"it makes them very anxious if they are left waiting without knowing how long they will be waiting, or if they feel that they've been forgotten." Whether it is the airport or airline's responsibility at a given point in the departing customer experience, working together to deliver the proper level of communication throughout the journey of these customers is what's truly important.

5.1 Departures Arrival Points (AP)

5.1.1 Curbside

Safety is an issue at any curbside area where both vehicular and pedestrian traffic share the same space. Aging travelers and persons with disabilities need to be able to safely find their way to the terminal when they need to cross the street (see D-AP.01 through D-AP.06). Another area of concern is dropping off or picking up passengers with disabilities at the terminal curbside. Sections 209 and 503 of the 2010 ADA Standards address these requirements, as shown in Figure 5-5. In the absence of traffic signals, a raised crosswalk slows traffic while also providing level access to pedestrians.



Source: Image at left is from www.ada.gov. Image at right is accessible drop-off point at LAX.

Figure 5-5. Accessible passenger loading zone* (left) *and drop-off point signage* (right)*.

D-AP.01 Accessible drop-off points for people with disabilities have been designated by the airport, appear on web, mobile, and terminal maps and directories, and are appropriately signed for easy viewing from roadways.

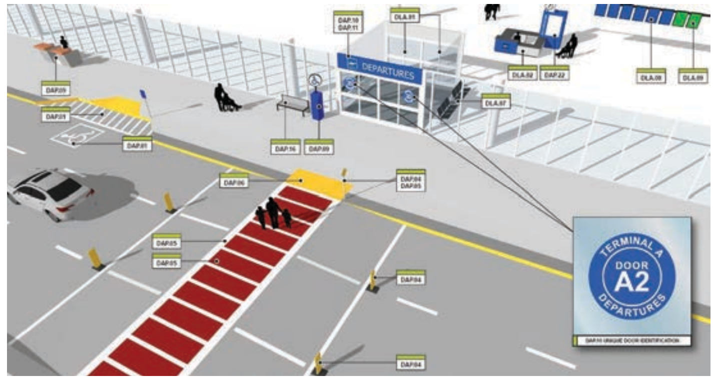
Accessible passenger loading zones are required to comply with scoping and design per the 2010 Americans with Disabilities Act Accessibility Standards (ADAAS) Section 209 and 503 (see Figure 5-5):

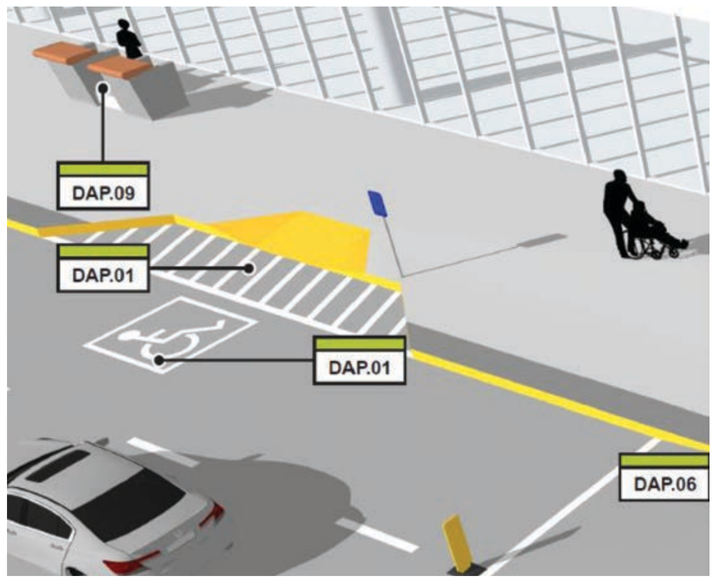
1. One accessible passenger loading zone in every continuous 100 linear feet of loading zone space, or fraction thereof (209.2.1).
2. Access aisle depth is at least 5 feet.
3. Access aisle length is at least 20 feet.
4. Curb ramp connects access aisle to the accessible route to the accessible entrance.

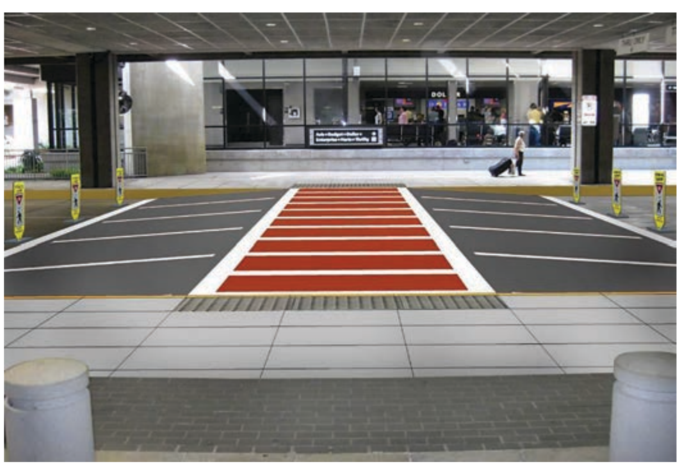
D-AP.02 Walking surfaces are stable, firm, and slip-resistant, inside and outside terminals and parking garages, and have no openings larger than 0.5 inch.

D-AP.03 Visual and auditory signals are in place at pedestrian crossings with traffic lights, with adequate crossing time for those who move more slowly.

D-AP.04 Where there are no signals, pedestrian crossing signs are prominently displayed for drivers and pedestrians. Raised pedestrian crossings help to slow traffic while providing level access. Speed bump signage and road markings are in place. (See Figure 5-6.)

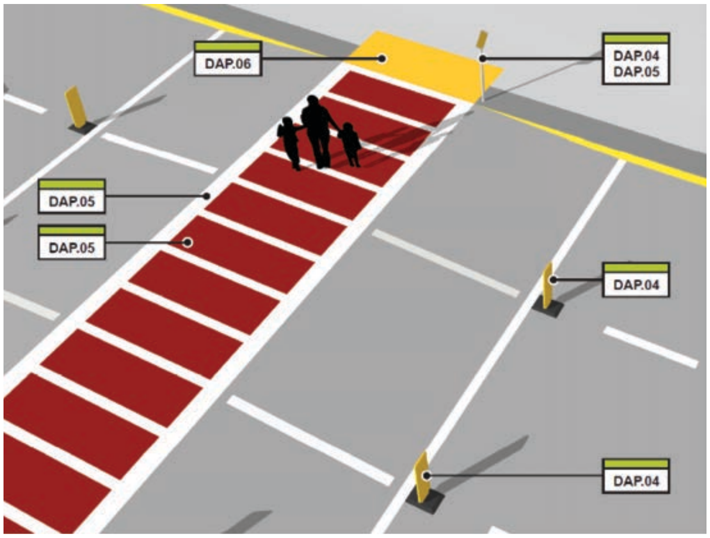






Source: ACRP Project 07-13 Research Team

Figure 5-6. Accessible route concept with raised, marked crosswalk; detectable warnings; higher illumination levels; stable, firm, walk surfaces; and prominently displayed signage.



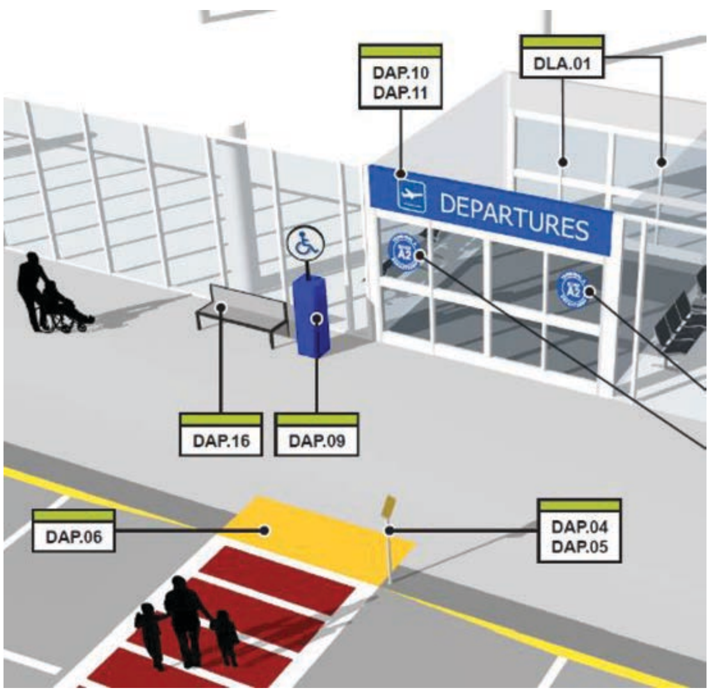
D-AP.05 Pedestrian crossings have higher illumination levels and/or different colors.

D-AP.06 Detectable warnings are in place at curb ramps and marked crosswalks.

D-AP.07 If the sidewalk is flush with the roadway, detectable warnings are in place along the entire edge.

D-AP.08 At least one accessible route is provided within the site from accessible parking spaces and accessible passenger loading zones, public streets and sidewalks, and public transportation stops to the accessible building or facility entrance they serve.

Providing the means to request assistance at key arrival points for passengers with disabilities is a feature that is mostly seen in European airports, but could enhance the wayfinding experience at U.S. airports. Accessible kiosks, call points, or telephones are means used to provide assistance outside the terminal in the curbside area.



D-AP.09 Assistance or means to request assistance is available outside the terminal, e.g., curbside check-in, accessible kiosk/call point or telephone identified by an easily visible and tactile sign.

While not currently required in the United States, the European Code Regulation contains guidance that states an arrival point should be clearly signed and should contrast with its surroundings. The controls and communication links of the signage should be located between 30 inches and 48 inches above ground level. Any manually operated controls should be capable of being operated with the palm of the hand and should require a force no greater than 15 Newtons to operate. The system should be accessible to people who are deaf or hard of hearing. As an alternative, a telephone-based system (incorporating an inductive coupler) can be used. Where new systems are introduced, a visual indication should be incorporated to notify the user that their request for assistance has been received.

D-AP.10 Directional and identification signs have fonts that are easily read, have good contrast, are non-glare and allow close approach wherever possible. (See Sections 3.2.1.3 and 3.2.1.5.)

D-AP.11 Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers. (See Section 3.2.1.7.)

Entrances into the terminal are important touch points in the customer wayfinding journey. Some large-hub airports have multiple terminals, most large- and medium-hub airports have split-level curbsides, and almost every airport has more than one entrance. Knowing where they are for aging travelers and persons with disabilities is important at terminal entrances as well as throughout the journey. Proper identification also provides a common point of reference for customers being picked up and/or dropped off who need to communicate the location to others, as shown in Figure 5-7. While an accessible help point kiosk (D-AP.09) is not a requirement by code, it is a higher level of service that is used in countries other than the United States, most notably at European airports (see Figure 5-8). Entrance identification should include

- Terminal name, letter, or number: e.g., domestic or international; T1, T2, T3, etc.; Terminal A, B, C etc.
- Level: departures or arrivals; ticketing or baggage claim.
- Unique door identification: use nomenclature logic that helps reinforce terminal and/or level when possible.

D-AP.12 Identification signs are visual and tactile, i.e., have raised characters and Braille and are correctly positioned.

Signage, both exterior and interior, for permanent rooms and spaces, is standardized per the ADA in terms of requirements for visual and tactile characters and positioning. Persons who are blind know how and where doors are labeled. In this case, arrival points are also part of the information that would be provided online and via the call center. When a customer arrives at the airport, they can then check where they are by reading the tactile and Braille signage.

To illustrate the point further, if there is a phone available to call for assistance, then information with the door number could be in tactile characters and Braille next to or below the phone. Again, people could be advised in advance of the system. Sliding doors are frequently used at entrances to an airport so correct placement of signage with raised lettering and Braille is important.

Source: Photograph by Chris Cunningham; Photo courtesy of Gresham, Smith and Partners.

Figure 5-7. Terminal identification, level identification, and unique entrance identification using large, high-contrast, unadorned fonts at Maynard H. Jackson Jr. International Terminal, Atlanta International Airport.

Source: ACRP Project 07-13 Research Team

Figure 5-8. Accessible curbside kiosk.

Per the ADA Standards Section 703.4.2 Location:

> Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.

D-AP.13 SARAs are located as close as possible to terminal entrances with at least one accessible route (see D-AP.08).

5.1.2 Other Arrival Points

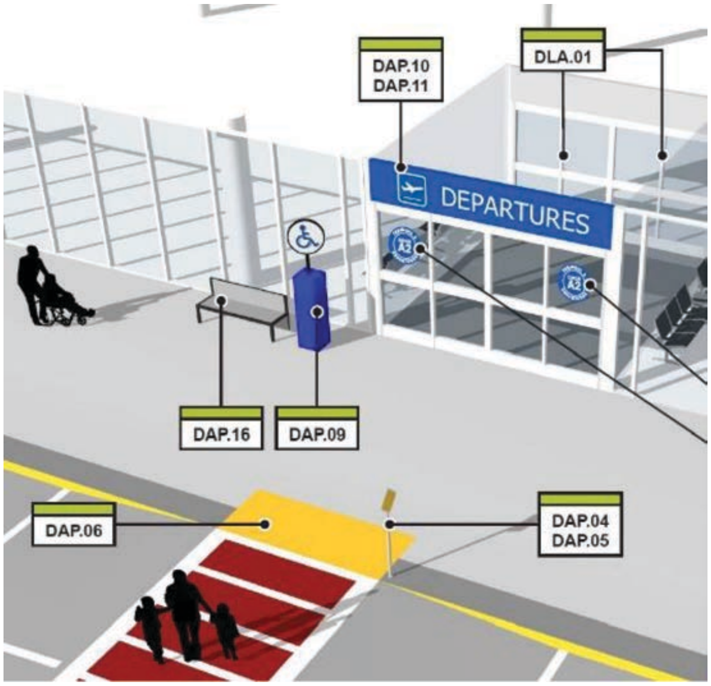
In addition to the obvious curbside arrival point, there are other types of arrival points for airports to consider, such as accessible parking areas, other areas where customers are waiting for assistance, more than one terminal connected to arrival point, elevators, lifts, and information desks.

D-AP.14 Other points of arrival are identified on airport maps, website, and mobile application, if provided.

D-AP.15 Means to request assistance is available at other points of arrival, e.g., accessible kiosk/help point or telephone identified by easily visible and tactile sign.

For the U.S. DOT's definition of terminal entrances, see the response to Question 28 in "Answers to Frequently Asked Questions Concerning Air Travel of People with Disabilities Under the Amended Air Carrier Access Act Regulation" (13 May 2009). Under European Community (EC) Regulation 1107/2006, means to request assistance is required at all points of arrival including accessible parking areas.

D-AP.16 A seating area, with some seats assigned for disability priority, is available for passengers waiting for assistance. (See Figure 5-9.)



While it is understood that providing seating throughout each journey segment for aging travelers and persons with disabilities is necessary, it is not a requirement typically associated with wayfinding. However, in the context of supporting the goal of these user groups to travel independently, seating does serve a significant support role. Proving seating throughout the journey segments can provide an opportunity for customers with cognitive issues to stop and collect their thoughts about where to go next. For customers with mobility challenges, seating offers a chance to rest before proceeding along their journey (see also D-AP.21).

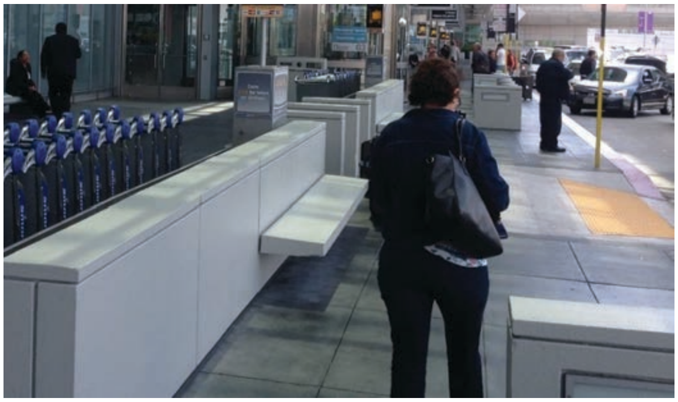
D-AP.17 A staff member is on hand to direct passengers, e.g., at monorail stations.

D-AP.18 There is at least one accessible route from each remote arrival point to each airport terminal, with each element (walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADAAS.

D-AP.19 There are no objects protruding more than 4 inches into the path of travel that are not cane detectable (lower edge 27 inches or less above finished floor), e.g., fire extinguishers, pay phones, drinking fountains.

D-AP.20 Overhead clearance is 80 inches minimum and unenclosed stairs or escalators have a rail or barrier underneath.

D-AP.21 Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path.



Source: ACRP Project 07-13 Research Team

Figure 5-9. Built-in curbside seating at San Francisco International Airport.

Source: ACRP Project 07-13 Research Team

Figure 5-10. Evenly illuminated gate areas at Norfolk International Airport.

D-AP.22 Where there is more than one terminal connected to the arrival point, an airline directory (static or dynamic signage) is hung at eye level and has large fonts, good contrast, and no glare.

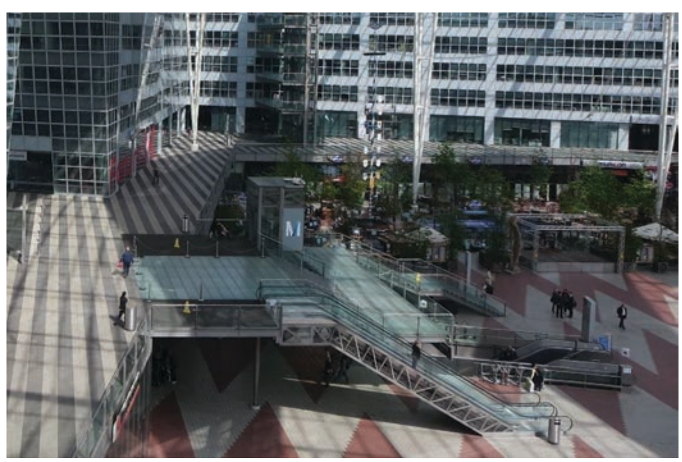
D-AP.23 Directional signs have large, unadorned, illuminated fonts. (See Chapter 3, Sections 3.2.1.5 and 3.2.1.6.)

D-AP.24 Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.

Lighting upgrades should be part of renovated spaces, as shown in Figure 5-10.

D-AP.25 Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts are in the same area as stairs and escalators. (See Figure 5-11.)

D-AP.26 Where elevators are not near or in sight of stairs and escalators, directional signage is provided. (See Figure 5-12.)



Source: ACRP Project 07-13 Research Team

Figure 5-11. Elevator, stairs, and escalators located closely together and all in direct line of sight at Munich Airport.

Source: ACRP Project 07-13 Research Team

Figure 5-12. Multiple directional signs required to find elevators from key arrival points in Denver International Airport.

D-AP.27 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.

D-AP.28 Audible indicators outside elevators are loud enough to be heard over ambient noise.

D-AP.29 Accessible means of egress (e.g., evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) are available and have appropriate identification and directional signage. (See Figure 5-13.)

D-AP.30 Detectable warnings are in place at curb ramps, marked crosswalks, and wherever the accessible route crosses vehicular roadways in parking structures. (See Figure 5-14.)

Source: ACRP Project 07-13 Research Team

Figure 5-13. Emergency evacuation plan with raised lettering and Braille at San Francisco International Airport.

Source: ACRP Project 07-13 Research Team

Figure 5-14. Example of clear identification of terminal, level, and unique door number, along with cane-detectable markers on the pavement to guide people to the door and identify crosswalks at San Francisco International Airport.

D-AP.31 Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.

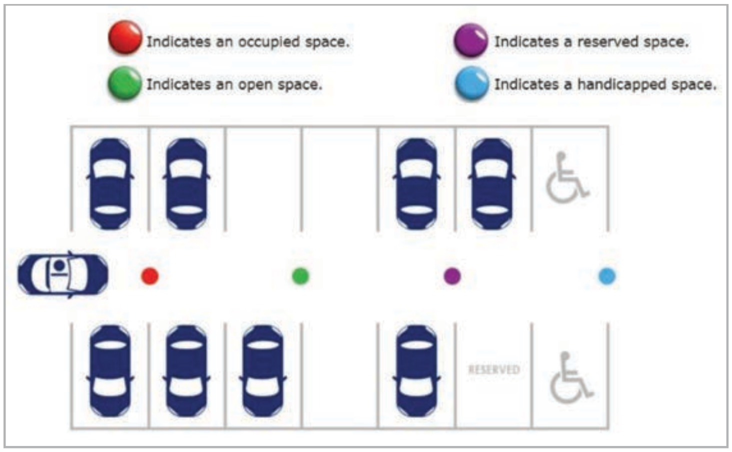
D-AP.32 An audible signal alerts passengers to the end of moving walkways.

D-AP.33 Emergency communications equipment is provided at strategic locations wherever potential security or safety threats may exist and is identified by visual and tactile signage. Locations are noted in the access database and mobile application, if any.

5.2 Parking (PK)

Unlike other areas of the airport, parking involves two wayfinding systems. The first system is vehicular wayfinding to find a space to park. By the ADAAS code, accessible parking spaces are required to be close to a shuttle stop, close to the elevator, or close to the building entrance. To some extent, the code helps make these parking spots easier to find, but not in all cases. Airport parking areas can be as complex as an airport terminal. Consequently, it may be necessary to provide wayfinding information to help customers locate accessible parking. Static signage, smart garage technology, and smartphone applications can all help customers find accessible parking spaces.

The second system is pedestrian wayfinding to locate the elevator, accessible path, and airport entrance. Remote parking, in either a garage or surface lot, will not have an accessible path to the terminal and not all airport shuttles may be wheelchair accessible, even though this is required under CFR 49 Part 37—"Transportation Services for Individuals with Disabilities (ADA)." Where this is the case, having a courtesy phone available to call and request a wheelchair-accessible van or shuttle is important.



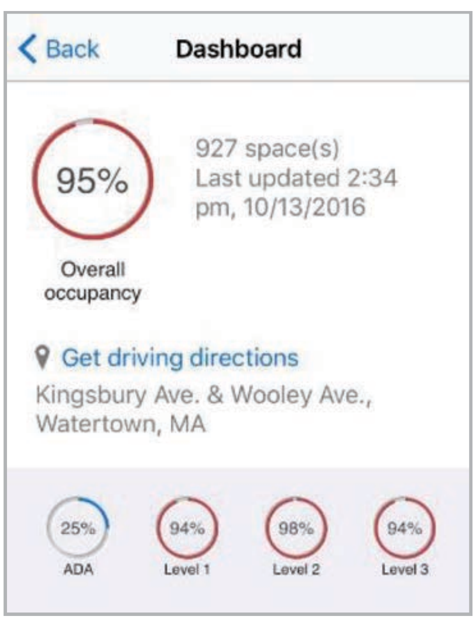
Source: Park Assist

Figure 5-15. Color-coded LED lights indicate accessible parking spaces.

5.2.1 All Parking

Advances in technology have greatly improved virtual communication in terms of helping aging travelers and persons with disabilities find accessible parking spaces as well as their car upon return. Early smart garage systems used a bi-color red/green light over each space to indicate full or open spaces. Multicolor indicating sensors now have the ability to display other colors to provide an even finer granularity of designated parking (see Figure 5-15). Brightly-lit blue LEDs on the smart sensors are used to signal the space is reserved for persons with disabilities.

D-PK.01 A smartphone application is available for locating parking spaces. (See Figure 5-16.)



Source: Park Assist

Figure 5-16. Smartphone application to help find accessible parking.

Smart garage systems also offer smartphone applications that can be used to help locate accessible parking. Using the smartphone application or mobile application programming interface (API), the customer selects the parking product they wish to see the parking occupancy for. The application can display real-time occupancy monitoring for the overall parking facility as well as a breakdown by specialized parking categories such as accessible, expecting mothers, and electric car charging spaces.

D-PK.02 A smart garage system aids in finding empty spaces. (See Figure 5-17.)

Digital wayfinding signage throughout the parking garage can guide customers to bays that are reserved for persons with disabilities. A two-digit car-count display with the symbol of accessibility is used to lead parkers to open spaces in the parking garage.

D-PK.03 A smart garage car-finding system and smartphone application help customers find their cars.

Using the Park Assist Find Your Car™ locator feature, the parker simply enters the number for a license plate at a touch-screen kiosk or on a smartphone application. In seconds, the core system searches a database of currently parked vehicles identified through integrated license plate recognition when they entered a space. The kiosk displays step-by-step walking directions to show exactly how to locate your vehicle (see Figure 5-18).

5.2.2 On-Site Parking

D-PK.04 Accessible parking spaces in parking lots and parking garages adjacent to the terminal are connected by an accessible path of travel to terminal entrances with each element (walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADA Standards. (See Figure 5-19.)

D-PK.05 Accessible parking spaces are located on the shortest possible route(s) to accessible terminal entrance(s) and dispersed if there is more than one accessible entrance.

D-PK.06 All accessible van spaces are grouped on one level in a multi-car parking facility.

Source: Park Assist

Figure 5-17. Smart garage wayfinding to help find accessible parking.

Source: ACRP Project 07-13 Research Team

Figure 5-18. Smart garage parking system kiosk to help find car at Fort Lauderdale-Hollywood International Airport.

Source: London Heathrow Airport

Figure 5-19. Accessible path of travel from accessible parking spaces to the terminal at Heathrow Airport.

D-PK.07 All accessible parking locations are identified in the airport access database, on maps and the mobile application, if any.
Note: a review of major U.S. airport websites shows this is a current gap in online airport maps.

D-PK.08 The number of accessible van and car spaces meets minimum local, state, or federal scoping (whichever is highest) and standards for size and identification signage.

D-PK.09 Directional signs are in place from the adjacent parking garage and parking lots to the closest terminal entrance.

5.2.3 Remote Parking

D-PK.10 Accessible parking spaces are on the shortest possible accessible route to the shuttle bus stop, monorail station, or other accessible means of transportation linking parking lots to airport terminals.

D-PK.11 The number of accessible van and car spaces in remote lots meets minimum local, state, or federal scoping (whichever is highest) and ADA Standards for size and identification signage.

D-PK.12 Accessible parking spaces do not have to be provided in each parking facility on the site but must have equivalence in terms of distance, parking fees, and user convenience. For areas where accessible parking may not exist, directional signage leading users to these accommodations is required.

D-PK.13 Shuttle bus stops and shelters meet ADA accessibility standards for dimension, paths of travel, and route signs. Bus schedules are not subject to signage standards.

D-PK.14 Shuttle bus drivers have disability awareness training in assisting and communicating with people with disabilities.

D-PK.15 Stations and platforms or automated people movers meet ADA accessibility standards.

D-PK.16 Signage for station entrances, routes, and destinations and station names comply with ADA accessibility standards.

D-PK.17 Staff is available in stations and on platforms to provide assistance and directions.

5.3 Rental Car (RC)

Wayfinding information needs in airport rental car areas are similar to the needs associated with parking areas.

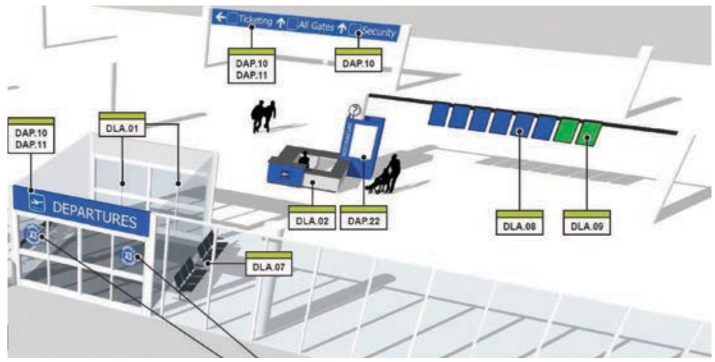
D-RC.01 There is at least one accessible route from the rental car facility to airport terminal.

D-RC.02 Directional signs are in place from the rental car drop-off area to the closest terminal entrance.

D-RC.03 Facility entrances, paths of travel, counters, and other features meet ADA Standards.

D-RC.04 An accessible means of transport links the rental car facility with airport terminals, e.g., shuttle bus, automated people mover.

5.4 Lobby Area (LA)



Information that confirms that the customer is in the correct terminal is important. It sounds simple, but at airports with multiple terminals there may be an international terminal with domestic flights and, conversely, domestic terminals with international flights (most typically departures).

Orientation is also essential. Customers who need to check in will want to know: "Where is my airline's ticket counter?" Customers who do not need to check in may need to find the closest security checkpoint. Depending on the layout, customers may need to find the elevator to access the ticket lobby. Immediate access to information desks, airport directories, and maps helps aging travelers and persons with disabilities become oriented as they transition from outside the terminal to inside the terminal.

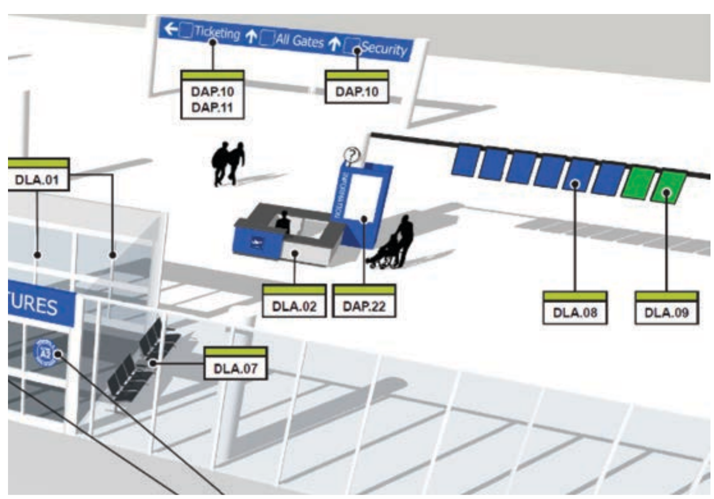
Some airport lobbies are massive, with long distances to span and navigate. Other airport lobbies are designed with intuitive flow and circulation, and therefore customers do not need a lot of information to help them find their destination. There are also other airports where destinations like security checkpoints and elevators are not in a direct line of sight or are even architecturally hidden and therefore require a higher level of access to information, whether it be visual, verbal, or virtual.

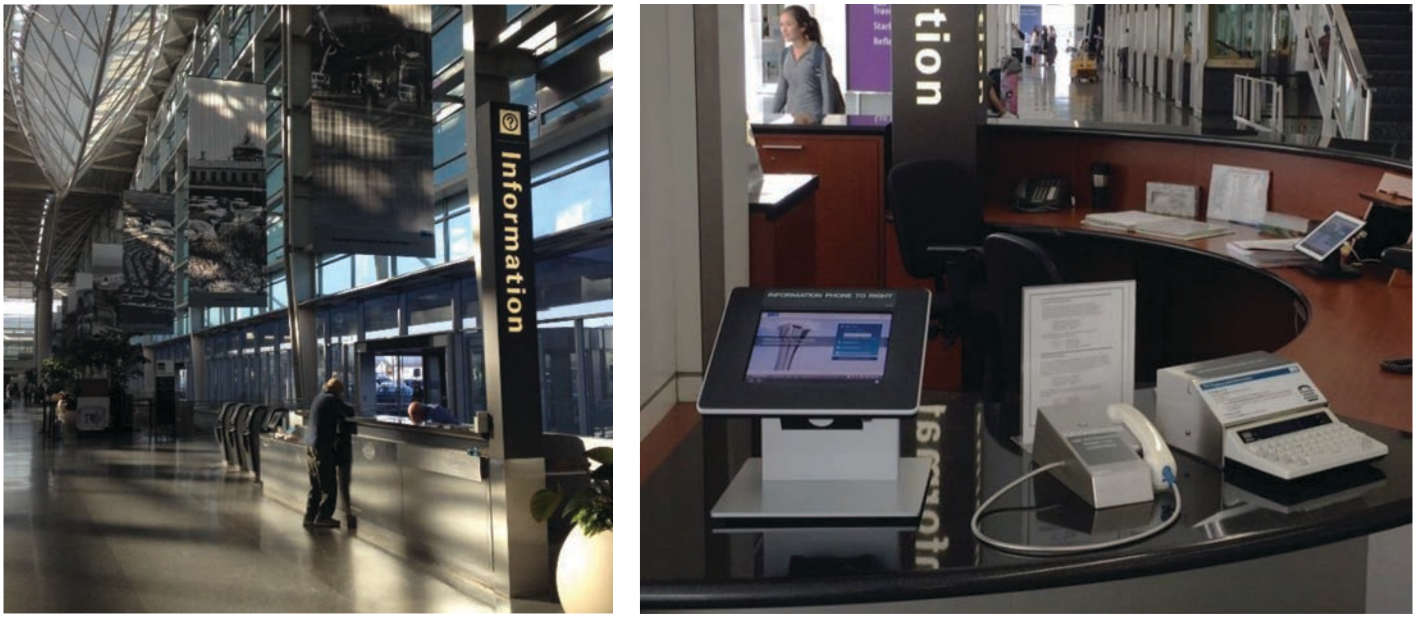
The key points in this section identify how access to information and assistance should be provided in the airport lobby area.

D-LA.01 Wide automatic doors provide universal ease of access.

D-LA.02 An information desk is located inside the terminal entrance and grouped with other information sources such as FIDSs, directories, or maps. If the airport has an information desk on the arrivals level only, directional signage for the information desk is prominently displayed at entrance(s) on the departures level.

D-LA.03 The information desk has prominent identification signage with a pictogram. (See the photo at left in Figure 5-20.)





Source: ACRP Project 07-13 Research Team

Figure 5-20. Information desk located next to the entrance of San Francisco International Airport's international terminal **(photo at left*****) and means to communicate with customers with vision and hearing disabilities*** **(photo at right*****).***

The information desk should be located within a direct line of sight from the terminal entrance and be close to the entrance for customers who need to request assistance. Information desks should also be equipped with means to communicate with customers who are blind, have low vision, or are deaf or hard of hearing, as shown in the photo at right in Figure 5-20.

Technology is changing how airport directories communicate information to customers. In addition to visual static directories and virtual interactive directories, there is technology that can deliver information verbally. An example is InfoGate, a directory system at the Munich Airport that is a highly efficient, multifunctional information and navigation instrument with extensive functionality, providing real-time access to a live, personal interaction with users speaking different languages (see Figure 5-21). The airport customer only has to push a button (which supports universal design criteria) to instantly start a video conference with an information service agent. During the conversation, both sides see each other as life-size screen images in real time. The multifunctional features allow additional information to be shared by various means to enable the customer to personalize how they want and need to receive information.

D-LA.04 A counter induction loop is installed for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.

D-LA.05A The information desk has video remote interpreting service.

This type of service is important because it enables a customer who is deaf to communicate via the internet to a hearing person (such as a CSA) either at a remote location or at the airport (see Figure 5-22).

Source: InfoGate

Figure 5-21. Directories that provide real-time access via live customer service agents at Munich Airport.

D-LA.05B Staff is fluent in English and other local languages and has access to interpreters for many languages through means such as the AT&T language line, or by training staff to use a no-cost option like a Google Translate application. (See Chapter 3, Section 3.3.2)

Examples of verbal communication can now include personnel who can deploy to key locations, at peak times, to enhance the customer wayfinding experience by finding customers who need help where they need it. A good case study of how verbal communication is combined with virtual technology is the Changi Airport.

Introduced in 2011, uniformed Changi Experience Agents (CEAs) identify and approach passengers and visitors who appear distressed (see Figure 5-23). The goal is to rise above simply being efficient, since many passengers who require help won't go to the information counters. Equipped with iPads and deployed airport-wide, CEAs look at nonverbal cues, assess the overall situation,

Source: Sorenson Communications

Figure 5-22. Flow of information using a video remote interpreting service.

Source: Changi Airport, Singapore

Figure 5-23. Roving mobile assistants at Changi Airport, Singapore.

and approach passengers who may need assistance. The iPads provide access to real-time airport data that include flight information, ground transportation services, taxi queues, etc. CEAs at Changi Airport collectively speak a total of more than 20 languages and dialects.

D-LA.06 A correctly oriented "You Are Here" illuminated map with large font designed for close approach is located at major decision points throughout the airport. (See Chapter 3, Section 3.4.1.3.)

D-LA.07 Seating areas, with some seats designated as disability priority, are located near the information desk and terminal entrances.

Congested lobbies with overcrowding can undermine a well-planned space with good wayfinding, and having designated areas like the one shown in Figure 5-24 can take on an added level of importance in these situations.

Source: ACRP Project 07-13 Research Team

Figure 5-24. Designated priority seating for customers with disabilities at Amsterdam Airport Schiphol.

D-LA.08 FIDS are located at frequent intervals, approximately every 400 feet.

D-LA.09 Visual paging is built into TV monitors.

D-LA.10 Escalators include visual reinforcement of operating direction.

Simple, bold graphic indicators help customers with cognitive issues, as well aging travelers who may struggle with visual acuity, know which escalator to use at vertical transitions. These indicators also mitigate safety concerns associated with escalators and are helpful for international travelers (see Figure 5-25).

D-LA.11 Elevators have glass doors for open sight lines and ease of identification. (See Figure 5-26.)

The consequence of architectural design that hides essential vertical transportation is adding extra signage and wayfinding, as discussed in D-AP.26 in this chapter.

D-LA.12 Primary entrance doors have clear identification of terminal, level, and a unique door number. (See Figures 5-7 and 5-14 for examples.)

D-LA.13 Self-identification is promoted and encouraged so that travelers are more likely to relay their disability-specific needs to staff. This can take place at any touch point: curbside check-in, lobby information desk, ticketing check-in, etc. Links are posted to the TSA notification card that assures special assistance.

The customer card needs only to list the person's disability, not the person's name (see Figure 5-27). (www.tsa.gov/travel/special-procedures)

Customers often think that by providing advance notice of a need for assistance that they will receive it, but if customers don't know to identify themselves as needing assistance, they likely

Source: ACRP Project 07-13 Research Team

Figure 5-25. Directional graphics at escalators at Changi Airport, Singapore.

Source: ACRP Project 07-13 Research Team

Figure 5-26. Glass elevators with clear, open sight lines at Munich Airport.

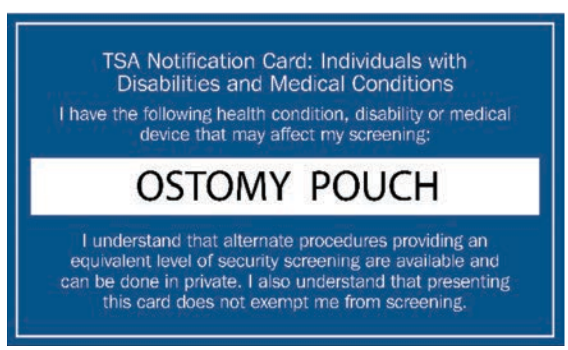
won't receive help. Customers cannot be identified simply on sight, and some customers are offended when proactively offered assistance, so self-identification is important.

5.5 Ticketing (TK)

Passengers finding their way from the curbside to the ticketing/check-in area can benefit from several airport enhancements and strategies.

Step 1 for airports is evaluating the terminal to understand what information is needed and where in order to help aging travelers and persons with disabilities find the correct airline ticket counter and/or accessible check-in kiosk. For example, in larger ticketing halls, digital signage provides an efficient means of presenting wayfinding information that is relevant to only the air carriers operating in a given time frame. In contrast, a static sign would have to show all potential airlines and directions. Simplifying the amount of information reduces confusion. (See Figure 5-28.)

Step 2 is gauging the need for staffing, either by the airline or the airport, and providing disability awareness training for the airport front-line staff, including those in the call center. Philadelphia International Airport hires disability organizations to conduct its annual awareness training



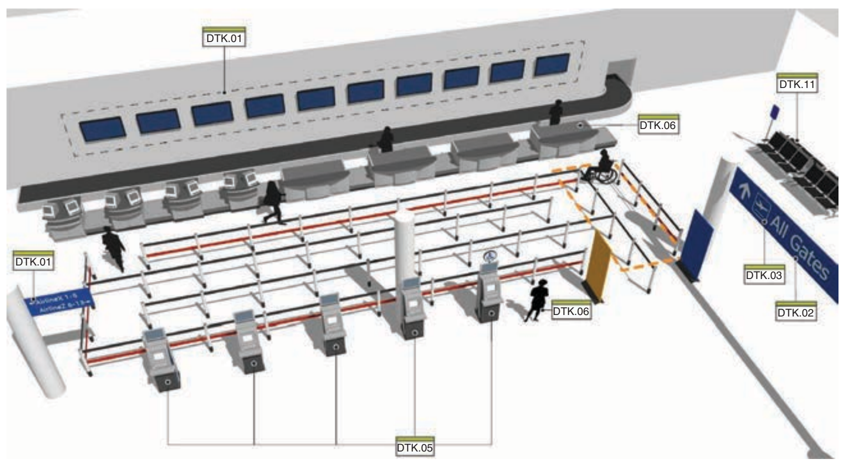
Source: tsa.gov

Figure 5-27. TSA notification card.

Source: ACRP Project 07-13 Research Team

Figure 5-28. Airline ticket counter check-in location at Raleigh Durham International Airport.

and open up the classes to anyone working at the airport, not just airport staff. Autism-related tips should be included in the awareness training. Noise is a major trigger for both children and adults with autism, so having a quiet space that travelers, including those with autism, can visit to de-stress is important. Yoga rooms are one such area now being provided. Meditation or prayer rooms are also quiet zones that persons with autism can use. Providing guidance to these types of spaces online, in directories, and on signage is part of a consistent wayfinding approach.



Step 3 is a review of details to find areas of improvement (visually, verbally, and virtually) from the perspective of each type of disability. Examples can include seemingly minor details, such as adding a lower second belt to ticketing queues to make them detectable to customers who are blind and use a cane or guide dog.

D-TK.01 Static or dynamic signage listing the location of each airline's ticket and check-in counters is hung at eye level and has large fonts, good contrast and no glare. This is available at each entry point.

A combination of static and digital signage, as shown in Figure 5-28, is used to communicate the location of airline ticket counters at Raleigh Durham International Airport.

D-TK.02 Directional signs have large, unadorned, illuminated fonts. (See Chapter 3, Sections 3.2.1.5 and 3.2.1.6)

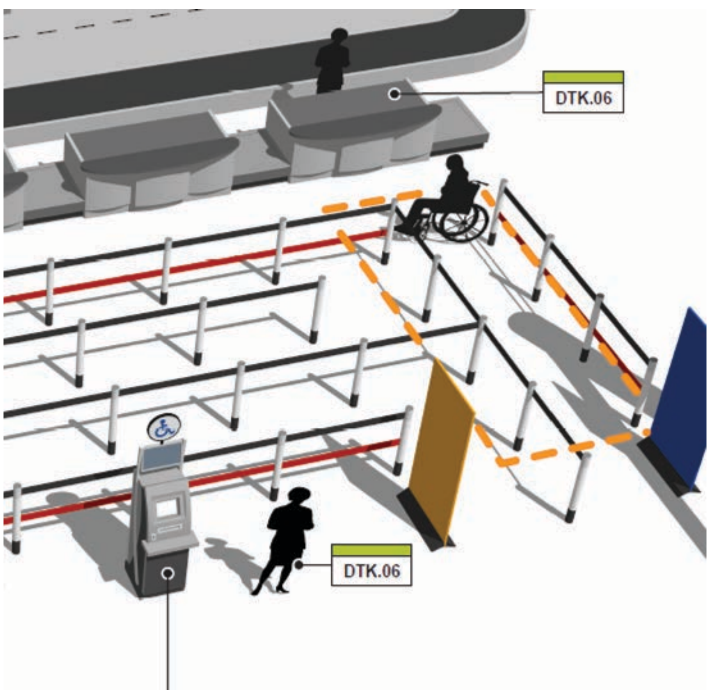
D-TK.03 Directional and identification signs include pictograms to improve comprehension by persons with intellectual disabilities and international travelers.

D-TK.04 Lighting levels are optimal at all times of the day throughout the terminal to support the reading of signs.

D-TK.05 If installed after 12/12/2016, check-in kiosks meet new accessibility standards under 14 CFR Part 382, and fully accessible kiosks are identified with a wheelchair symbol.

While a ticketing/check-in kiosk may not be the first thought that comes to mind when thinking about wayfinding, it is an important touch point that can provide valuable information to any customer such as confirming a gate number (gate assignments do change) and boarding time (flights get delayed). Installing kiosks with an accessible keypad and other required features, such as a headset jack, provides passengers with disabilities access to the same touch points as other passengers (see Figure 5-29).

When properly implemented, all of the principles of universal design work together to benefit older adults, persons with disabilities, and all travelers. Check-in kiosks that meet the new accessibility standards provide equitable, flexible, approachable, simple, intuitive use, with perceptible information that allows tolerance for error and requires low physical effort.



D-TK.06A A ticket agent is available to assist at check-in kiosks, or people with disabilities who cannot readily use the automated kiosks may go to the head of the line. (See Figure 5-30.)

This will remain a requirement of the ACAA even after kiosks meet the new accessibility standards.

D-TK.06B Crowd control barriers have a lower belt or rail, as indicated by the red band, that is cane (and guide dog) detectible, i.e., 27 inches maximum above the floor, on outermost lines adjacent to paths of travel.

D-TK.07 A counter induction loop, as indicated by the dashed orange line, is installed at one check-in counter with priority access for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.

D-TK.08 An airline complaint resolution official (CRO) is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues involving requested accommodations, assistive devices, checked baggage, etc.

D-TK.09 Where baggage drop-off is not at the check-in counter, ticket agents provide directions or assistance.

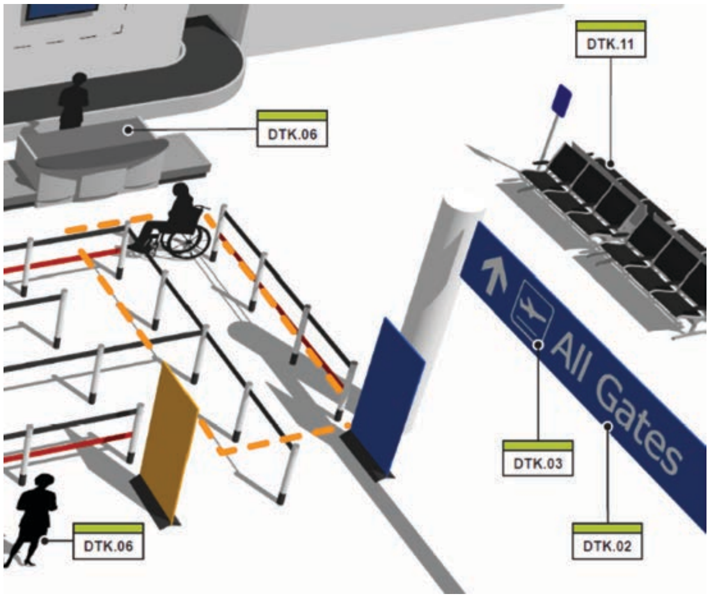
D-TK.10 Where a terminal has multiple security check points, ticket agents direct passengers to the appropriate location.

Source: ACRP Project 07-13 Research Team

Figure 5-29. Accessible check-in kiosks at San Francisco International Airport.

Source: Vancouver International Airport

Figure 5-30. Available ticket agent to assist customers with disabilities.



D-TK.11 A seating area is available for passengers who need to wait for assistance from the airline/service company and designated as priority seating. (See D-AP.16 and D-LA.07.)

D-TK.12 Accessible routes coincide with, or are located in, the same area as general circulation paths. Elevators and lifts are in the same area as stairs and escalators.

D-TK.13 Where elevators and lifts are not near or in sight of stairs and escalators, directional signage is provided. (See D-AP.26.)

D-TK.14 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor levels is preferable to a beeping sound.

D-TK.15 Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.

D-TK.16 Accessible men's and women's restrooms, a companion restroom, and drinking fountains are located before security.

D-TK.17 Visual and tactile signage for all permanent rooms and spaces, e.g., restrooms, is placed at the height and location specified under the ADA Standards. All accessible restrooms, not just companion/family facilities, are identified with a wheelchair symbol, especially in international airports/terminals. (See D-AP.12.)

D-TK.18 The maximum force for pushing or pulling open an interior door, e.g., to a companion restroom, is 5 lb. (exception fire doors).

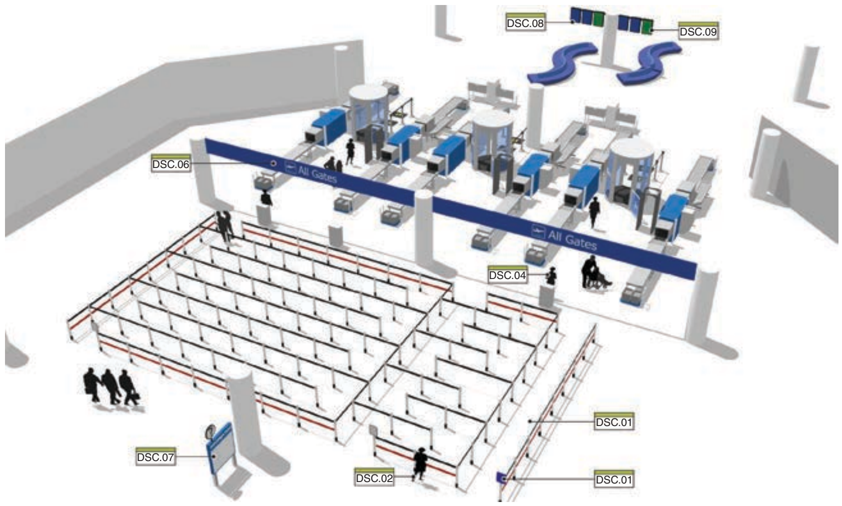
D-TK.19 FIDSs are hung at eye level (as shown in Figure 5-31) for close approach with larger fonts, good contrast, and a slower refresh rate. (See Chapter 8, Section 8.7.)

Source: Zurich Airport

Figure 5-31. FIDS mounted at eye level.

D-TK.20 FIDS information is available via a mobile application or verbally via a dedicated telephone number.

5.6 Security Checkpoint (SC)

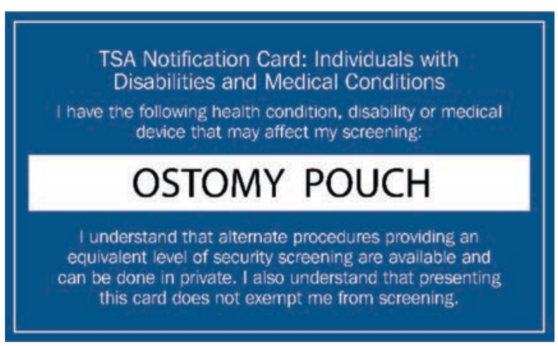


Security screening checkpoints (SSCPs) create a number of challenges for older adults and passengers with disabilities. There is already a heightened level of anxiety associated with the SSCP process, so using the Wayfinding Accessibility Audit Checklist to help enhance the wayfinding experience, and working with TSA agents to ensure that proper verbal communication is provided, is important.

The process of getting through an airport's security screening checkpoint is one of the most anxiety-filled aspects of air travel. Communication is critical for aging travelers or persons with a disability so that they know what to expect during the screening process. Information can be disseminated online (virtually) as part of the pre-trip planning process, as well as visually and verbally prior to and during the screening process. Research from the UK's CAA report validates how an inadequate flow of information on medical or disability-related needs can cause frustration and stress during the SSCP process. This section covers Wayfinding Accessibility Audit Checklist items that can help mitigate the frustration and stress associated with the SSCP process.

While neither airports nor airlines control the SSCP area, it is important to understand how vital the role of the TSA is, and how TSA can enhance the customer experience of aging travelers and persons with disabilities. The TSA website includes very detailed information on "Disabilities and Medical Conditions" and the assistance that these travelers can request in advance. Including a link to these pages on both airport and airline websites ensures that travelers are aware in advance of the special facilities and programs the TSA now offers, including the following:

- TSA Notification Card—A card downloadable from the TSA website that informs TSA officers of any disability, medical condition, or device that could impact the screening process (see Figure 5-32). The customer card in Figure 5-32 needs only to list the person's disability, not their name. For example, a customer would write in "Ostomy pouch" or other condition of a sensitive nature.



Source: tsa.gov https://www.tsa.gov/travel/special-procedures

Figure 5-32. TSA self-identification card being used at the SSCP.

Source: tsa.gov

Figure 5-33. TSA agent assistance for passengers is a key touch point for communicating information verbally.

- TSA Cares—A toll-free help line through which travelers with disabilities and medical conditions can arrange for additional assistance during the security screening process, including being met curbside, if necessary.
- Passenger Support Specialists (PSSs)—TSA officers who receive advanced training in assisting and communicating with passengers with disabilities and medical conditions and who can help these travelers with advance notice through TSA Cares (see Figure 5-33). Where a PSS is not available, a supervisor will instead provide assistance on request.

A recent introduction in U.S. airports is the new SSCP known as an "automated security checkpoint lane," as shown in Figure 5-34. What this means for aging travelers and persons with disabilities is that each customer can occupy one of five divestment points and remove their shoes, belongings, etc., at their own pace. Without the worry of holding up the rest of the queue, quite a bit of stress and anxiety are removed from the customers like older adults and persons with disabilities who may need more time than other customers to prepare themselves for screening. While an automated security lane may not be wayfinding per se, the result is a better state of mind as the customer moves on to find their way to their gate or other points of interest. London Gatwick Airport added color-coded floor graphics to reinforce individual divesting stations that help persons with disabilities feel more comfortable and in control of their travel experience (see Figure 5-35).

Source: Delta Airlines

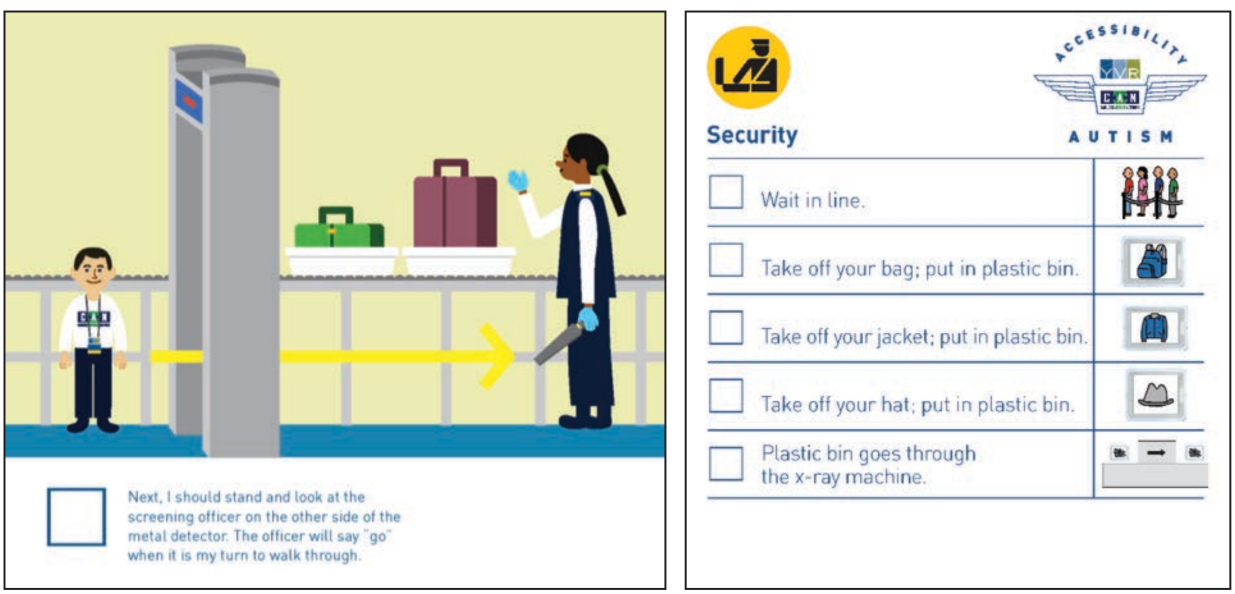
Figure 5-34. Automated lane at the SSCP in Hartsfield-Jackson Atlanta International Airport.

Source: London Gatwick Airport

Figure 5-35. Floor graphics reinforce individual SSCP divesting stations at London Gatwick Airport.

Some airports have developed programs for persons with specific disabilities like autism. Vancouver International Airport (YVR), in partnership with the Canucks Network, developed a series of resources called "I CAN FLY WITH YVR" aimed at helping facilitate safe and pleasant travel for the person with autism, the family, and other customers. The resources include a step-by-step storybook, a step-by-step checklist, and a video (see Figure 5-36). The storybook teaches the airport routine to travelers living with autism via step-by-step illustrations of each journey segment. The checklist is an interactive tool that includes steps for completion of each key segment of the airport journey, which can help reduce anxiety by increasing predictability for parents and customers with autism.

The goals of these types of resources are to ease the stress associated with the travel experience for families living with autism and provide a tool that helps promote understanding of the unique struggles of families living with autism among passengers and airport employees.



Source: Vancouver International Airport

Figure 5-36. Vancouver International Airport resources for traveling as or with a person with autism (image at left is an excerpt from a storybook; image at right is an excerpt from a checklist).

Source: Dublin Airport

Figure 5-37. Important Flyer wristband and lanyard used at Dublin Airport.

Other airports, such as Dublin Airport, have implemented award-winning programs like their "Important Flyer" program, where customers can request a wristband or lanyard, as seen in Figure 5-37, which can be shown to any Dublin Airport staff member (customer care and security screening staff, for example) if assistance is required at security, passport control, or any area where queues or crowds may exist.

Communicating information prior to entering the SSCP can help educate customers on what to expect, such as average wait times (see Figure 5-38). Some older adults and persons with disabilities have trouble standing for long periods of time, so the wait time information is important to them so they can decide whether to go through the SSCP on their own or request assistance.

While it is not a requirement in the United States, having an SSCP lane dedicated to persons with disabilities provides a higher level of service to customers who need it the most. Munich Airport, as shown in Figure 5-39, has an accessible lane identified with clear signage posted over wide doorways.

Research has shown that pictures can help communicate information to persons with cognitive disabilities. A pilot program at Dallas/Fort Worth International Airport used pictures to

Source: ACRP Project 07-13 Research Team

Figure 5-38. Pre-screening information at Heathrow Airport with average wait times.

Source: ACRP Project 07-13 Research Team

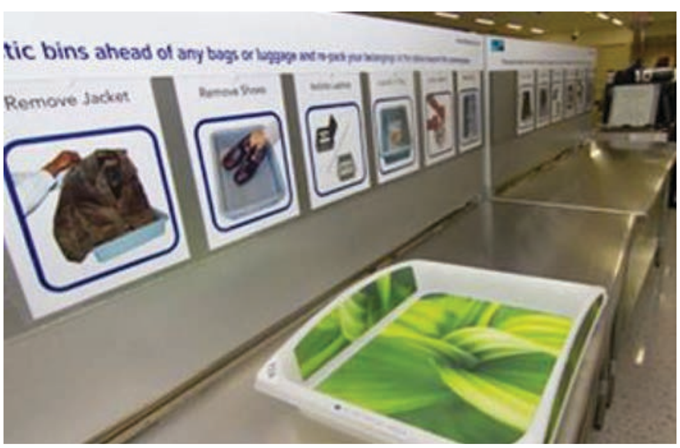
Figure 5-39. Dedicated SSCP lanes for accessibility at Munich Airport.

illustrate the divesting process as customers move through the queue (see Figure 5-40). The configuration of SSCP can vary from airport to airport, which means this kind of opportunity may not exist at every airport.

Post-security, it is very important to have accessible seating for customers who are older adults or traveling with disabilities. The seating design is also key and needs seat backs, as shown in Figure 5-41, as some of these individuals will need such support.

D-SC.01 There is a dedicated lane for employees and people with disabilities, clearly identified by signage or staff to direct people with disabilities, or those who self-identify as needing the accommodation, to the front of the line.

D-SC.02 Personnel are at lane entrances, and then TSA employees direct passengers to the correct lane.

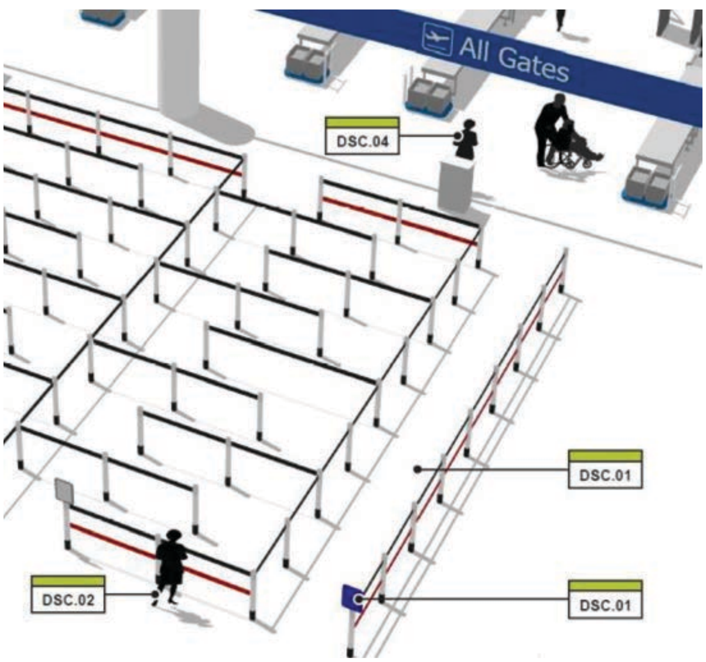


Source: ACRP Project 07-13 Research Team

Figure 5-40. Pictures used to explain divestment process at Dallas/Fort Worth International Airport.

Source: ACRP Project 07-13 Research Team

Figure 5-41. Accessible seating with backs post-SSCP at Munich Airport.



D-SC.03 On request, TSA employees reconnect the passenger with their belongings on the belt, or collect the passenger's belongings from the belt, to ensure they are not lost or stolen during the screening process. Service company employees can also assist.

D-SC.04 PSSs, trained TSA disability experts, are available to resolve problems or complaints or provide additional assistance. Where PSSs are not available, managers will instead assist.

D-SC.05 If there is no SARA installed airside, a basic TSA policy is in place to allow people traveling with service/emotional support animals to bypass the line on return.

D-SC.06 Directional signs have large, unadorned, illuminated fonts. (See Chapter 3, Sections 3.2.1.5 and 3.2.1.6.)

Conduct regular periodic reviews for all types of signage clutter (directional, informational, and regulatory) leading to and around the SSCP.

D-SC.07 An airport directory (static or dynamic signage) is hung at eye level and has large fonts, good contrast, and no glare.

Source: ACRP Project 07-13 Research Team

Figure 5-42. Clear signage that provides flight information and directions to gate post-security at Boston Logan International Airport.

D-SC.08 FIDSs are located at security exit points. Locating static directional signs adjacent (D-SC.06) with FIDSs can enhance wayfinding as shown in Figure 5-42.

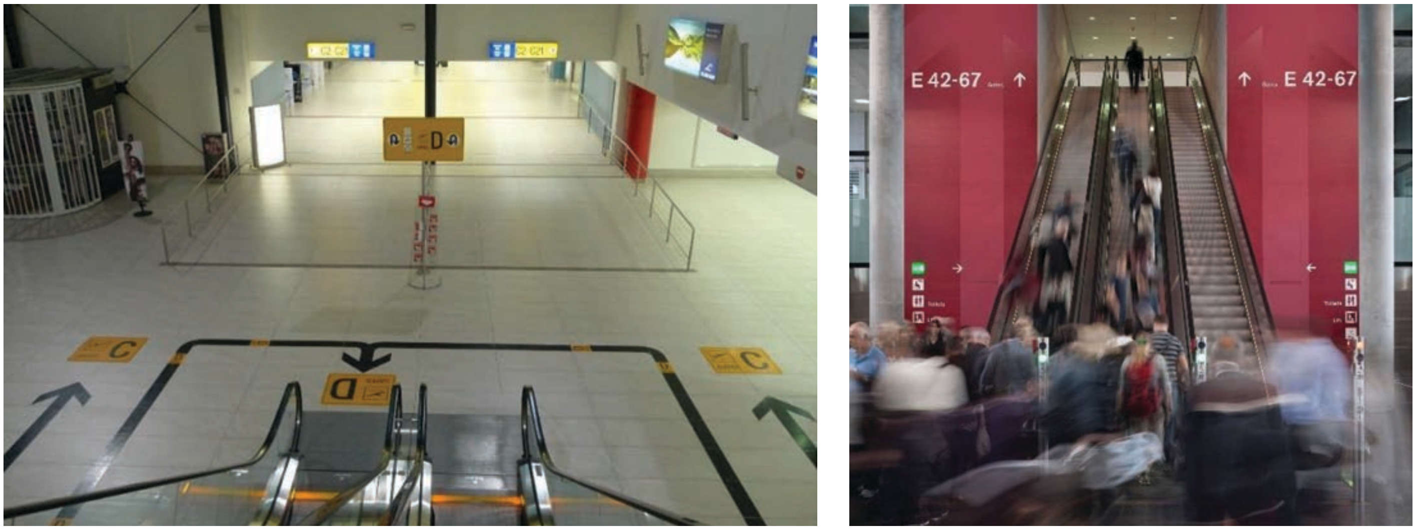
D-SC.09 Visual paging is built into TV monitors or FIDS.

5.7 Vertical Transition

Airports are usually designed with more than one level, thus requiring passengers to move either up or down to reach their destination. Many of the checklist items associated with vertical transitions have been included in Sections 5.1, 5.4, and 5.5 of this chapter. However, it is worth including a section focused on vertical circulation because there are several factors associated with it that can adversely impact the wayfinding experience for aging travelers and persons with disabilities.

The first factor is orientation. Escalators that involve a switch back, or require a change of direction after reaching the end, can be disorienting. Elevators with front and back doors that open depending on which level is being accessed can also be disorienting. The result of being disoriented is confusion in terms of which way to go.

Research studies have noted that over signing is commonly employed to compensate for the complex floor plan layouts in environments such as airports where wayfinding is a chronic problem. Other studies show that increases in plan complexity are directly related to decreases in wayfinding performance. The presence of signs cannot compensate for wayfinding problems that are due to the complexity of a floor plan. However, compensating is exactly what wayfinding in a complex airport environment is expected to do. Figure 5-43 shows, at left, the Prague International Airport, where the challenges of trying to overcome non-intuitive architecture that dictates counterintuitive passenger circulation at the bottom of the escalators are

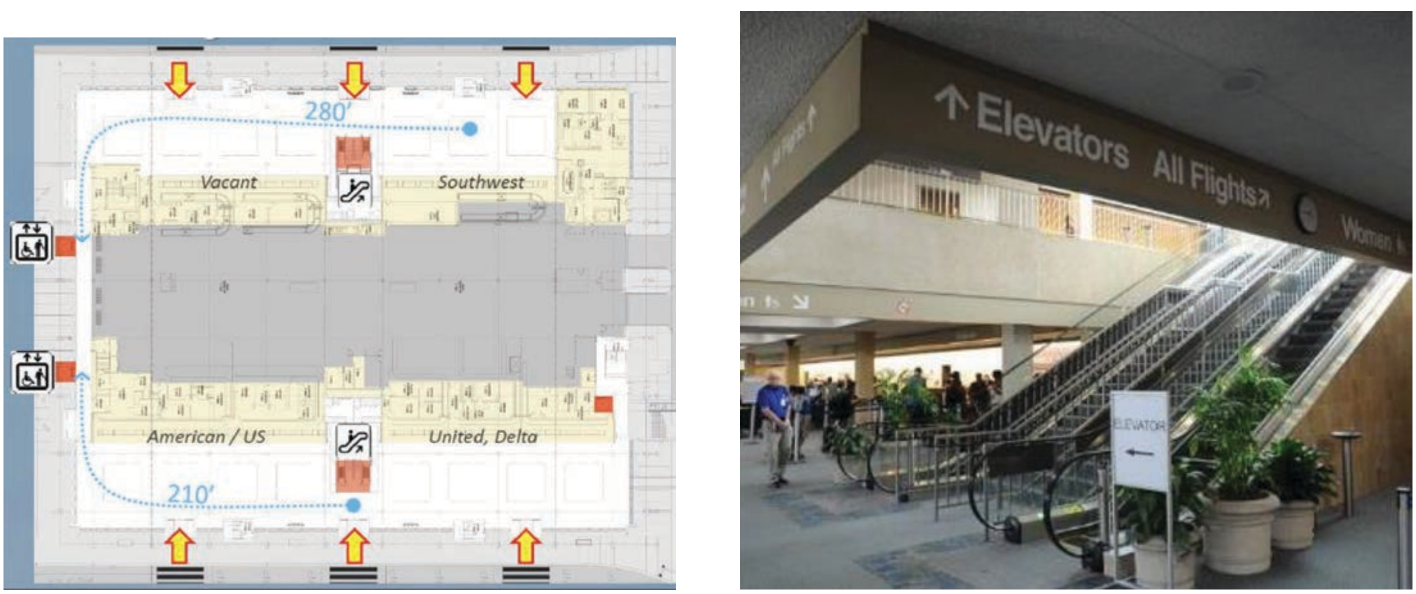


Source: Left photo courtesy of Tom Smahel, Human Factors North; right photo, Zurich Airport

Figure 5-43. Comparison of non-intuitive versus intuitive wayfinding at vertical transitions.

evident. By comparison, in Figure 5-43, at right, escalators at the Zurich Airport provide simple, clear, and bold visual graphics that support intuitive wayfinding in ways that can help customers with cognitive disabilities.

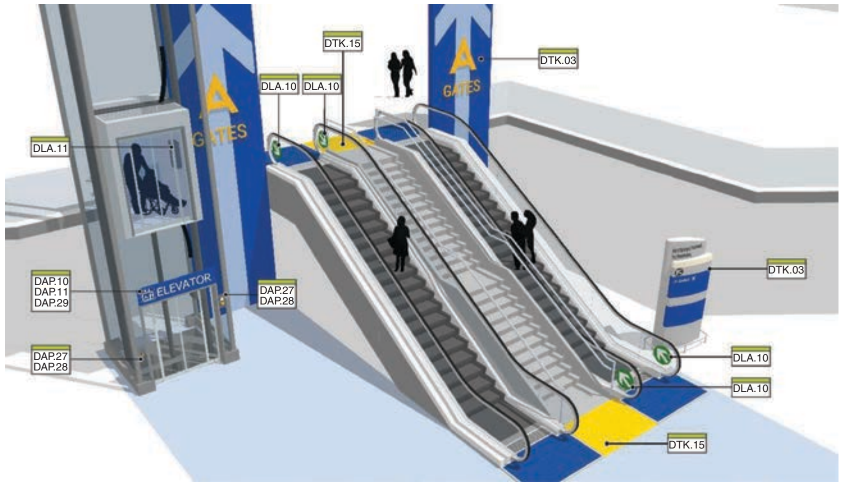
The second factor is direct line of sight. Vertical transitions that are hidden from the direct line of sight require an additional layer of signage (see Figure 5-44). They also call for one or more additional turns, and each turn requires a certain level of mental effort to reorient oneself afterward as the customer exits the elevator and finds their way back to the primary circulation path. For passengers who are blind or have low vision or cognitive impairments, what seem like minor details can have a significant impact on their ability to successfully negotiate these vertical transitions.



Source: ACRP Project 07-13 Research Team

Figure 5-44. Additional wayfinding required to find the elevator when it is not visible or adjacent to escalators.

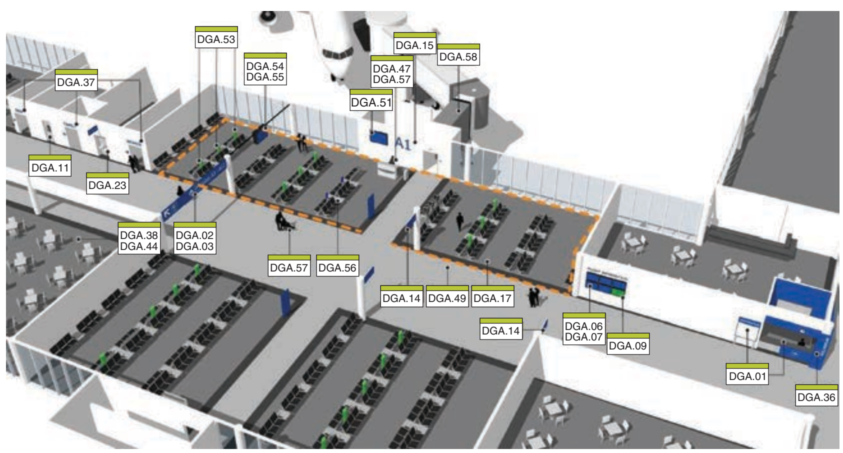
The following guidelines can help airports improve wayfinding at vertical transitions for older adults and people with disabilities:



- Locating elevators and lifts in the same area as stairs and escalators makes a big difference (see D-AP.26 and D-TK.13).
- Where elevators are not close by or in sight of stairs and escalators, clear directional signage is needed to find the elevator plus wayfinding from the elevator back to the primary path. (See D-AP.26, D-TK.13, and P-PD.16 for additional information.)
- For both confirmation as well as safety, detectable floor surface changes (color, texture) should be in place at approaches to escalators, moving walkways, and stairs (see D-AP.31 and D-TK.15).
- As an additional safety measure, escalators that include visual reinforcement of operating direction can help older adults and passengers with cognitive disabilities. These also benefit international travelers who may be used to walking left rather than right or vice versa (see D-LA.10).
- Elevators enclosed in glass or with glass doors provide line of sight from inside the cab, which helps orient passengers as they transfer from one level to another. Glass-enclosed elevators also are easier to identify as a means of vertical egress (see D-LA.11).

5.8 Gate Area (GA)

The gate area typically includes the common areas with concessions and shopping, followed by concourses that lead to the gates. Communicating the time and/or distance it takes to reach these and other destinations is important for aging travelers and passengers with a disability. Verbal communication of this information can come from an airline agent at the gate or a customer service representative at an information desk. Visual communication of this information can be accomplished with clear signage displaying walking distances or times. This information can also be communicated virtually online before arrival or on-site with personalized information provided by interactive digital directories. Walk times can also be displayed adjacent to FIDSs or incorporated as part of an FIDS.



It is also important to consider how information is conveyed to aging travelers and persons with disabilities in the hold room. Considerations include seating and adjacency of information and careful attention to how it is placed and communicated. Insightful feedback from the UK's CAA research shows that it makes PRMs very anxious to be left waiting without knowing how long they will be waiting and can lead to them feeling that they've been "forgotten."

5.8.1 Concourse

D-GA.01 At major decision points, multisensory destination/directional information is provided via a map, kiosk, or information booth.

Interactive directory maps at the Changi Airport in Singapore, as shown in Figure 5-45, use both estimated distance and time to inform their customers about what to expect moving forward, which helps them decide whether they need to request assistance or travel independently.

D-GA.02 Directional and identification signs have fonts that are easily read, with good contrast, and are non-glare and allow close approach wherever possible. (See Figure 5-46.)

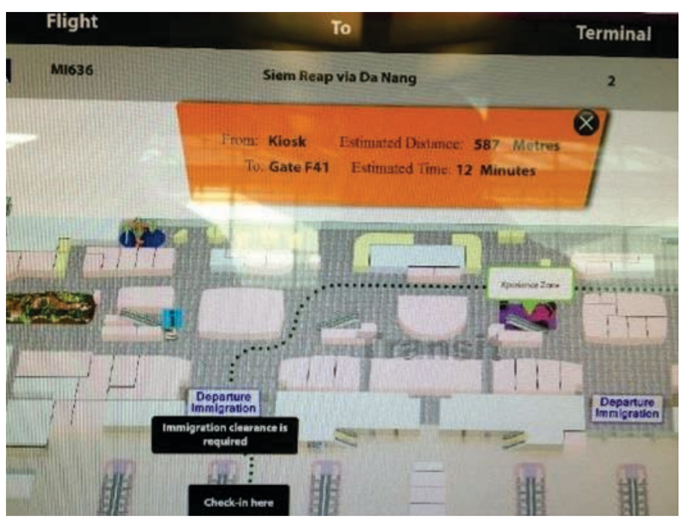
D-GA.03 Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers. (See Figure 5-46.)

D-GA.04 Identification signs are visual and tactile, i.e., have raised characters and Braille, and are correctly positioned. (See Figure 5-47.)

Per the ADA Standards, these types of signs are classified as permanent room identification signs and must comply with mounting heights between 48 inches and 60 inches above the finished floor for the tactile information.

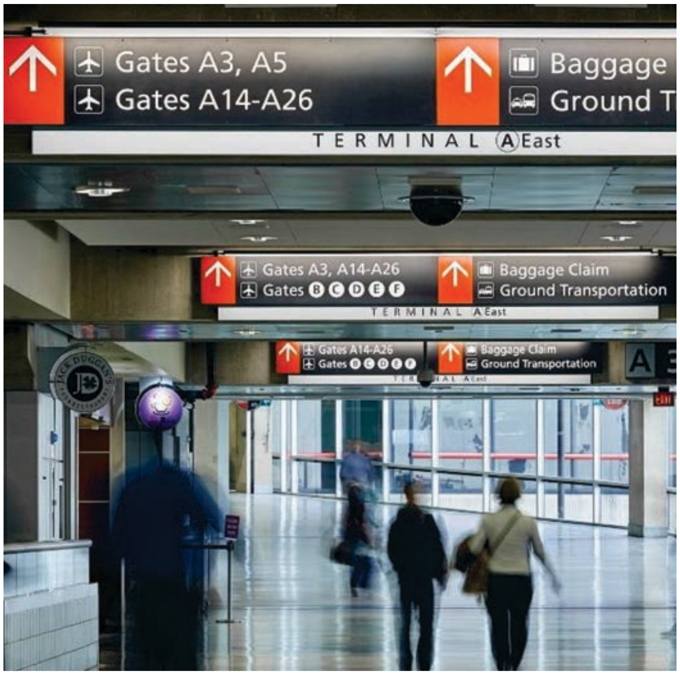
The design, placement, and planning of directional signs should take into account secondary decisions along the primary circulation path. For example, after a customer with an intellectual or cognitive disability has stopped to shop or use the restroom, the directional signage should be in close enough proximity to help them get re-oriented and choose the correct path. This recommendation can sometimes be in conflict with the goal to reduce visual clutter and only install as few signs as necessary. Ultimately, a balance needs to be found so both goals can be addressed satisfactorily. For additional information, see *ACRP Report 52: Wayfinding and Signing Guidelines for Airport Terminals and Landside* (Harding et al. 2011).

D-GA.05 Directional signs have large, unadorned, illuminated fonts.



Source: ACRP Project 07-13 Research Team

Figure 5-45. Interactive directories provide information on both time and distance to the destination at Changi Airport, Singapore.



Source: ACRP Project 07-13 Research Team

Figure 5-46. Directional signs at Philadelphia International Airport with high-contrast, easy-to-read fonts and consistent use of pictograms.

Source: ACRP Project 07-13 Research Team

Figure 5-47. Restroom sign at Heathrow Airport with tactile lettering and Braille.

Incremental increases in font size can have a significant impact on legibility of interior directional signs. Based on the Snellen visual acuity chart, the viewing distance for a person with 20/40 vision increases approximately 30 feet for every 1-inch increase in letter height (see Chapter 3, Sections 3.2.1.5 and 3.2.1.6).

D-GA.06 FIDSs are located at frequent intervals along concourses.

A minimal approach would be a FIDS located at each major decision point and then spaced approximately 400 feet thereafter; the basis for the spacing is 265 feet per minute of walking time with no obstructions, which is based on a person with no disabilities. The A Gate concourse at Detroit's McNamara Terminal is 1 mile long, so walking distances are a significant concern. To help aging customers and persons with disabilities have access to information without having to walk long distances or get lost or confused while searching, FIDSs are located at frequent intervals and adjacent to restrooms (see Figure 5-48).

D-GA.07 FIDSs are hung at eye level for close approach with larger fonts, good contrast, and a slower refresh rate. (See Chapter 8, Section 8.7, and Figure 5-49.)

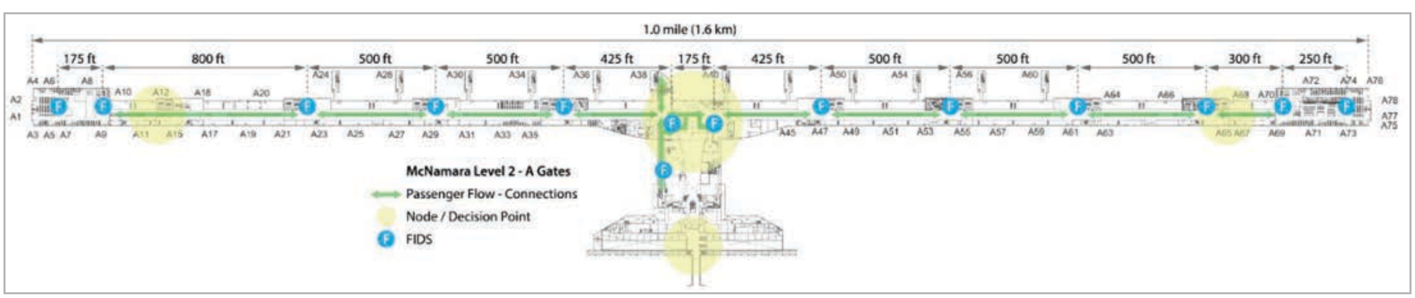
D-GA.08 FIDS information is available via a mobile application or verbally via a dedicated telephone number. (See Figure 5-50.)

Information should include destination, gate, status (time) of departure, and walk time (if available). The mobile application should have the functionality to help persons with disabilities, per the application guidelines "Do's and Don'ts" (see Chapter 8, Section 8.3).

D-GA.09 Visual paging is available at frequent intervals along concourses, e.g., built into FIDSs. Pages may also be provided on the airport website or via a mobile application.

In addition to appearing on FIDSs, visual paging can appear on other digital displays or as dedicated visual paging displays. When the displays are not being used for visual paging they can be used to display alternate content that would generally show relevant airport information or internal airport marketing campaigns.

The visual paging system at Philadelphia International Airport is a good example of a comprehensive solution. The FIDSs have a dedicated screen (center display) for visual paging. In between FIDSs, single displays dedicated to visual paging are located to fill in gaps. Also, in large, open areas like the food court, visual paging is part of the overall FIDS (see Figure 5-51).When there is an active page, the advertising is overridden by the visual paging.

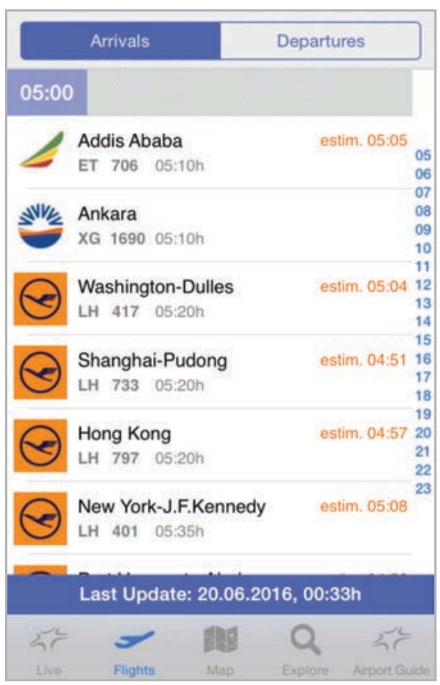


Source: ACRP Project 07-13 Research Team

Figure 5-48. FIDSs located at frequent intervals in Detroit Metropolitan Airport's McNamara terminal.

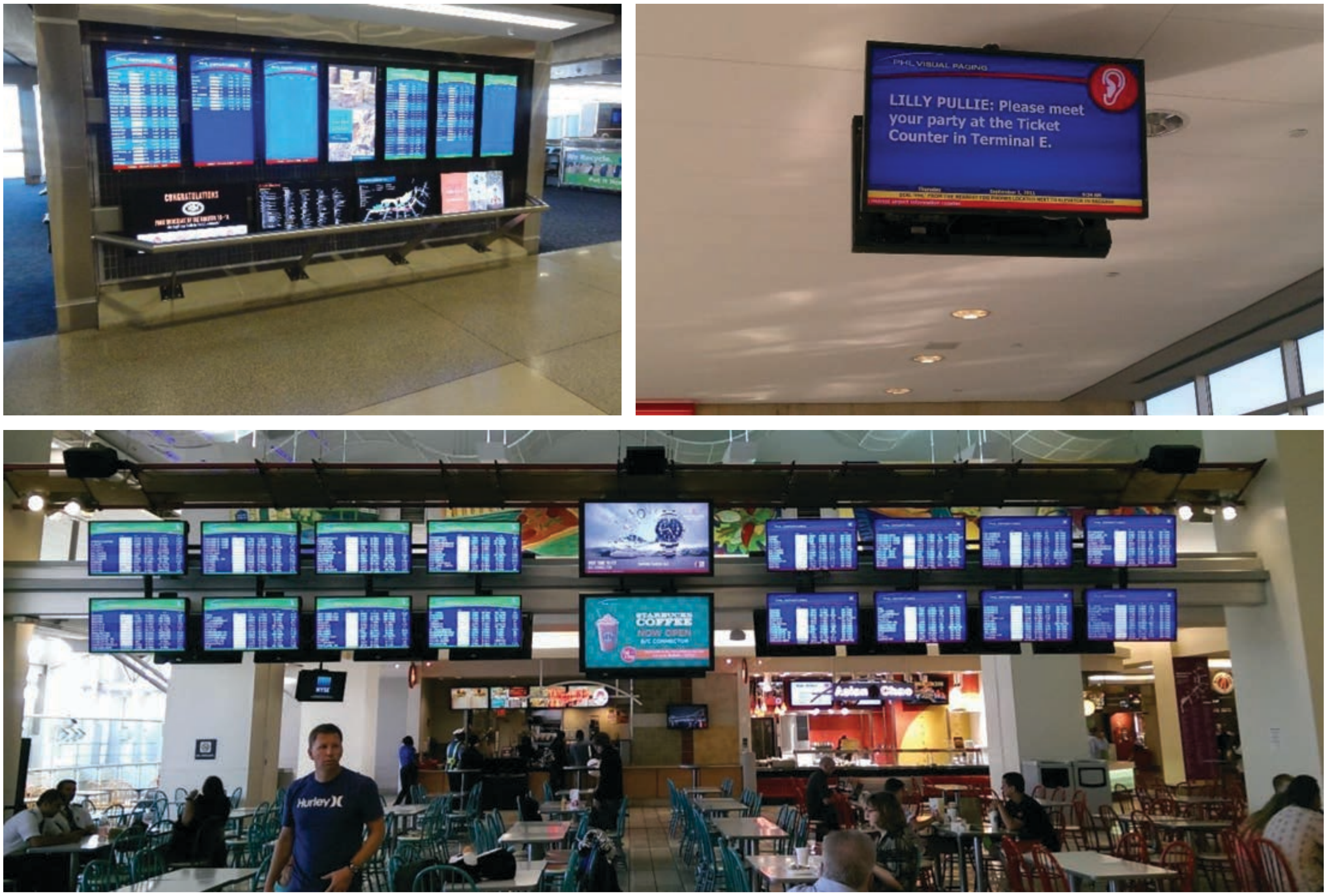
Source: Vancouver International Airport

Figure 5-49. FIDS mounted at eye level at Vancouver Airport.



Source: Munich Airport

Figure 5-50. Mobile application with flight information.



Source: ACRP Project 07-13 Research Team

Figure 5-51. Example of comprehensive visual paging system at Philadelphia International Airport.

D-GA.10 The paging system allows passengers to request audible or visual page by phone, text, or email.

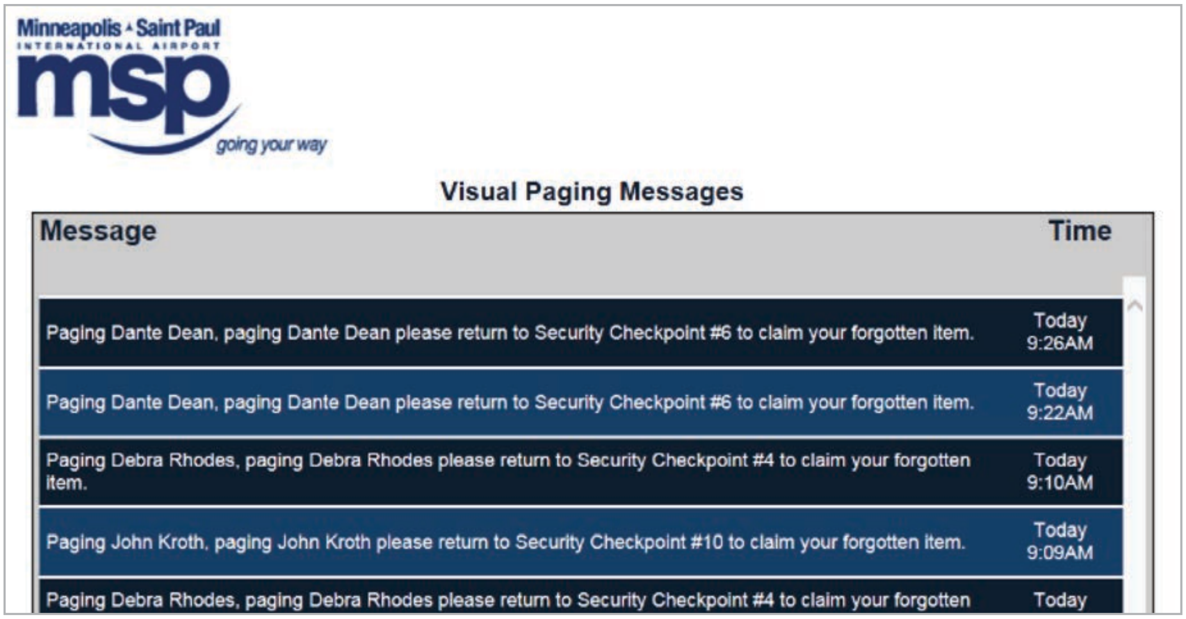
Some airports, like Minneapolis-St. Paul International Airport, make visual paging information accessible through their website (see Figure 5-52). Other airports, like Phoenix Sky Harbor International Airport, provide a universally accessible kiosk that allows all customers, including those who are deaf or blind, to request or access a page (see Figure 3-52).

D-GA.11 Courtesy phones are located at regular intervals along the concourse, including at major decision points, and are identified by visual and tactile signage.

D-GA.12 Directional signage for gate numbers is located at regular intervals, at all entrances onto the concourse from security, and at all decision points/nodes.

D-GA.13 Signs indicating the direction to the baggage claim/terminal exit are located at frequent intervals and outside restrooms.

D-GA.14 Good lines of sight allow travelers to see a series of gate numbers along the concourse, i.e., gate numbers are not blocked by other signage or architectural elements.



Source: Minneapolis-St. Paul International Airport

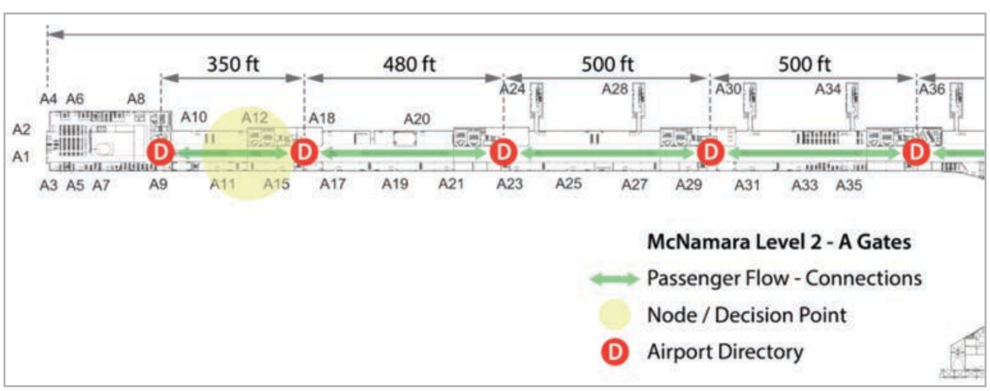
Figure 5-52. Visual paging on Minneapolis-St. Paul International Airport website.

D-GA.15 Gate numbers follow a regular pattern, e.g., even on left, odd on right, and are distinguished by a zone identifier, not just a number, e.g., A5 on the A concourse (see Figure 5-53).

For airports with more than one gate area, adding the alpha prefix creates distinct zones, which can help customers with intellectual and cognitive disabilities navigate more easily, e.g., A Gates, B Gates, C Gates, etc.

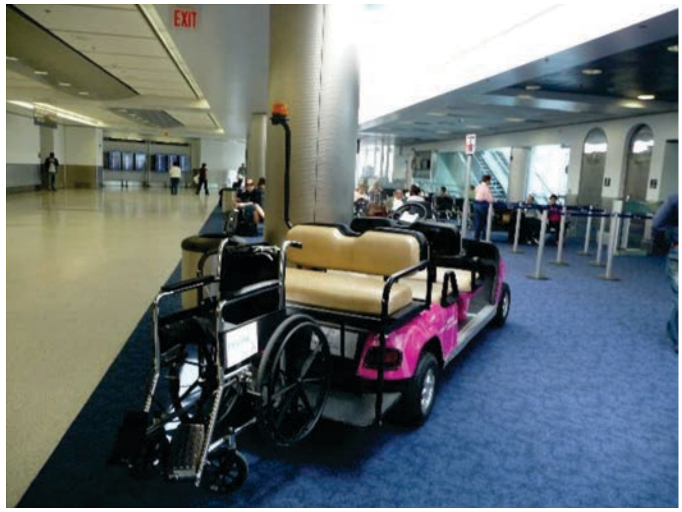
D-GA.16 Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path, e.g., where there are long corridors not adjoining holding areas.

D-GA.17 Differences in floor texture and color help provide an "edge" for wayfinding and distinguish the concourse walkway from holding areas.



Source: ACRP Project 07-13 Research Team

Figure 5-53. Gate numbering with a logical sequence.



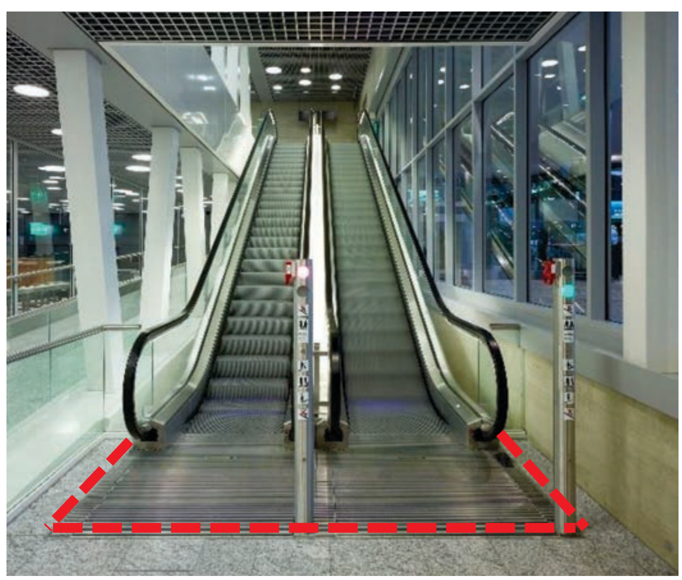
Source: ACRP Project 07-13 Research Team

Figure 5-54. Floor texture and color used to create a navigable edge at Miami International Airport.

This is helpful for customers who are blind or have low vision. Floor textures in airports that provide a navigable edge will typically use a hard surface next to a soft surface, e.g., a terrazzo concourse for high-traffic areas next to a carpeted area for seating, as shown in Figure 5-54.

D-GA.18 Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways and stairs. (See Figure 5-55.)

This is a safety issue, especially for older adults and persons with disabilities.



Source: Zurich Airport

Figure 5-55. Detectable floor surface change at base of escalator.

D-GA.19 Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.

D-GA.20 Accessible routes coincide with, or are located in, the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.

D-GA.21 Where elevators are not near or in sight of stairs and escalators, directional signage is provided.

D-GA.22 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floors is preferable to a beeping sound.

D-GA.23 There are no objects protruding more than 4 inches into the path of travel that are not cane-detectable (lower edge 27 inches or less above finished floor), e.g., fire extinguishers, pay phones, and drinking fountains.

D-GA.24 Overhead clearance is 80 inches minimum, and there are no unenclosed stairs or escalators without a rail or barrier underneath.

D-GA.25 An audible signal alerts passengers to the end of moving walkways.

D-GA.26 Accessible means of egress (evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) have appropriate identification and directional signage in view from concourse walkways and/or holding rooms.

D-GA.27 Signs at exit doors and areas of safe rescue are tactile as well as visual. Instructions for summoning assistance in areas of safe rescue are also tactile with an accessible two-way communication system in place.

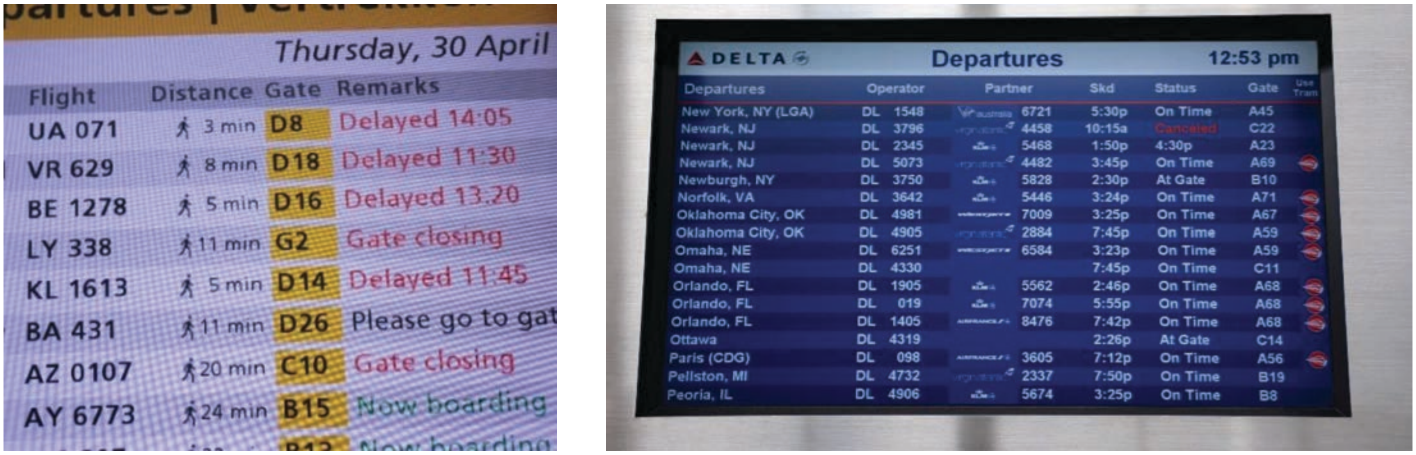
D-GA.28 Airport, airline, and concessions staff have training on the Airport Evacuation Plan (AEP) and how to assist passengers with disabilities in case of emergency.

D-GA.29 Visual and audible signaling systems are under central control to help direct people along the best route. Push notification sends emergency information and directions to mobile phones.

5.8.2 People Movers

D-GA.30 Where people movers to or along the concourse are optional, dynamic signage indicates flights or gates for which the tram or monorail ride is recommended. Walking times/distances are provided.

Airports, like Schiphol, that have moving sidewalks (aka travellators) post walk times on the FIDS next to the gate number. Other airports, like Detroit's McNamara Terminal (which is over 1 mile long), have a tram inside. The FIDS posts a tram icon to indicate which gates customers should ride to versus walk to (see Figure 5-56). Equipping customers with advance



Source: ACRP Project 07-13 Research Team

Figure 5-56. FIDS with walk times **(photo at left)** ***and FIDS with Ride Tram icon*** **(photo at right)*.***

knowledge allows them to choose whether to request assistance or proceed to their gate independently.

D-GA.31 Station and other announcements on the tram or monorail are both visual and audible.

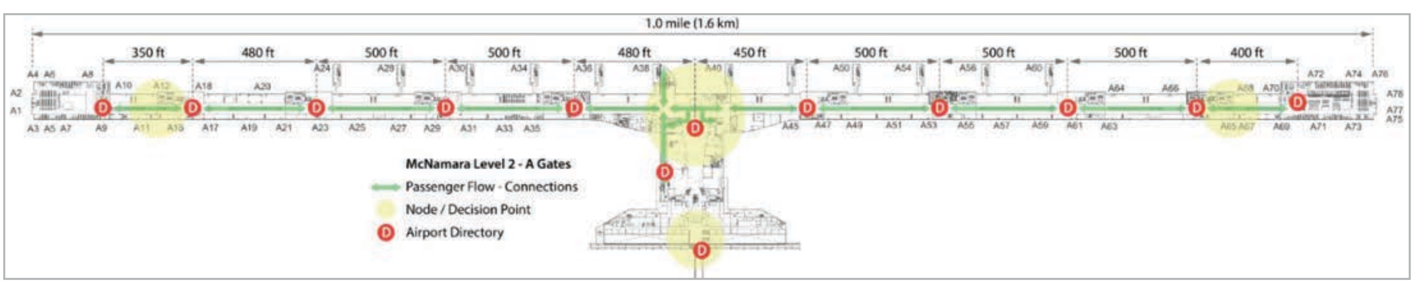
D-GA.32 A designated seating area and wheelchair area with grab bar are provided in the cars.

D-GA.33 Effective directional signage is in place, especially where a level change is involved.

5.8.3 Points of Interest

D-GA.34 On long concourses, maps with points-of-interest directories are placed at regular intervals. (See Figure 5-57.)

D-GA.35 SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.



Source: ACRP Project 07-13 Research Team

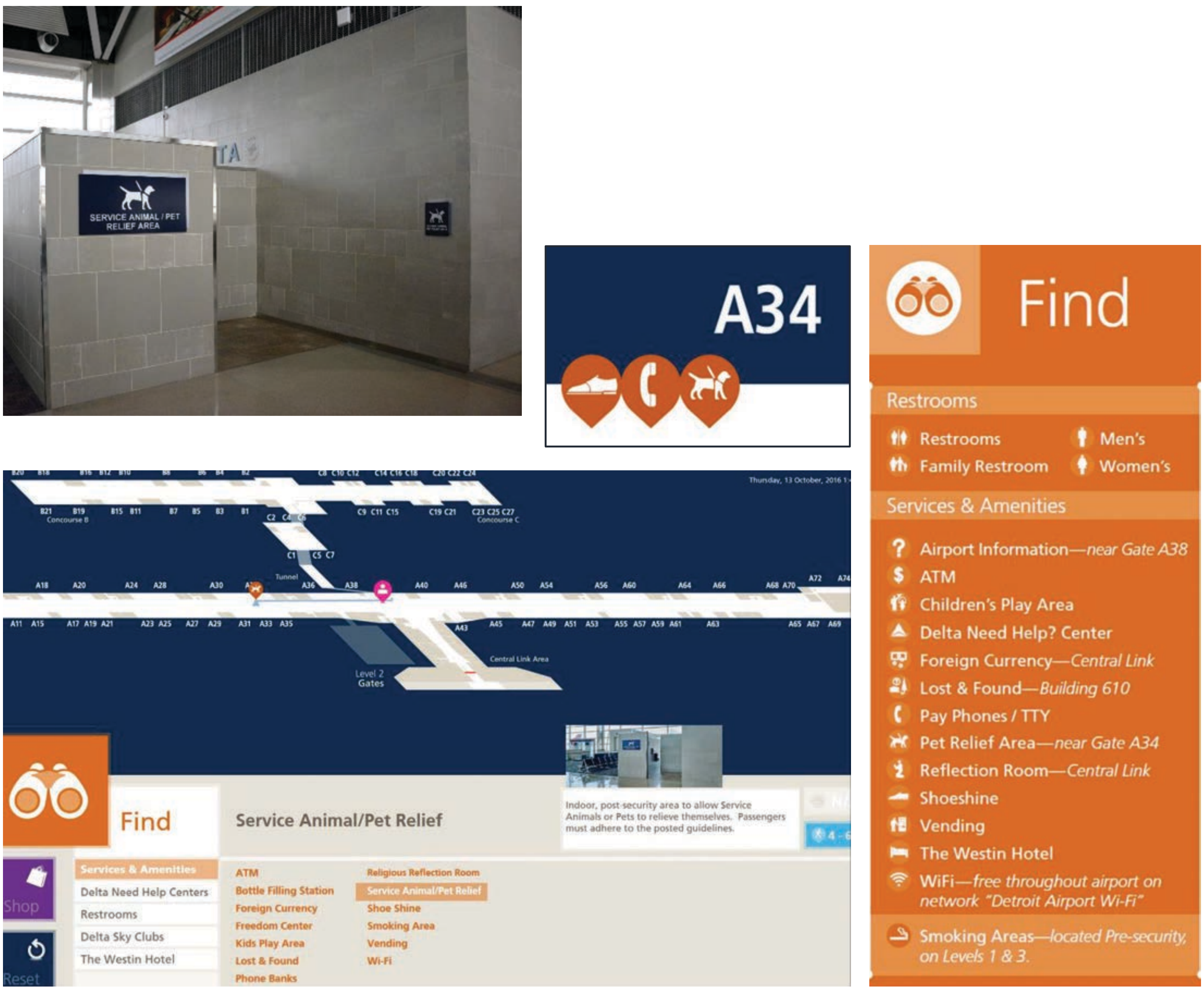
Figure 5-57. Consistent placement of directories on concourses at Detroit Metropolitan Airport.

49 CFR Part 27.71 requires SARAs airside with limited exceptions (see Figure 5-58).

D-GA.36 Staff are available who can speak in sign language and know how to identify and reach those who need this service. If no staff members are versed in sign language, remote interpreting (at airport information desk or Traveler's Aid) enables communication with travelers who are deaf.

D-GA.37 Restrooms, companion restrooms, and drinking fountains are grouped at frequent intervals along concourses with men's and women's facilities in a standard relation to each other, e.g., men's to the left of women's.

D-GA.38 Restaurants, food kiosks, and convenience stores are distributed along concourses to provide close access from all gates.



Source: ACRP Project 07-13 Research Team

Figure 5-58. Visual and virtual information used to locate SARA at Detroit Metropolitan Airport.

D-GA.39 Restaurant menus are in large print, Braille, or posted in an accessible format online.

D-GA.40 For electronic menus, e.g., on an iPad, accessibility features such as VoiceOver are enabled, and the device allows close approach for easy viewing.

D-GA.41 Restaurants that have wall menus also have a large print copy available on request.

D-GA.42 Restaurant staff will read the menu or assist with electronic menus.

D-GA.43 Restaurant staff willingly accommodate service animals.

D-GA.44 Aisles in stores and spaces between tables in restaurants have a clear width of 36 inches.

D-GA.45A Restaurant and retail staff have disability awareness training, including how to guide people who are blind.

D-GA.45B ATMs and currency exchange counters meet ADA accessibility standards.

5.8.4 Hold Room Areas

D-GA.46 VIP Lounges are fully accessible, have appropriate directional and identification signage, and are identified on the airport access database, maps, and directories.

D-GA.47 Gate agents provide confirmation that the passenger is at the correct gate as well as expected boarding and departure time.

D-GA.48 The quality of the PA system and terminal acoustics allow announcements in the gate area to be easily understood.

D-GA.49 Gate areas have induction loops to allow PA announcements to be transmitted directly to persons using hearing aids with T-coils or cochlear implants. Graphic signage alerting passengers to the presence of the hearing loop is displayed on the podium and in the gate areas.

These signs tell customers using hearing aids with T-coils to activate that feature and also reassure others with cochlear implants that they will be able to hear announcements without fear of missing important flight information, boarding status, gate changes, etc. (see Figure 5-59).

D-GA.50 There is a general pre-boarding announcement for people with disabilities or personal notification by gate agents for those who self-identify as needing to pre-board.

D-GA.51 GIDSs have real-time information, including which rows are boarding.

Source: Loopseattle.org

Figure 5-59. Signage for hearing loops in boarding gate area at Gerald R. Ford International Airport.

D-GA.52 Passengers with sensory disabilities who self-identify are provided prompt access to information given to other passengers, personally by the gate agent if no other means is employed, e.g., GIDS, text message, PA system, etc.

There is a requirement in Part 382 that people who want services from airlines must "self-identify" in order to be accommodated:

§382.53 What information must carriers give individuals with a vision or hearing impairment at airports? (a)(1) As a U.S. carrier, you must ensure that passengers with a disability who identify themselves as persons needing visual or hearing assistance have prompt access to the same information provided to other passengers at each gate, ticketing area, and customer service desk that you own, lease or control at any U.S. or foreign airport, to the extent that this does not interfere with employees' safety and security duties as set forth in FAA, TSA, and applicable foreign regulations.

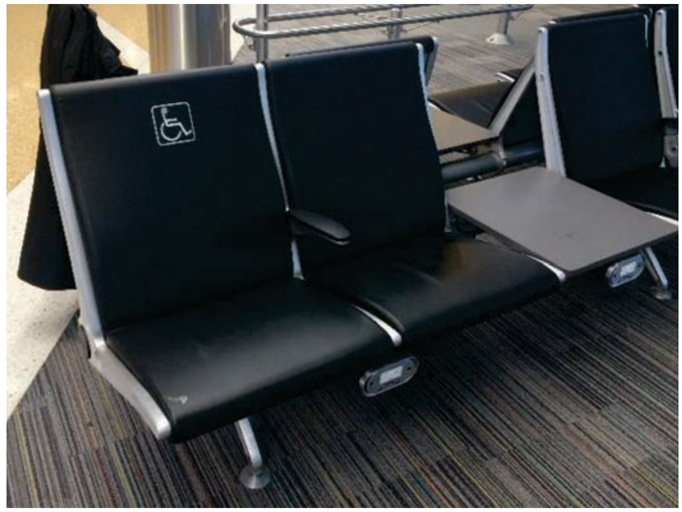
Airlines no longer have to make a boarding announcement for customers with disabilities to pre-board. To get that service, customers need to self-identify to the gate agent. With regard to communication assistance for people with vision or hearing loss, customers also must identify themselves as needing the assistance. In other words, the airline is not obligated to provide a GID with real-time information to meet these needs, but can simply write something on a piece of paper for someone who is deaf.

D-GA.53 Accessible recharging stations are available in the gate area for mobile devices and assistive equipment. (See Figure 5-60.)

D-GA.54 TV monitors have high-contrast closed captioning enabled.

D-GA.55 Visual paging is built into TV monitors. (See D-GA.09.)

D-GA.56 A designated seating area for people with disabilities is located near the podium or boarding gate.

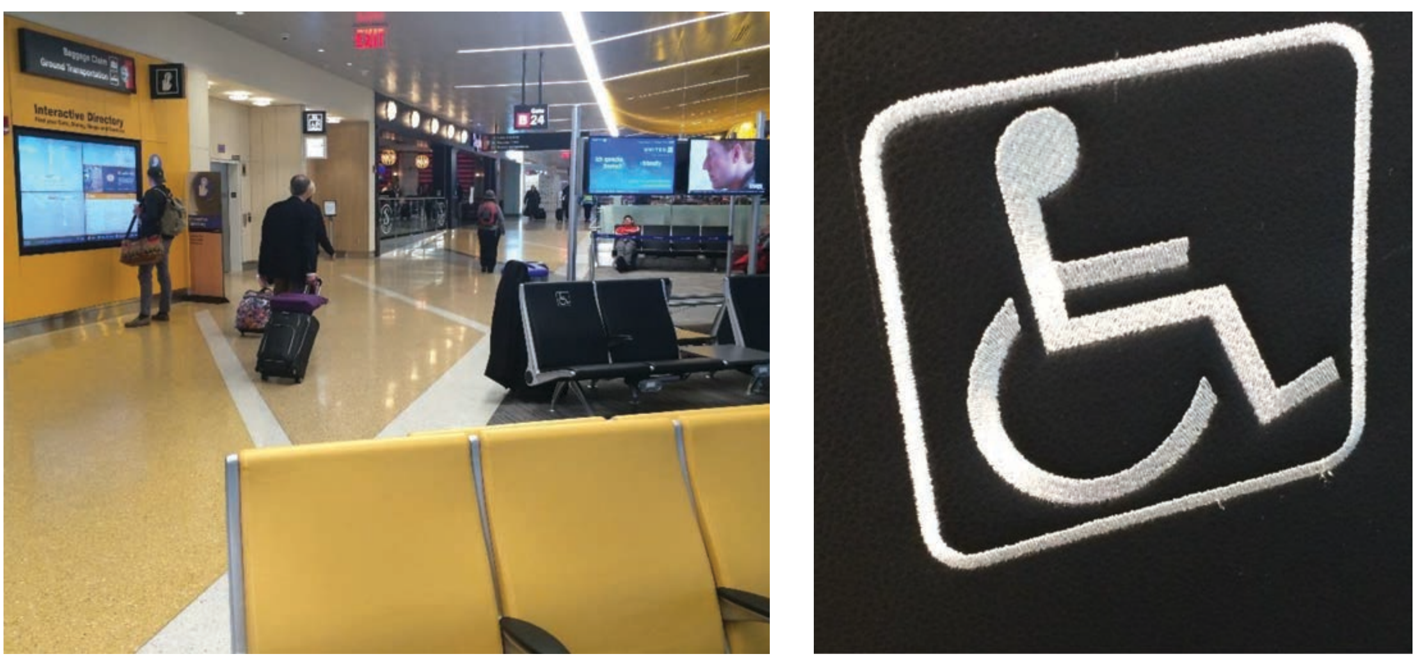


Source: ACRP Project 07-13 Research Team

Figure 5-60. Recharging stations built into accessible seating at Boston Logan International Airport.

Figure 5-61 shows a designated seating area for people with disabilities in the B Terminal at the Boston Logan International Airport that is part of a holistic wayfinding effort. The designated seating is a different color, with the symbol of accessibility stitched into the seat back, and it is located adjacent to the boarding gate door. Each gate's hold room is color-coded, with the seating, lighting, and wall accent colors all matching. The designated seating is also close to interactive airport directories and a video screen with video paging capability.

D-GA.57 Airline or service company personnel assist passengers with disabilities to the door of the plane, or seat, as needed.



Source: ACRP Project 07-13 Research Team

Figure 5-61. Accessible seating near boarding gate at Boston Logan International Airport.

D-GA.58 Boarding bridge slopes are as gentle as possible, with handrails at transitions and minimal gap/step into plane.

D-GA.59 Passenger wheelchairs may be used until the door of the plane then gate-checked for stowage as cargo, or manual chairs or walkers may be stowed in the cabin on a first-come, first serve basis. An elevator or lift near the jet bridge allows safe and timely transfer of wheelchairs to the tarmac for stowage.

D-GA.60 An airline CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues involving requested accommodations, assistive devices, carry-on baggage, denied boarding, etc.

5.9 Airline Support (AS)

D-AS.01 In case of flight cancellation, the rebooking center is accessible with either a ticket agent or phone instead of/in addition to an inaccessible touch-screen kiosk. Alternatively, passengers can rebook by airline mobile application.

D-AS.02 Where possible, passengers with disabilities are given priority in rebooking.

D-AS.03 A counter induction loop is installed at one rebooking counter with priority access for persons who are hard of hearing and have hearing aids with T-coils or cochlear implants. A hearing loop graphic sign is displayed on the counter.

D-AS.04 Rebooking centers have appropriate directional and identification signage and appear on maps/directories.

D-AS.05 Staff from the airline service company are recalled by gate agents to provide an escort to the rebooking center and the new gate.

D-AS.06 Gate agents direct passengers to rebooking centers.

D-AS.07 A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues.

5.10 International Flights (IN)—Passport Control

D-IN.01 There is a dedicated lane for employees and people with disabilities, clearly identified by signage, or staff direct people with disabilities or those who self-identify as needing the accommodation to the front of the line.

D-IN.02 Personnel at lane entrances direct passengers to the correct lane.

CHAPTER 6

Arriving Customer Journey

This chapter is focused on the arriving customer journey and presents and elaborates on recommendations/requirements listed in the Wayfinding Accessibility Audit Checklist presented in Appendix A of this guidebook (see below for a description of the Wayfinding Accessibility Audit Checklist).

Each of the sections in this chapter has a corresponding two-letter section code (see Figure 6-1). This two-letter code is combined with a letter "A" prefix for "Arriving" and a numerical suffix to create a unique label for each recommendation/requirement. These labels are also used in the Wayfinding Accessibility Audit Checklist in Appendix A. These recommendations/requirements are presented and discussed in the appropriate section throughout this chapter.

The Wayfinding Accessibility Audit Checklist is a checklist of recommendations/requirements to be considered in an assessment of an airport's wayfinding accessibility. All of the recommendations/requirements in the checklist are numbered and labeled to correspond to a particular chapter and section in this guidebook. Each labeled recommendation or requirement is grouped according to chapter and section and characterized according to form of communication (visual, virtual, and/or verbal), the types of disabilities accommodated (vision, hearing, cognition, and/or mobility), and any known standards or additional guidance available (see Figure 6-2).

To help provide a visual reference for the recommendations/requirements in the Wayfinding Accessibility Audit Checklist, the research team developed virtual models of different journey segments at an airport with the recommendation/requirement labels embedded (see Figure 6-3). A model view of the arrival point journey segment is shown in Figure 6-4. All the virtual models of journey segments are compiled in Appendix C.

There is redundancy built into the checklist because there are some needs that are required in more than one area of the airport. For example, seating area needs are noted in areas ranging from the arriving gate through the terminal and in the baggage claim and ground transportation areas. So when an airport is using the checklist to review a problem area, or plan a new project, the checklist is complete for each area as well as the entire arriving journey segment.

This chapter covers the arriving passenger whose final destination is the city and region served by the airport at which they are landing. Arriving passengers continuing on to their final destination on a connecting flight are covered in Chapter 7.

Depending on the disability, challenges for arriving customers with disabilities can begin upon exiting the plane and can have a significant ripple effect later on in the arrival journey segment. Research from the study conducted by the UK's CAA in 2009 shows that persons with reduced mobility expect they may need to wait to exit the airplane, which in itself is not unreasonable. However, the combination of not knowing how long they will have to wait and not having requested assistance can result in a sense of abandonment for the customer. As noted in

Section #	Section Description	Section Code
6.1	Airline Support	AS
6.2	Gate Area	GA
6.3	Baggage Claim	BC
6.4	Lobby Area	LA
6.5	Ground Transportation	GT
6.6	Rental Car - On-site and Remote	RC
6.7	Parking	PK
6.8	International Flights	IN

A-AS.01

Source: ACRP Project 07-13 Research Team

Figure 6-1. Chapter 6 matrix and example of a recommendation/requirement label.

Chapter 6

Wayfinding Audit Checklist

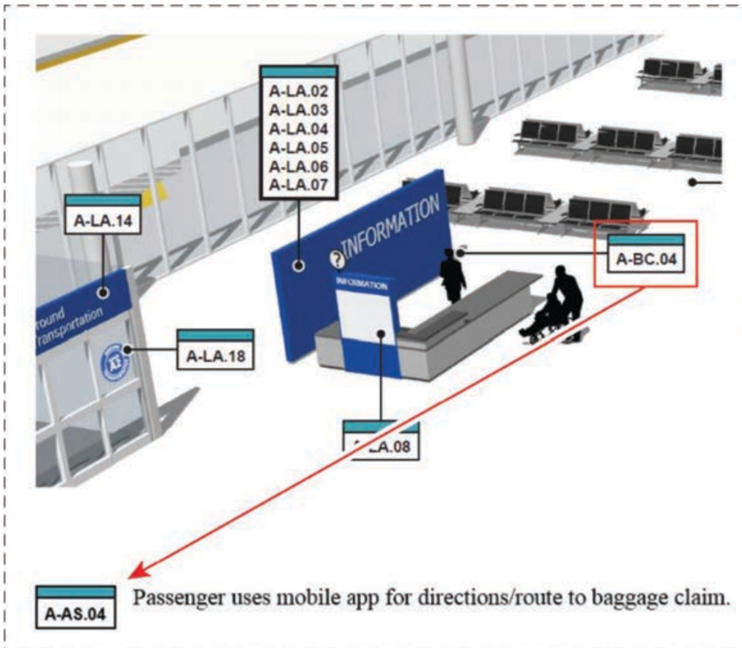
ARRIVING PASSENGER (A)

REF #	Recommendations & Requirements	3V's	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
Section 6.1: Airline Support (AS)								
A-AS.01	Baggage claim information is provided on board aircraft by flight attendant or by agent in gate area after arrival, verbally or visually as needed.	Verbal	X	X	X	X	14 CFR 14 CFR Part 382.69, 382.119	
A-AS.02	Baggage claim information is sent by text message or passenger can check carousel location via mobile phone after arrival.	Virtual	X	X	X	X		
A-AS.03	Agent gives directions to baggage claim.	Verbal	X	X	X	X		
A-AS.04	Passenger uses mobile app for directions/route to baggage claim.	Virtual	X	X	X	X		

A-AS.02 Baggage claim information is sent by text message, or passenger can check carousel location via mobile phone after arrival.

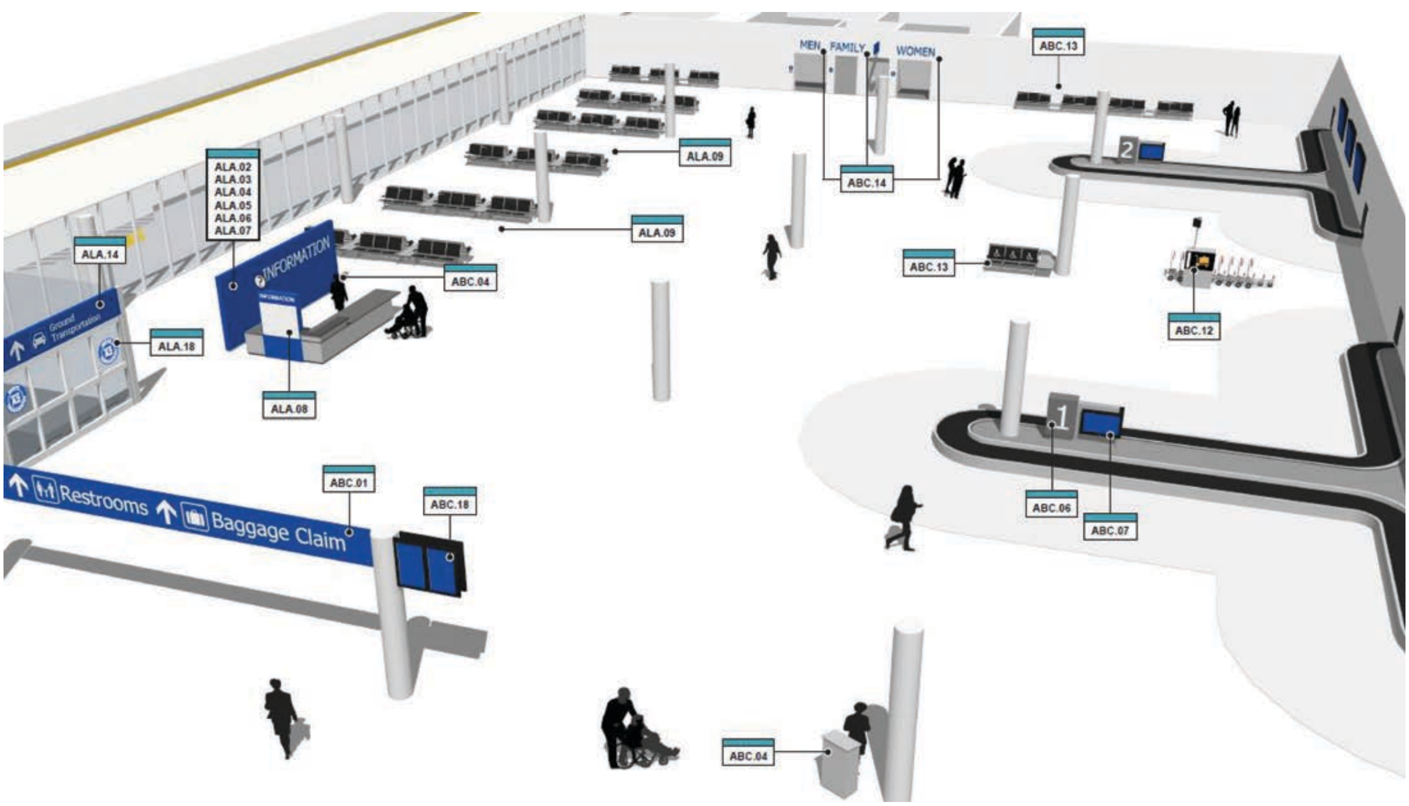
Source: ACRP Project 07-13 Research Team

Figure 6-2. Excerpt from Wayfinding Accessibility Audit Checklist, Chapter 6.



Source: ACRP Project 07-13 Research Team

Figure 6-3. Example of recommendation/requirement labels embedded in a virtual airport model and recommendation/requirement text.



Source: ACRP Project 07-13 Research Team

Figure 6-4. Model view of the arrival point journey segment.

the research, the wait time was so long in several cases that the customers' luggage was removed from the baggage claim carousel and stored in lost luggage.

Passengers typically fly with certain expectations, and there are consequences when these expectations are violated. In the case cited above, the consequence can be substantial. Anxiety becomes compounded; it begins with the customer wondering where their luggage is and ends with concern about how to find the lost luggage office. While the source of these types of issues is not specific to wayfinding, the consequences end up having an impact on the wayfinding experience and underscore the importance of communication throughout the customer journey.

Some information that needs to be communicated is airline-related while other information is airport-related. Regardless of responsibility, there are expectations that require effective communication:

- Explain to the customer requiring assistance that they may need to wait to exit the aircraft until other passengers have deplaned and let them know the estimated wait time while offering reassurance that every effort will be made to minimize the delay.
- Communicate to the customer that the airline and the airport have coordinated their efforts and that requested equipment will be waiting.
- Communicate to the customer that they will have access to their own mobility equipment at the earliest possible point in the journey, typically at the door of the aircraft unless requested otherwise.
- Reassure the customer that they will be able to get help with their luggage, if needed, extending to the next destination in their journey.

6.1 Airline Support (AS)

As part of the initial landing, information is communicated primarily verbally by the flight attendant over the PA system and also on a person-to-person level to aging travelers and persons with disabilities who have requested it. Advances in technology can also help provide information virtually via mobile applications that post information on which baggage carousel luggage can be claimed from.

A-AS.01 Baggage claim information is provided on board the aircraft by a flight attendant or by an agent in the gate area after arrival, verbally or visually as needed.

The baggage claim carousel on which the luggage will be arriving can also be displayed on the GIDS at the gate (see Figure 6-5). Whether verbally or virtually, advance communication equips aging travelers and persons with disabilities with information that sets forth expectations and helps reduce the anxiety that comes with wondering at which carousel to claim their luggage.

A-AS.02 Baggage claim information is sent by text message, or the passenger can check carousel location via mobile phone after arrival.

A-AS.03 Agent gives directions to baggage claim.

A-AS.04 Passenger uses mobile application for directions/route to baggage claim.

A-AS.05 Airline service provider meets plane and provides wheelchair assistance or escort from seat or door of plane, as needed, to baggage claim. Service by electric cart replaces wheelchair service for ambulatory passengers in some airports.

Source: ACRP Project 07-13 Research Team

Figure 6-5. GIDS in Munich Airport with baggage claim information posted where passengers can see it immediately after deplaning.

A-AS.06 In case of ad hoc request(s), airline or service agent calls for additional personnel to provide assistance.

A-AS.07 Passenger's wheelchair, if any, is returned at door of plane. For those stowed as cargo, elevator or lift near jet bridge allows prompt delivery from tarmac.

A-AS.08 A CRO is available in person or remotely (e.g., by phone, TTY, text) to resolve issues involving damage or loss of an assistive device, assistance in the terminal, etc.

6.2 Gate Area (GA)

A-GA.01 Signs indicating direction to baggage claim/terminal exit are in easy view on exit from each gate area.

Messaging for arrivals is not as simple as it might seem. It may seem logical to assume that one can exit the terminal somewhere near baggage claim, but passengers who do not check luggage are not looking for baggage claim. Therefore, posting directions to the terminal exit becomes important, especially for customers who have cognitive issues. Other customers may be focused on finding various modes of ground transportation. As a result, airports need to consider where it is appropriate to post three types of messaging to meet the wayfinding information needs of arriving customers:

- Exit
- Baggage Claim
- Ground Transportation

A-GA.02 Signs indicating direction to baggage claim/terminal exit are located at frequent intervals and outside restrooms.

Source: ACRP Project 07-13 Research Team

Figure 6-6. Wayfinding for arriving passengers at Munich Airport.

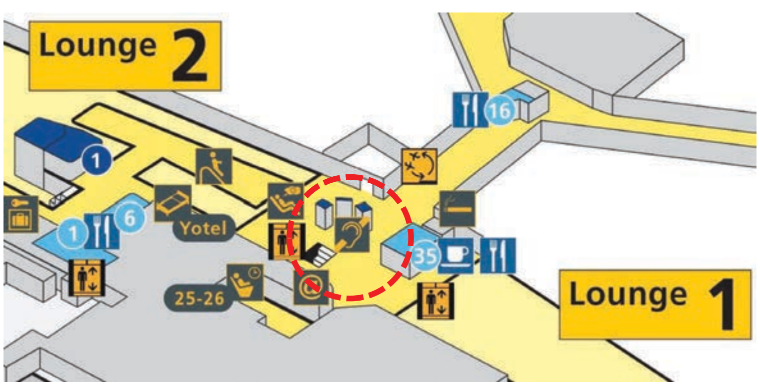
Examples of signage from the Munich Airport shown in Figure 6-6 include clear directions to the terminal exit and baggage claim, large pictograms for the restrooms, and directions to the airline services center for customers needing assistance.

A-GA.03 At major decision points, multisensory destination/directional information is provided via map, directory, kiosk, or information desk.

For example, Figure 6-7 shows a directory map from Schiphol Airport that includes the hearing loop symbol denoting where a loop has been installed.

A-GA.04 Directional and identification signs have fonts that are easily read, have good contrast, are non-glare, and allow close approach wherever possible.

A-GA.05 Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.



Source: Amsterdam Airport Schiphol

Figure 6-7. Hearing loop zones indicated on directory map at Amsterdam Airport Schiphol.

A-GA.06 Identification signs are visual and tactile, i.e., have raised characters and Braille and are correctly positioned.

A-GA.07 FIDSs are located at frequent intervals along concourses (for passengers who need to check on other arriving flights). Most airport's FIDSs on the airside only display departing flight information, but there are scenarios where passengers need to locate and meet friends or family arriving on a different flight. In Figure 6-8, one terminal map on display at each FIDS array is the same in all locations, but a second map shows details specific to the area in which the array is located.

A-GA.08 FIDSs are hung at eye level for close approach, with larger fonts, good contrast, and slower refresh rate. (See Chapter 8, Section 8.7.)

A-GA.09 FIDSs information is available via mobile application or verbally via dedicated telephone number.

A-GA.10 Visual paging is available at frequent intervals along concourses, e.g., built into FIDS. Pages may also be provided on the airport website or via a mobile application.

Including additional screens that can display paging and map information as part of the FIDS creates an information hub that mitigates walking and searching for the same information in another part of the airport. Consolidation of these types of information helps all customers including aging travelers and persons with disabilities (see Figure 6-9).

A-GA.11 Paging system allows passengers to request audible or visual page by phone, text or email.

The FIDS installation at the Portland International Airport includes digital paging screens for gate agents so that they can easily request and view pages (see Figure 6-9).

Source: Portland International Airport

Figure 6-8. FIDS array at the Portland International Airport.

Source: Portland International Airport

Figure 6-9. Digital paging screen for gate agents at the Portland International Airport.

A-GA.12 Courtesy phones are located at regular intervals along concourse including major decision points and identified by visual and tactile signage.

A-GA.13 Differences in floor texture and color help provide an “edge” for wayfinding and distinguish the concourse walkway from holding areas.

A-GA.14 Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.

A-GA.15 An audible signal alerts passengers to the end of moving walkways.

A-GA.16 Accessible means of egress (e.g., evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) have appropriate identification and directional signage in view from concourse walkways and/or holding rooms.

A-GA.17 Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.

While architecture is the most likely means of creating an intuitive wayfinding experience, airport architecture can also be the source of non-intuitive spaces. Changing levels can be confusing and disorienting, and, when twists and turns are added to the equation, changing levels can become even more challenging. At Denver International Airport, art is used to clarify a complex wayfinding scenario. Paper airplane sculptures lead passengers finding their way from the train to the Great Hall, as shown in Figure 6-10.

Source: ACRP Project 07-13 Research Team

Figure 6-10. Art providing intuitive wayfinding for navigation of level changes.

A-GA.18 Where elevators are not near or in sight of stairs and escalators, directional signage is provided.

A-GA.19 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.

A-GA.20 Audible indicators outside elevators are loud enough to be heard over ambient noise.

A-GA.21 Signs at exit doors and areas of safe rescue are tactile as well as visual, and instructions for summoning assistance in areas of safe rescue are also tactile with accessible two-way communication system in place.

A-GA.22 Airport, airline, and concessions staff have training on the AEP and how to assist passengers with disabilities in case of emergency.

A-GA.23 Visual and audible signaling systems are under central control to help direct people along best route. Push notification sends emergency information and directions to mobile phones.

6.2.1 Gate Area—People Mover

A-GA.24 Where people movers to or along the concourse are optional, dynamic signage indicates flights or gates for which the tram or monorail ride is recommended. Walking times/distances are provided.

A-GA.25 Station and other announcements on the automated people mover are both visual and virtual.

A-GA.26 A designated seating area and wheelchair area with grab bar are provided in the cars.

A-GA.27 Effective directional signage is in place, especially where a level change is involved.

6.2.2 Gate Area—Points of Interest

A-GA.28 On long concourses, maps with points-of-interest directories are placed at regular intervals. (See Chapter 5, D-GA.34.)

6.2.3 Gate Area—SARAs

A-GA.29 SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/ directories. (See Chapter 5, D-GA.35.)

14 CFR Part 382 (ACAA) requires that the SARA be on an accessible route.

A-GA.30 Restrooms, companion restrooms, and drinking fountains are grouped at frequent intervals along concourses with men's and women's facilities in a standard relation to each other, e.g., men's to left of women's.

A-GA.31 ATMs and currency exchange counters meet ADA accessibility standards.

6.2.4 Gate Area—Secure Area Exit

A-GA.32 Large, easy-to-read signs with pictograms identify each exit from concourse/ secure area and warn that there is no return after exit.

A-GA.33 TSA agent is positioned to ensure that exiting passengers do not attempt to reenter concourse/secure zone.

6.3 Baggage Claim (BC)

The baggage claim area can be quite congested, with passengers arriving in large groups. This congestion can create both circulation and navigational challenges for passengers with disabilities and older adults. The three Vs of communication can be applied to convey information in ways that reassure customers who cannot easily access certain forms of communication.

6.3.1 Visual

To help overcome the challenges presented to older adults and persons with disabilities by baggage claim areas, airport planners should design these areas to be open spaces that allow a direct line of sight to as many destinations as possible, e.g., exits, baggage carousels, luggage carts, and restrooms. Directional signage to each baggage carousel, listed by number and/or airline, should be prominently displayed on each BIDS.

Because the arrival time of baggage at the claim device can vary greatly, the availability of designated accessible seating is very important for older travelers and travelers with disabilities. Availability, guidance to, and clear identification of restrooms is also essential.

For airports with multiple terminals, it is important to provide confirmation to passengers of where they are upon arrival. Confirmation of the customer's location can be communicated in multiple ways, e.g., at transitions into the baggage claim area, on the headers of directories and BIDSs, at key touch points like the baggage claim device and information desks, and at egress points. This allows customers to let others know their location as well as plan where they are going next.

Directional signage should lead from baggage claim to an accessible information desk where passengers can get assistance with ground transportation, hotels, etc. Directional signage should also provide guidance to the ground transportation counters and other points of interest as well as to ground transportation pick-up areas and SARAs.

6.3.2 Verbal

Baggage carousel information can be communicated verbally by the flight attendant while the passenger is still on the plane. For passengers with hearing or cognitive disabilities, this information can be written down. Having personnel readily available in the baggage claim area to answer questions and give directions is also important.

To avoid having aging travelers and persons with disabilities wandering in search of help, airline staff should be available to assist with missing baggage, along with luggage porters to help customers needing assistance. Adjacency of luggage carts to the baggage carousels is also important.

If access to an information desk is not available, an alternative is to provide accessible help points where older adults or those with disabilities can request information or someone to provide assistance.

6.3.3 Virtual

Virtual communication with BIDSs at the entrance points to the baggage claim area will help passengers know which baggage claim device they are looking for. With what in essence is a captive audience, the baggage carousel is an important touch point. Dynamic signage located at each carousel confirms the flight(s) assigned to it. If signage is placed in the middle of the carousel and therefore viewable only from a distance, the fonts used should be large and have good contrast. Each BIDS should have the capability of communicating information about when the first bag will be delivered and/or the status of baggage. Dynamic signage at the baggage carousels and directories can also be used to display alternate content that helps educate passengers on what to expect next, e.g., ground transportation services, connecting to another terminal (international to domestic), etc. This signage can also provide information on how to report lost or damaged luggage/assistive devices, etc.

A-BC.01 Directional signage for baggage carousels, e.g., by number, is prominently displayed at each entrance to baggage claim from concourse/secure zone.

A-BC.02 Correctly oriented "You Are Here" illuminated map with large font designed for close approach shows facilities and services on terminal arrivals level including baggage claim. (See Chapter 3, Section 3.4.1.3.)

A-BC.03 An accessible directory (large font, high contrast, and hung at eye level for close approach) lists arriving flights and carousel assignments.

A-BC.04 Airport or airline staff are available to give information/directions.

Source: ACRP Project 07-13 Research Team

Figure 6-11. Clear signage and BIDS for baggage carousels at Amsterdam Airport Schiphol.

A-BC.05 Baggage claim information is sent by text message, or passenger can check carousel location via mobile application after arrival.

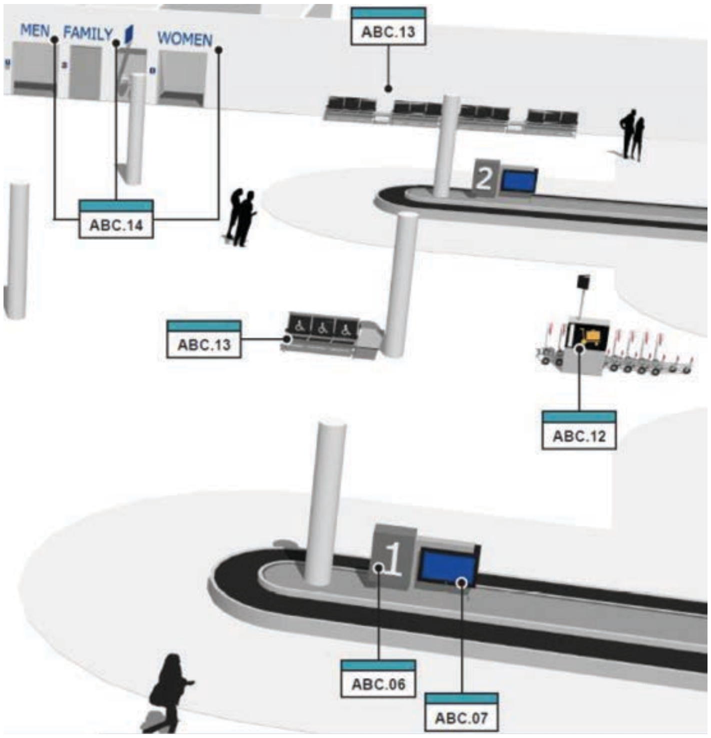
A-BC.06 Number of each carousel is prominently displayed and clear lines of sight allow easy viewing on entry to baggage claim. (See Figure 6-11.)

A-BC.07 Dynamic signage at each carousel lists the flight(s) assigned to it. If carousel signage does not allow close approach by passenger, e.g., is placed in the center of carousels, font size and contrast allow easy viewing from a distance.

Additional information such as bag status can help provide the reassurance aging travelers and persons with disabilities want (see Figure 6-12).

Source: ACRP Project 07-13 Research Team

Figure 6-12. Baggage claim displays with bag status at Changi Airport, Singapore.



A-BC.08 Flat carousels without a raised edge to keep bags on the belt require less physical effort and are more universally accessible. (See Figure 6-13.)

A-BC.09 Carousels have a designated area for persons with disabilities or others who need assistance in retrieving their bags.

A-BC.10 Baggage handlers are available to provide assistance in retrieving and transporting checked luggage.

A-BC.11 Airline service company staff are available to help retrieve and provide assistance with checked baggage to a curbside/ground service connection (or other terminal for connecting flight).

A-BC.12 Luggage carts, free or fee-based, are available at central locations in the baggage claim area.

A-BC.13 Seating areas are available near carousels for those waiting for checked luggage. (See Figure 6-14.)

A-BC.14 Accessible men's, women's, and companion restrooms are available in the baggage claim area and have appropriate directional and identification signage.

A-BC.15 Accessible facilities for reporting lost or damaged luggage or assistive devices are available in the baggage claim area and have appropriate directional and identification signage.

Source: ACRP Project 07-13 Research Team

Figure 6-13. Flat carousel at Tampa International Airport.

Source: ACRP Project 07-13 Research Team

Figure 6-14. Seating in the baggage claim area at Heathrow Airport.

As noted previously in this chapter, it can take longer for a person with disabilities to deplane and arrive in the baggage claim area, and sometimes this results in their luggage being pulled and stored in lost luggage. (See Figure 6-15.)

A-BC.16 Lost or damaged luggage or assistive devices can be reported via mobile application, website, or phone, as well as in person.

A-BC.17 A CRO is available in person or remotely (e.g., by phone, TTY, text) to resolve issues involving damage or loss of an assistive device.

A-BC.18 BIDSs are located at baggage claim entrance.

Source: ACRP Project 07-13 Research Team

Figure 6-15. Signage for lost luggage at Heathrow Airport.

Source: ACRP Project 07-13 Research Team

Figure 6-16. Dynamic signage at the baggage claim device with real-time information that also educates passengers on what to do next (Boston Logan International Airport).

Virtual information can go beyond just communicating where to claim luggage and educate customers waiting for their bags on what to expect next, such as options for ground transportation, information on the next bus, location of SARAs (see Figure 6-16), or what to do if there are problems getting luggage (see Figure 6-17).

6.4 Lobby Area (LA)

While the lobby area for domestic arrivals in U.S. airports is typically an extension of the baggage claim area, it is also a transition zone as customers move from a waiting posture into a mobile mode. As customers refocus their attention, there is important information that needs to be communicated to them so that they can make good decisions. The mindset of aging travelers and persons with disabilities in the lobby area is similar to their mindset in the baggage claim area: they want to feel equal and they want to be reassured. To help them feel this way, airport planners should design arrival lobby areas to be open spaces that allow a direct line of sight to as many destinations as possible (e.g., exits, elevators, information and ground transportation desks) and that therefore don't have to have as much signage.

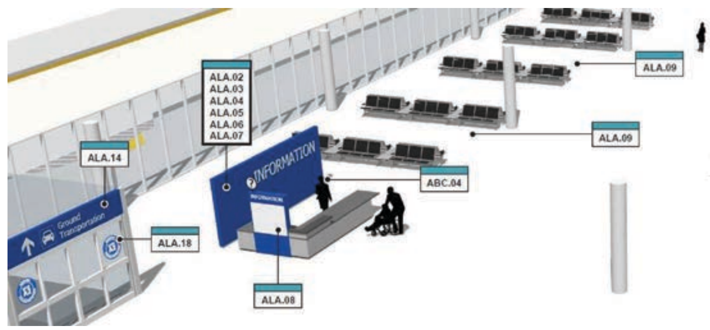
Source: ACRP Project 07-13 Research Team

Figure 6-17. BIDS with additional information for customers who have problems with their luggage at Amsterdam Airport Schiphol.

Source: ACRP Project 07-13 Research Team

Figure 6-18. Directional signage leading from baggage claim area to points of interest.

Customers who need assistance should understand how they can request help in moving forward in their journey to ground transportation services or parking areas.



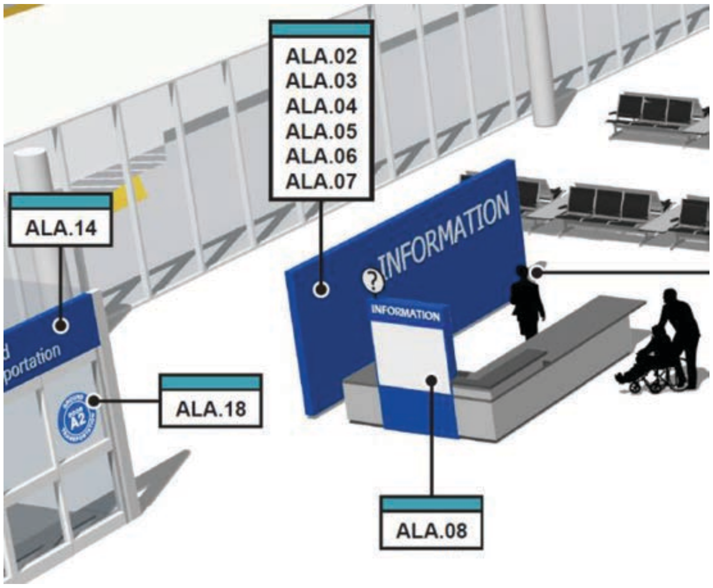
A-LA.01 Directional signage leads from baggage claim to information desk, ground transportation counters, and other points of interest and to ground transportation pick-up areas and SARAs outside terminal or on departures level. (See Figure 6-18.)

A-LA.02 An accessible information desk is available to assist passengers with ground transportation, hotels, etc.

A-LA.03 The information desk has prominent identification signage with a pictogram. (See Figure 6-19.)

Source: ACRP Project 07-13 Research Team

Figure 6-19. Accessible information desk identified with pictogram.



A-LA.04 Staff have disability awareness training and computer access to airport access database.

A-LA.05 Staff is fluent in English and other local languages and has access to interpreters for many languages through means such as the AT&T language line.

A-LA.06 The information desk has video remote interpreting service.

A-LA.07 A counter induction loop is in place for persons who have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.

A-LA.08 Correctly oriented "You Are Here" illuminated maps and directories for arrival-level facilities, ground transportation pick-up locations, and SARAs are located near the information desk and inside each terminal entrance. (See Chapter 3, Section 3.4.1.3.)

A-LA.09 Seating areas, with some seats designated as disability priority, are located near the information desk and terminal entrances.

A-LA.10 The shuttle kiosk (for hotels, rental car companies, etc.) has a TTY as well as phone. Phone numbers for all free shuttles serving the airport are provided in the airport mobile application, if there is one.

A-LA.11 Where public pay phones are provided, ADA requirements for wheelchair-accessible phones, volume control, and TTYs are also met.

A-LA.12 ATMs meet ADA accessibility standards.

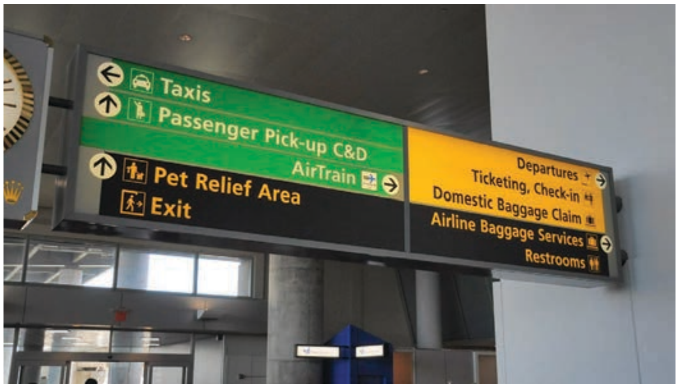
A-LA.13 Ground transportation counters (e.g., rental cars, paid bus and van shuttle services) meet ADA accessibility standards.

A-LA.14 Directional signage indicates the specific terminal exit to use for each mode of ground transportation and for SARAs.

After long flights, animals as well as people need access to areas of relief (see Figure 6-20).

A-LA.15 Directional signage is also in place for any modes of transportation that pick up from/connect to a different level of the terminal.

A-LA.16 Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.



Source: ACRP Project 07-13 Research Team

Figure 6-20. Signage directing customers to SARAs and ground transportation options at John F. Kennedy International Airport.

A-LA.17 Where elevators are not near or in sight of stairs and escalators, directional signage is provided.

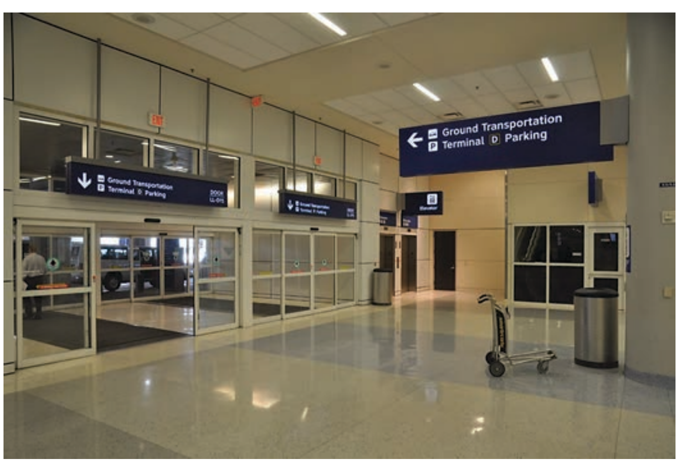
A-LA.18 Primary exit doors have clear identification of terminal and level and have a unique door number.

Each exit door has a unique identification number at Dallas/Fort Worth Airport, as shown in Figure 6-21. While the primary function is for safety responses, the unique door number can also be used for communicating location between parties looking to find each other. In this example, elevators are located close by, in the direct line of sight and identified with clear signage.

6.5 Ground Transportation (GT)

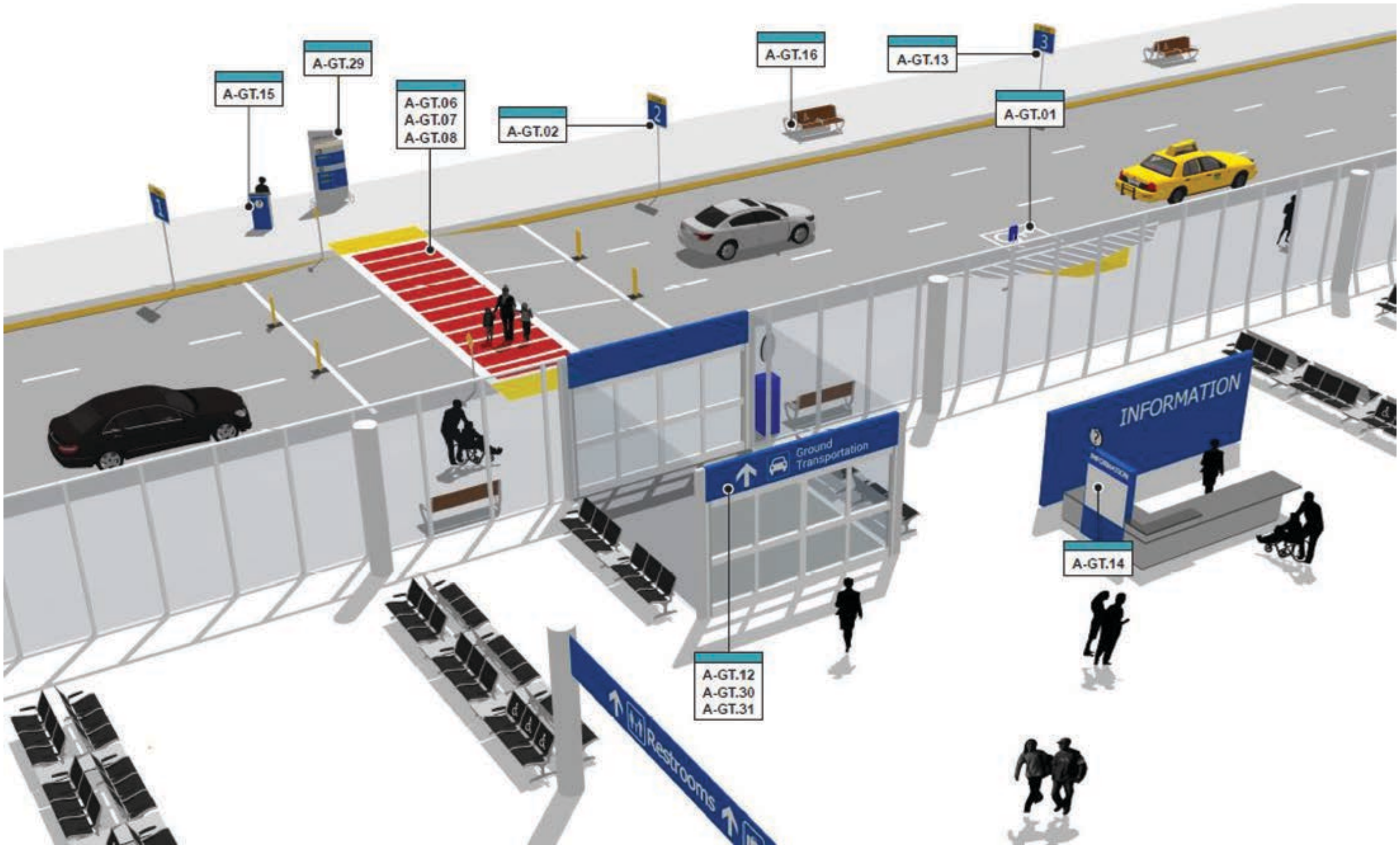
6.5.1 Curbside

The majority of ground transportation services occur at the airport curbside as shown in the model view shown in Figure 6-22. As noted in Chapter 5 (Section 5.1), safety is a primary concern for any curbside area, where vehicular and pedestrian traffic share the same space. Aging



Source: ACRP Project 07-13 Research Team

Figure 6-21. Signage at primary exit from arrivals lobby at Dallas/Fort Worth International Airport.



Source: ACRP Project 07-13 Research Team

Figure 6-22. Model view of the arrival journey segment for ground transportation.

travelers and persons with disabilities need to be able to find their way from the terminal when they need to cross the street (see A-GT.04 through A-GT.10). Also, passengers with disabilities need to be safely picked up at the terminal curbside. The 2010 ADAAS 209 and 503 address these requirements (see Section 5.1, Figure 5-5). In the absence of traffic signals, a raised crosswalk slows traffic while also providing level access to pedestrians.

The mindset of persons with disabilities is that they want to feel as if they have an equal status to other customers, and they want to feel reassured that the communication and provisions that should be in place are in place. These provisions allow older adults and persons with disabilities to travel more independently and with confidence.

Examples of basic provisions include the following:

- Assistance in getting to curbside pick-up areas is available (see A-GT.11).
- Seating is available near transportation stops (see A-GT.16).
- Transportation vehicles meet ADA Standards (see A-GT.18).

Verbal communication can happen inside the arrivals lobby, at the information/ground transportation desks, with porters and airline representatives, or even outside along the curb. Visual information needs to communicate safety first, followed by wayfinding information that identifies ground transportation zones as well as pathways to other destinations such as parking and rental cars. Virtual information can be provided inside the airport through interactive directories and outside on the curb by providing real-time information on the status of the next bus. As noted previously, it is important to communicate anticipated wait times to aging travelers and persons with disabilities.

Lighting is also an important feature for safety and wayfinding. Many ground transportation areas are on the lower level where it is not only dark at night, but there is little or no natural light during the day. Overall, adequate lighting levels help aging eyes see curbs and other obstacles. Higher lighting levels at areas like crosswalks can help all pedestrians intuitively know where to cross and allow drivers to clearly see the pedestrians on the crosswalk.

A-GT.01 Accessible pick-up points for people with disabilities have been designated by the airport; are included in the access database and on web, mobile, and terminal maps; and are signed for easy viewing from roadways and by passengers waiting for pick-up.

A-GT.02 There is a designated pick-up point for motor coaches to meet tour groups and deploy a lift as needed.

A-GT.03 SARAs are located as close as possible to terminal exit doors and have appropriate directional and identification signage.

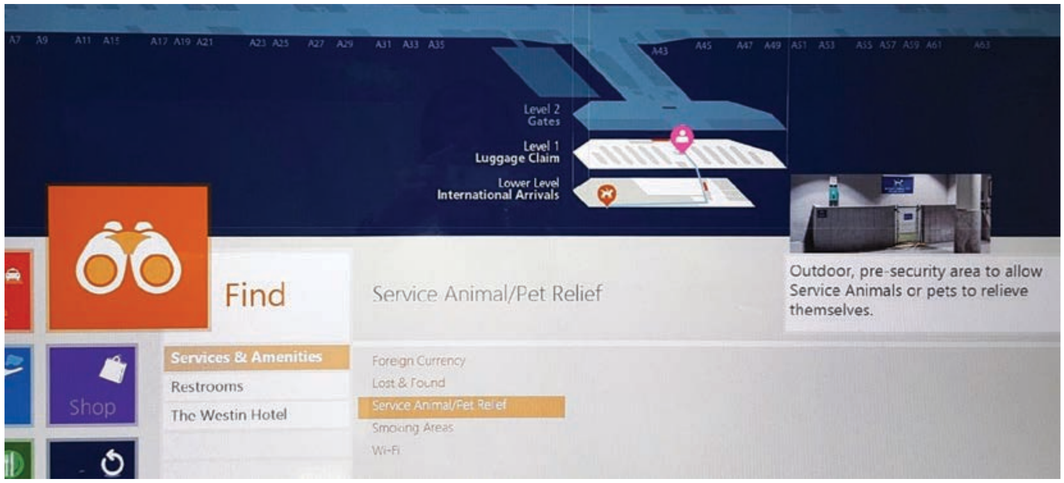
Figure 6-23 shows a pet relief area directly across the curbside drive from the arrivals lobby at Austin-Bergstrom International Airport. Location of the landside SARA at Detroit Metropolitan Airport is communicated virtually through interactive directories that show route, level change, and a photo of the destination to help with recognition and confirmation (see Figure 6-24).

A-GT.04 Walking surfaces are stable, firm, and slip-resistant and have no openings more than ½ inch.

A-GT.05 Visual and auditory signals are in place at pedestrian crossings with traffic lights, with adequate crossing time for those who move more slowly.

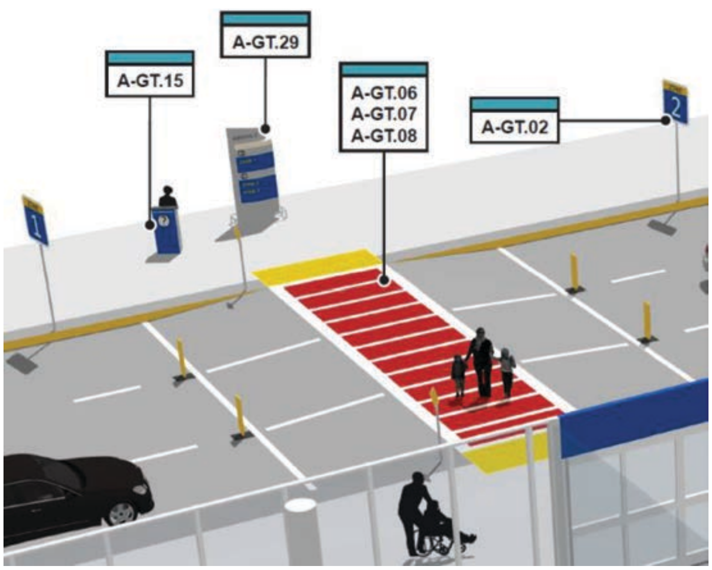
Source: ACRP Project 07-13 Research Team

Figure 6-23. Wayfinding to the pet relief area at Austin-Bergstrom International Airport.



Source: ACRP Project 07-13 Research Team

Figure 6-24. Interactive directory with wayfinding to SARAs at Detroit Metropolitan Airport.



A-GT.06 Where there are no signals, pedestrian crossing signs are prominently displayed for drivers and pedestrians. Raised pedestrian crossings help to slow traffic while providing level access. Speed bump signage and road markings should be in place.

A-GT.07 Pedestrian crossings have higher illumination levels and/or different colors.

A-GT.08 Detectable warnings are in place at curb ramps and marked crosswalks.

A-GT.09 If sidewalk is flush with roadway, detectable warnings are in place along the edge.

A-GT.10 At least one accessible route is provided from the terminal to accessible parking spaces and accessible passenger loading zones, sidewalks, and public transportation stops.

A-GT.11 Air carriers or their contracted service companies provide assistance to all curbside pick-up points.

A-GT.12 Directional and identification signs have fonts that are easily read, have good contrast, are non-glare, and allow close approach wherever possible.

A-GT.13 Identification signs for each mode of transportation are prominently displayed for both drivers and pedestrians. (See Figure 6-25.)

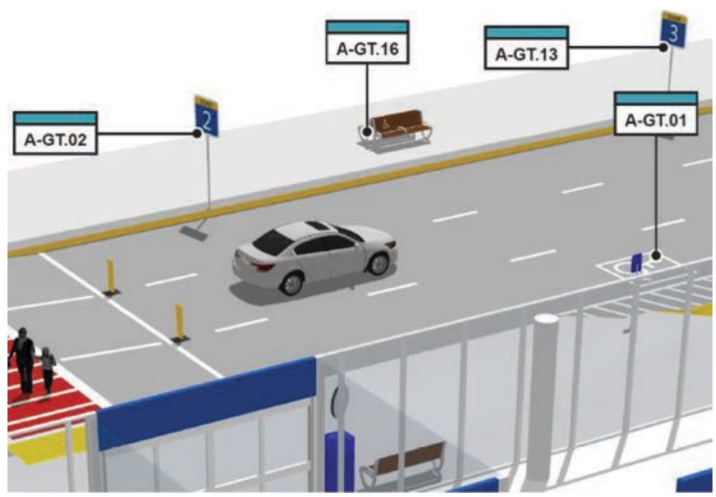
Color-coded zones help with recognition. Buses and coaches are also clearly marked on the outer curbside.

Source: ACRP Project 07-13 Research Team

Figure 6-25. Modes of ground transportation displayed prominently for both pedestrians and motorists at Dallas Fort Worth International Airport.

A-GT.14 Where specific hotels, parking lots, or rental car companies are assigned a particular pick-up point (rather than all hotels at one point, all rental cars at another, etc.), a directory is provided inside the terminal and at each location (e.g., Marriott, Hilton—Stop A; Embassy Suites, Sheraton—Stop B). (See Figure 6-26.)

A-GT.15 Airport staff, as shown in Figure 6-26, are available curbside to provide information and directions.



A-GT.16 Seating areas, with some seats designated as disability priority, are provided near transportation stops.

A-GT.17 Where bus shelters are provided, they meet ADA accessibility standards.

A-GT.18 Transportation systems/vehicles provided by or contracted by the airport meet ADA Standards.

A-GT.19 Fee-based private shuttles (bus and van) serving the airport meet the ADA Standards. Where there is more than one route per stop, the destination of each vehicle is clearly announced.

A-GT.20 At taxi stands, people with disabilities can go to the head of the line, and a priority access sign with wheelchair symbol is in place at head of queue/dispatch stand.

A-GT.21 Where accessible taxis are available, a system is in place and dispatchers are trained to give priority to those vehicles to persons who use wheelchairs or have large service animals.

Source: ACRP Project 07-13 Research Team

Figure 6-26. Ground transportation directory at Dallas Fort Worth International Airport.

6.5.2 Ground Transportation—Other

A-GT.22 Remote ground transport pick-up locations are identified on airport maps and on website and mobile application.

A-GT.23 Wheelchair and escort assistance (including help with luggage) is available from airline or service company to remote pick-up points.

A-GT.24 Staff member is on hand to direct passengers, e.g., at AirTrain or light rail stations.

A-GT.25 There is at least one accessible route from airport terminals to remote pick-up points with each element (walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADA Standards.

A-GT.26 There are no objects protruding more than 4 inches into the path of travel that are not cane detectable (lower edge 27 inches or less above finished floor), e.g., fire extinguishers, pay phones, drinking fountains.

A-GT.27 Overhead clearance is 80 inches minimum, and unenclosed stairs or escalators have a rail or barrier underneath.

A-GT.28 Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path.

A-GT.29 Directional signs to guide travelers to different modes of transportation/pick-up points are located at frequent intervals and at any decision points en route.

A-GT.30 Directional signs have large, unadorned, illuminated fonts. (See Chapter 3, Sections 3.2.1.5 and 3.2.1.6.)

A-GT.31 Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.

A-GT.32 Identification signs are visual and tactile, i.e., have raised characters and Braille, and are correctly positioned.

A-GT.33 Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.

A-GT.34 Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.

A-GT.35 Where elevators are not near or in sight of stairs and escalators, directional signage is provided.

A-GT.36 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.

A-GT.37 Audible indicators outside elevators are loud enough to be heard over ambient noise.

A-GT.38 Accessible means of egress (e.g., evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) are available and have appropriate identification and directional signage.

A-GT.39 Detectable warnings are in place at curb ramps, marked crosswalks, and wherever the accessible route crosses vehicular roadways in parking structures.

A-GT.40 Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.

A-GT.41 An audible signal alerts passengers to the end of moving walkways.

A-GT.42 Emergency communications equipment is provided at strategic locations wherever potential security or safety threats may exist and is identified by visual and tactile signage. Locations are noted in the access database and mobile application, if any.

A-GT.43 Seating areas, with some seats designated as disability priority, are provided at transportation stops.

A-GT.44 Accessible men's, women's, and companion restrooms and drinking fountains are available near the remote pick-up location or en route and have appropriate directional and identification signs.

A-GT.45 Where bus shelters are provided, they meet ADA accessibility standards.

A-GT.46 Airport or ground transportation staff are on hand at stations/stops to provide information or directions, or a courtesy phone/kiosk is available.

A-GT.47 Fare machines meet ADA accessibility standards, or cash fares can be paid to the driver.

6.6 Rental Car (RC)—On-Site and Remote

A-RC.01 There is at least one accessible route from the rental car facility to airport terminal.

A-RC.02 Directional signs are in place from the rental car drop-off area to the closest terminal entrance.

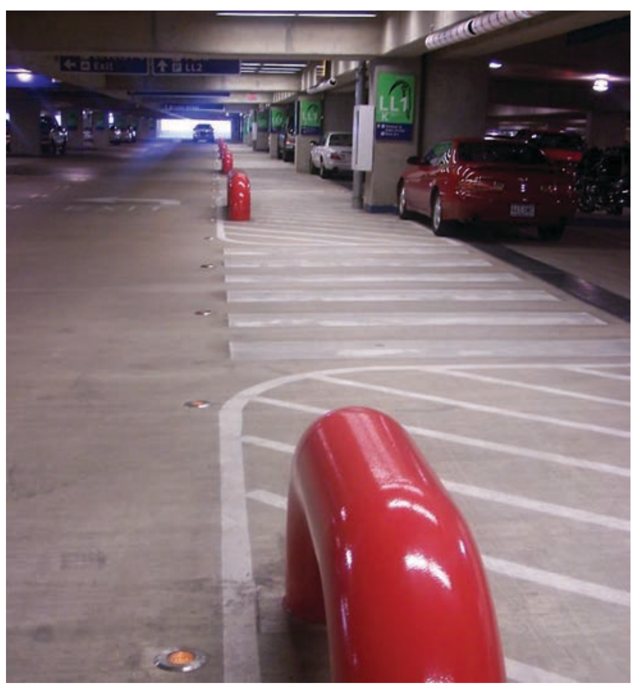
A-RC.03 Facility entrances, paths of travel, counters, and other features meet ADA Standards.

A-RC.04 An accessible means of transport links the rental car facility with airport terminals, e.g., shuttle bus or automated people mover.

6.7 Parking (PK)

As noted in Chapter 5 (Section 5.2), parking involves two wayfinding systems. For arriving customers, the scenario is reversed. The first system is pedestrian wayfinding to find the elevator, accessible path, and ultimately the vehicle. Static signage, smart garage technology, and smartphone applications can all help customers find their vehicle.

The second system is vehicular. For arrivals, this is safety-related, and the wayfinding should promote safe pathways to navigate the parking garage or lot (see Figure 6-27).



Source: ACRP Project 07-13 Research Team

Figure 6-27. Pedestrian pathways and wayfinding in a parking garage at Dallas Fort Worth International Airport, Terminal D.

6.7.1 All Parking

Advances in technology have greatly improved virtual communication in terms of helping aging travelers and persons with disabilities find accessible parking spaces as well as their car upon return. Early smart garage systems used a bi-color red/green light over each space to indicate full or open spaces. Multicolor indicating sensors now have the ability to display other colors to provide an even finer granularity of designated parking (see Figure 5-15). Brightly lit blue LEDs on the smart sensors are used to signal the space is reserved for persons with disabilities.

A-PK.01 Accessible parking spaces in parking lots and parking garages adjacent to the terminal are connected by an accessible path of travel to terminal entrances with each element (e.g., walking surfaces, ramps, lifts, elevators, doors, etc.), meeting either 1991 or 2010 ADA Standards.

A-PK.02 Accessible parking spaces are located on the shortest possible route(s) to accessible terminal entrance(s) and dispersed if there is more than one accessible entrance.

A-PK.03 All accessible van spaces may be grouped on one level in a multi-car parking facility.

A-PK.04 All accessible parking locations are identified in the airport access database, on maps, and in the mobile application, if applicable.

A-PK.05 The number of accessible van and car spaces meets minimum local, state, or federal scoping (whichever is highest) and standards for size and identification signage.

A-PK.06 Directional signs are in place from the terminal entrance to adjacent parking garage and parking lots.

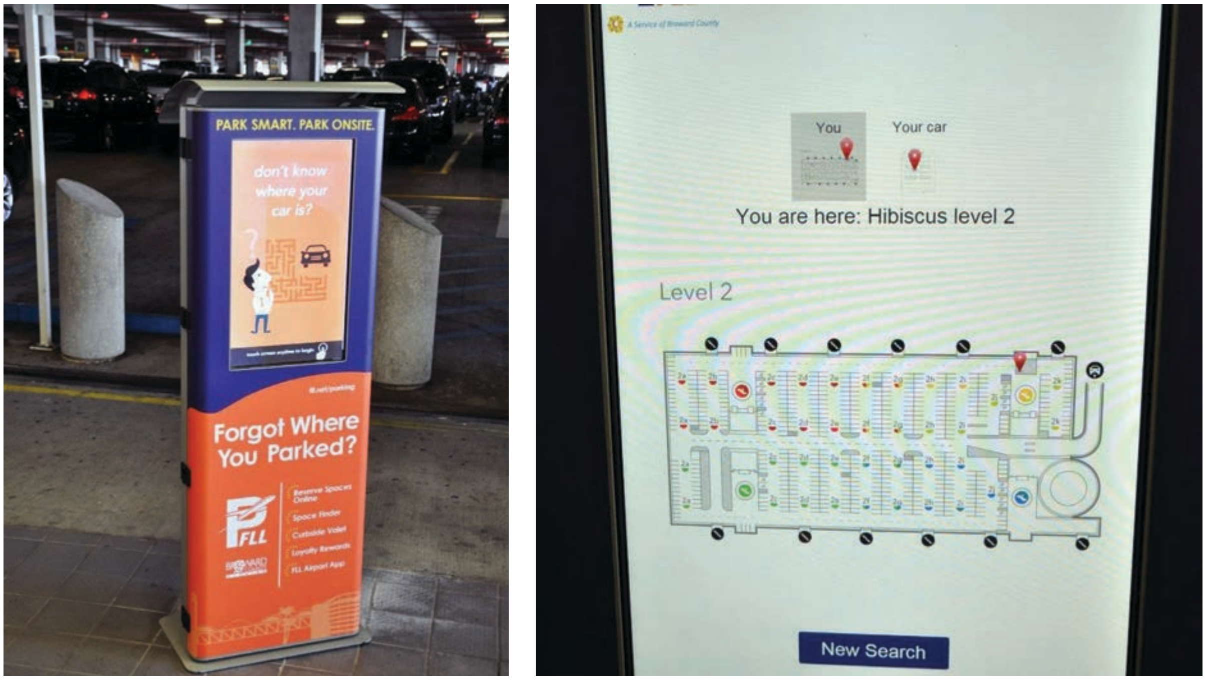
A-PK.07 Parking fare machines meet ADA accessibility standards.

A-PK.08 The signage system in parking garages and lots allows drivers to easily locate their vehicle or a car finder application is available.

There are multiple reasons why customers struggle to find their car. Persons with cognitive and intellectual disabilities can benefit from the smart park technology mentioned in Chapter 5, by using virtual communication to help them find their car. Persons with mobility issues can also benefit by finding the shortest route to their car.

Customers can either insert their ticket or enter their license plate number at a touch-screen kiosk, as shown in Figure 6-28, or on a smartphone application. The smart park system searches the database of currently parked vehicles, which were identified through integrated license plate recognition (LPR) when they entered a space. Within seconds, the kiosk or application displays step-by-step walking directions for the customer to locate their vehicle.

A-PK.09 Directional signs to parking exits are in easy view for drivers.



Source: ACRP Project 07-13 Research Team

Figure 6-28. Smart park technology to help customers find their cars.

A-PK.10 Drive-through fare machines are accessible to persons with limited use of arms/hands or a staffed booth is available.

6.7.2 Parking—Remote

A-PK.11 Accessible parking spaces are on the shortest possible accessible route to shuttle bus stops, automated people mover station, or other accessible means of transportation linking parking lots to airport terminals.

A-PK.12 The number of accessible van and car spaces in remote lots meets minimum local, state, or federal scoping (whichever is highest) and ADA Standards for size and identification signage.

A-PK.13 Accessible parking spaces do not have to be provided in each parking facility on the site but must have equivalence in terms of distance, parking fees, and user convenience.

A-PK.14 Transportation systems/vehicles provided by or contracted by the airport meet ADA Standards.

A-PK.15 Shuttle stops and shelters meet ADA accessibility standards.

A-PK.16 Directional signs to parking exits are in easy view for drivers.

A-PK.17 Drive-through fare machines are accessible to persons with limited use of arms/hands, or a staffed booth is available.

6.8 International Flights (IN)

6.8.1 Immigration

A-IN.01 Single route leads from arrival gate to immigration.

A-IN.02 Airline service provider meets plane and provides wheelchair assistance or escort from seat or door of plane, as needed, to immigration.

A-IN.03 In case of ad hoc request(s), airline or service agent calls for additional personnel to provide assistance.

A-IN.04 Passenger's wheelchair, if any, is returned at door of plane. For mobility equipment stowed as cargo, elevator or lift near jet bridge allows prompt delivery from tarmac.

A-IN.05 A CRO is available in person or remotely (e.g., by phone, TTY, text) to resolve issues involving damage or loss of an assistive device, assistance in the terminal, etc.

A-IN.06 Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path, unless not permitted by the TSA.

A-IN.07 Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.

A-IN.08 Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.

A-IN.09 Where elevators are not near or in sight of stairs and escalators, directional signage is provided.

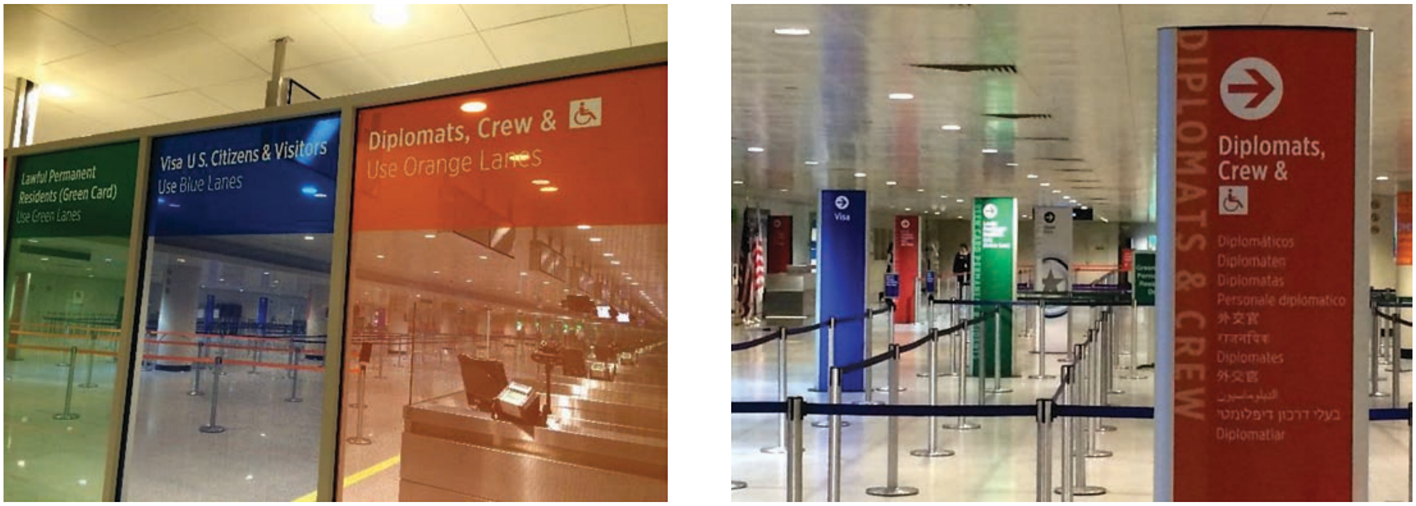
A-IN.10 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.

A-IN.11 Audible indicators outside elevators are loud enough to be heard over ambient noise.

A-IN.12 There are no objects protruding more than 4 inches into the path of travel that are not cane detectable (lower edge 27 inches or less above finished floor), e.g., fire extinguishers, pay phones, drinking fountains.

A-IN.13 No overhead clearance is less than 80 inches, and there are no unenclosed stairs or escalators without a rail or barrier underneath.

A-IN.14 Accessible men's and women's restrooms and companion restroom, appropriately signed, and drinking fountains are available in or before immigration area.



Source: ACRP Project 07-13 Research Team

Figure 6-29. Dedicated lanes for persons with disabilities at Boston Logan International Airport.

A-IN.15 There are dedicated lanes for employees and people with disabilities, or staff direct people with disabilities and those who self-identify as such to front of line.

A-IN.16 Where available, signs indicate lanes for employees and people with disabilities. This benefits those not being escorted, especially those with hidden disabilities (see Figure 6-29).

Color-coded wayfinding in the Customs and Border Patrol area at Boston Logan International Airport helps visually guide persons with disabilities by providing advance education prior to the queue with confirmation at queue entry point.

A-IN.17 Accessible passport kiosks enable U.S. passengers to scan passport and customs forms and print a receipt to show officers (see Figure 6-30).

Source: Tampa International Airport

Figure 6-30. Accessible passport kiosk at Tampa International Airport.

A-IN.18 Staff are on hand to assist people with disabilities and others unfamiliar with the passport kiosks.

A-IN.19 Mobile Passport Application enables U.S. passengers to submit passport information and customs declaration forms electronically and receive an electronic receipt to show officers.

6.8.2 Baggage Claim

A-IN.20 The route leads directly from immigration to baggage claim.

A-IN.21 An accessible directory (large font, high contrast, and hung at eye level for close approach) lists arriving flights and carousel assignments.

A-IN.22 Baggage claim information is sent by text message or passenger can check carousel location via mobile application after arrival.

A-IN.23 Airport or airline staff are available to give information/directions.

A-IN.24 Dynamic signage at each carousel lists the flight(s) assigned to it.

A-IN.25 If carousel signage does not allow for close approach by passenger, e.g., is placed in the center of carousels, font size and contrast allow easy viewing from a distance.

A-IN.26 Flat carousels without a raised edge to keep bags on the belt require less physical effort and are more universally accessible.

A-IN.27 Carousels have a designated area for persons with disabilities or others who need assistance in retrieving their bags.

A-IN.28 Baggage handlers are available to provide assistance in retrieving and transporting checked luggage.

A-IN.29 Airline service company staff help retrieve and provide assistance with checked baggage to a curbside/ground service connection (or other terminal for a connecting flight).

A-IN.30 Luggage carts, free or fee-based, are available at central locations in the baggage claim area.

A-IN.31 Seating areas are available near carousels for those waiting for checked luggage.

A-IN.32 Accessible men's, women's and companion restrooms are available in the baggage claim area and have appropriate directional and identification signage.

A-IN.33 Accessible facilities for reporting lost or damaged luggage or assistive devices are available in the baggage claim area or after exiting customs and have appropriate directional and identification signage.

A-IN.34 Lost or damaged luggage or assistive device can be reported via mobile application, website, or phone, as well as in person.

A-IN.35 A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve issues involving damage or loss of an assistive device.

A-IN.36 Directional signage to the customs and baggage claim exit is prominently displayed (in view from all carousels).

CHAPTER 7

Connecting Customer Journey

This chapter is focused on the connecting customer journey and presents and elaborates on recommendations/requirements listed in the Wayfinding Accessibility Audit Checklist presented in Appendix A of this guidebook (see below for a description of the Wayfinding Accessibility Audit Checklist).

Each of the sections in this chapter has a corresponding two-letter section code (see Figure 7-1). This two-letter code is combined with a letter "C" prefix for "Connecting" and a numerical suffix to create a unique label for each recommendation/requirement. These labels are also used in the Wayfinding Accessibility Audit Checklist in Appendix A. These recommendations/requirements are presented and discussed in the appropriate section throughout this chapter.

The Wayfinding Accessibility Audit Checklist is a checklist of recommendations/requirements to be considered in an assessment of an airport's wayfinding accessibility. All of the recommendations/requirements in the checklist are numbered and labeled to correspond to a particular chapter and section in this guidebook. Each labeled recommendation or requirement is grouped according to chapter and section and characterized according to form of communication (visual, virtual, and/or verbal), the types of disabilities accommodated (vision, hearing, cognition, and/or mobility), and any known standards or additional guidance available (see Figure 7-2).

There is redundancy built into the checklist because there are some needs that are required in more than one area of the airport. For example, seating area needs are noted in areas ranging from the arriving gate through the terminal and in the connecting gate areas. So, when an airport is using the checklist to review a problem area, or plan a new project, the checklist is complete for each area as well as the entire connecting journey segment.

Similar to wayfinding in a parking garage where the customer experiences wayfinding as both a driver and a pedestrian, a connecting customer experiences the airport as both an arriving passenger and a departing passenger. Wayfinding communication challenges can occur when customers are connecting between two international flights, arriving on an international flight and departing on a domestic flight, or arriving on a domestic/precleared flight and departing on an international flight.

Research has shown that customers making a connection have more difficulty finding their way than customers who are arriving or departing. Customer surveys conducted as part of ACRP Project 03-35 research show that on average 78 percent of departing customers rated their wayfinding experience as excellent or very good. By comparison, only 63 percent of customers making a domestic to international connection rated their wayfinding experience as excellent or very good. Ratings among international to international connecting customers were even worse, with just 44 percent rating their wayfinding experience as excellent or very good (Landrum & Brown, Inc. 2016).

Section #	Section Description	Section Code
7.1	Airline Support - Same Airline / Same Terminal	AS
7.2	Gate Area	GA
7.3	Terminal Transportation	TT
7.4	Airline Support - Same Terminal / Different Airline	AS

C-AS.01

Source: ACRP Project 07-13 Research Team

Figure 7-1. Chapter 7 matrix and example of a recommendation/requirement label.

As noted in previous chapters, the research study conducted by the UK's CAA in 2009 identified six dimensions of the PRM "mindset" that affect these customers' travel experience. Connecting customers in general have more wayfinding challenges than departing or arriving passengers; for aging travelers and persons with disabilities who are making a connection, it is critical that they have confidence in and reassurance about the information and services they are receiving.

Wayfinding associated with connecting flights is more challenging when the wayfinding involves changing terminals or gate areas. Most airport signage provides little or no identification of the terminal within a given gate area, which can be confusing for passengers who are unfamiliar with the airport. Other factors are the distances and complexity that can be involved in making flight connections. For travelers with mobility and cognitive issues, these factors make it harder to know where they are and where they need to go, which are Wayfinding Steps 1 and 2, respectively. Knowing the best way to get where they are going is Step 3. Because airport layouts are configured differently, the means and methods of effectively communicating wayfinding information can vary, but the basic elements remain the same: know where you are; know where you want to go; determine the best way to get there; and, finally, in Step 4, confirm that you have arrived. Further discussion of Steps 1 through 4 follows.

Chapter 7

Wayfinding Audit Checklist

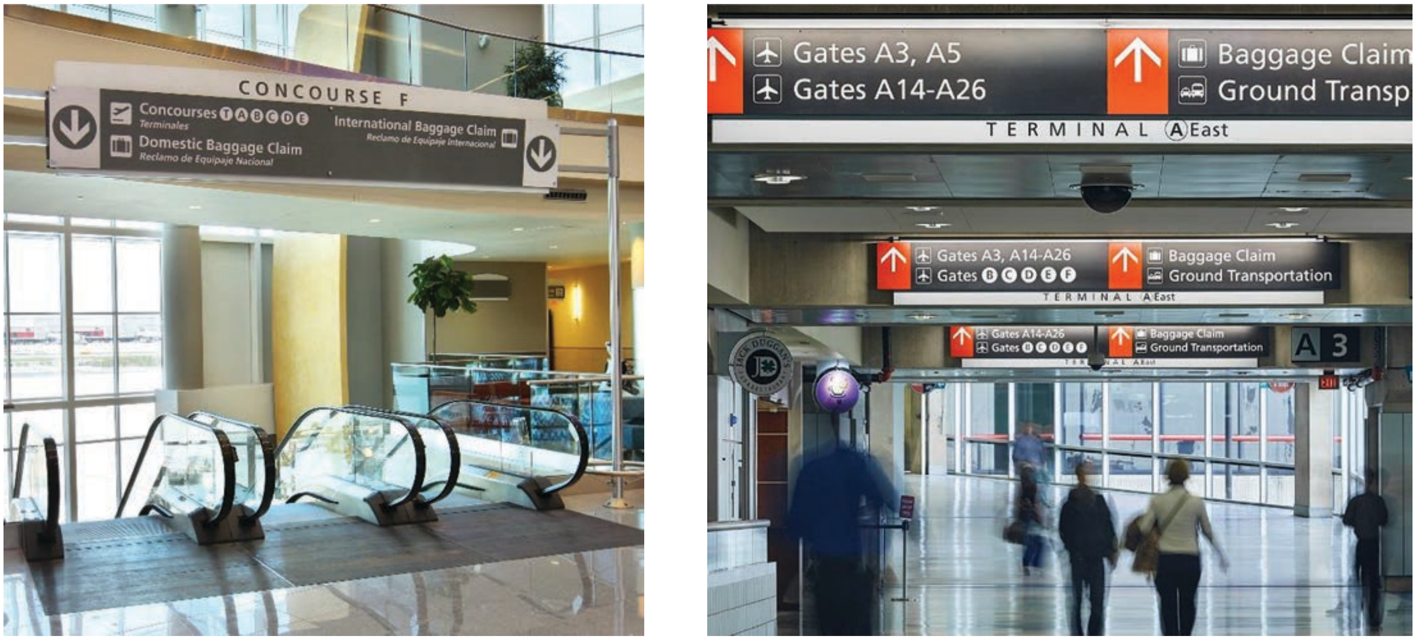
CONNECTING PASSENGER (C)

REF #	Recommendations & Requirements	3V's	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
Section 7.1: Airline Support - Same Airline/Same Terminal (AS)								
C-AS.01	Gate numbers are provided onboard the aircraft by flight attendants or by agents in the gate area after arrival, verbally or visually as needed.	Verbal	X	X	X	X	14 CFR Part 382.69, 382.119	
C-AS.02	Gate numbers are sent by text message or passengers can check flight information via mobile phone after arrival.	Virtual	X	X	X	X		
C-AS.03	Passengers consult the nearest FID after exiting the arriving gate.	Virtual	X	X	X	X		
C-AS.04	Agents give directions to the connecting gate.	Verbal	X	X	X	X		

C-AS.01 Gate numbers are provided onboard the aircraft by flight attendants or by agents in the gate area after arrival, verbally or visually as needed.

Source: ACRP Project 07-13 Research Team

Figure 7-2. Excerpt from Wayfinding Accessibility Audit Checklist, Chapter 7.



Source: ACRP Project 07-13 Research Team

Figure 7-3. Headers and footers used to confirm current location on static signs.

Step 1: Knowing Where You Are. Airports like Hartsfield-Jackson International Airport, Philadelphia International Airport (shown in Figure 7-3), and Phoenix Sky Harbor International Airport visually convey where the customer is with a header or footer on all the primary wayfinding signs, which reinforces their location with consistent visual communication. The header on the sign to connecting flights reminds customers they are currently in Concourse F before they choose to go to another concourse.

One of the very first things a connecting customer does after deplaning is check the FIDS. Essential touch points like a FIDS can also indicate to customers what terminal or concourse they are in, reinforce that knowledge, and help them to determine whether they need to stay in the same gate area or find their way to a different part of the airport. As shown in Figure 7-4, a FIDS at Changi Airport in Singapore clearly indicates that the customer is located in Terminal 3, which helps them to know if they need to remain in Terminal 3 or transfer to another terminal.

Source: ACRP Project 07-13 Research Team

Figure 7-4. FIDS at the Changi Airport, Singapore.

Source: Omnivex.com

Figure 7-5. Interactive information kiosks at San Francisco International Airport showing where the customer is, communicating walking and riding options, and highlighting points of vertical transition.

Steps 2 and 3: Knowing Where You Are Going and the Best Way to Get There. Directories are a key touch point and communication tool in helping passengers determine where they are as well as where they need to go. Interactive touch-screen directories can provide step-by-step guidance (see Figure 7-5). They can also help passengers make what can sometimes be a very difficult as well as an important decision of whether to walk or ride to the destination. While time is typically the driving factor, physical effort is also a key consideration for passengers with disabilities and older adults who may only be able to walk short distances.

FIDSs can also help communicate information on whether to walk or ride to your destination. In Figure 7-6, an additional column on the right side of the display uses the symbol icon

Source: ACRP Project 07-13 Research Team

Figure 7-6. A FIDS **(photo at left)** ***communicates walk versus ride*** **(photo at right)** ***information to passengers at Detroit Metropolitan Airport.***

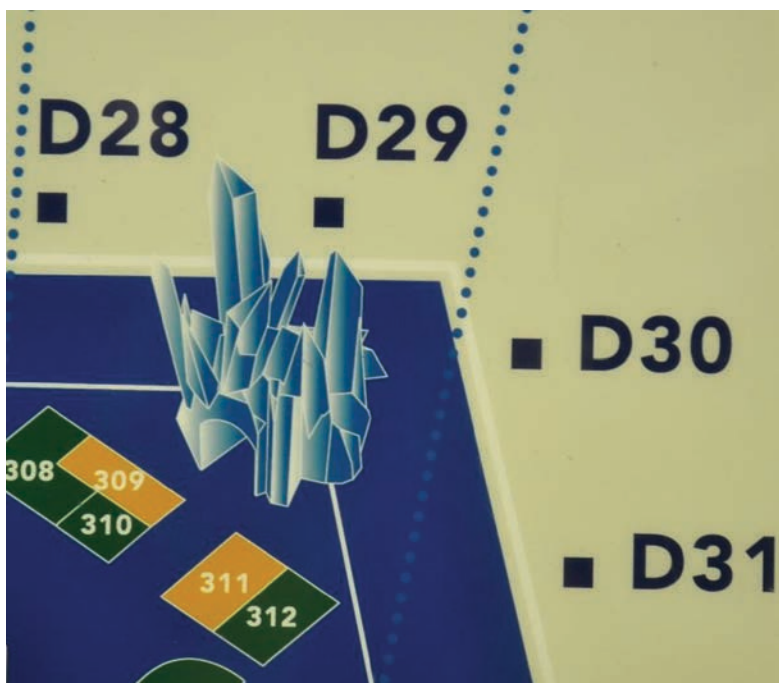
for the airport's train/tram to indicate it is better to ride to the destination, a simple but effective visual tool.

Landmarks are an excellent point of reference in helping people find their way. As noted in Section 3.2.2.5, different passengers choose to receive information in different forms. Therefore, providing information that can help customers establish relationships between concrete landmarks and graphic representations on maps is one more way to help aging travelers and persons with disabilities navigate a complex airport environment and confirm they are on the correct path to find their connecting gate. Figure 7-7 shows how artwork, in this case a castle, can be used as a recognizable landmark for navigation.

Step 4: Knowing You Have Arrived at Your Destination. Regardless of how obvious a destination may seem, a key part of wayfinding is to provide consistent confirmation. For customers with connecting flights, it can be a series of confirmations, like the ones outlined in this section:

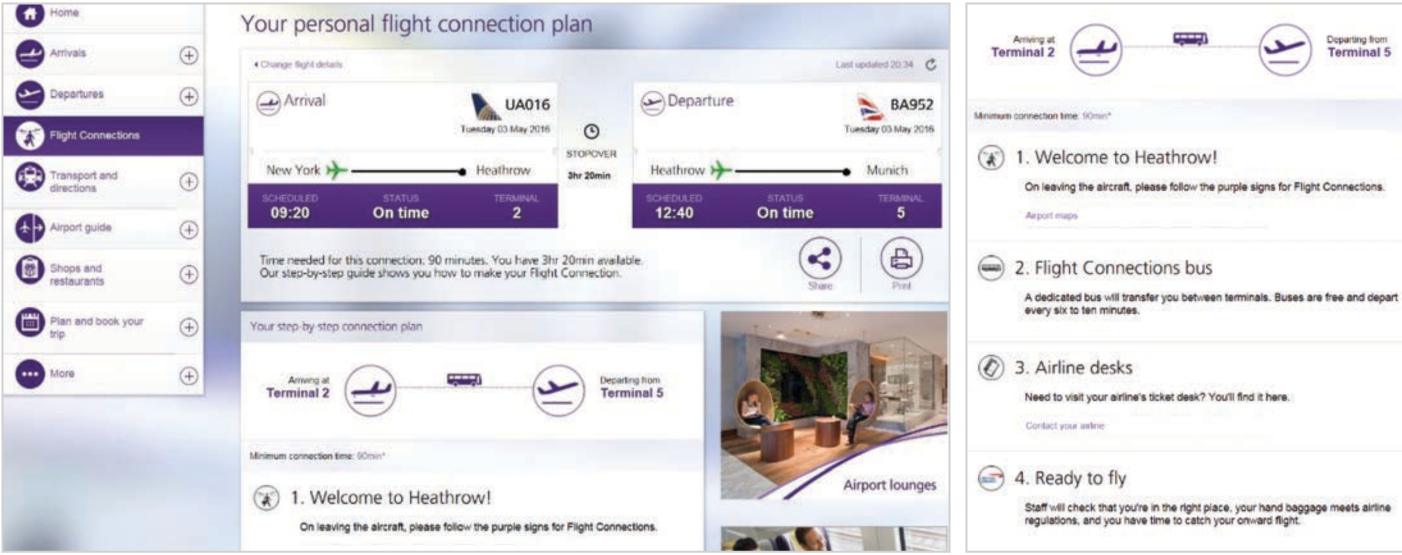
- Where am I?
- Where am I going?
- What is the best way to get there?
- How do I know when I have arrived?

As noted previously, research shows that connecting passengers experience greater wayfinding difficulty than either departing or arriving passengers. Pre-trip planning can be an excellent tool to help aging travelers and persons with disabilities achieve their goal of being confident about traveling independently. London's Heathrow Airport website, as shown in Figure 7-8, has an excellent, easy-to-use tool that helps travelers understand the transfer process and establish expectations at what can be one of the more complex airport wayfinding scenarios for passengers to navigate. Step 1 in the instructions informs the customer to follow the purple signs for connecting flights.



Source: ACRP Project 07-13 Research Team

Figure 7-7. Visual landmark coordinated with a directory map at Dallas Fort Worth International Airport.



Source: London Heathrow Airport

Figure 7-8. Heathrow Airport's website showing connection time and simple step-by-step instructions.

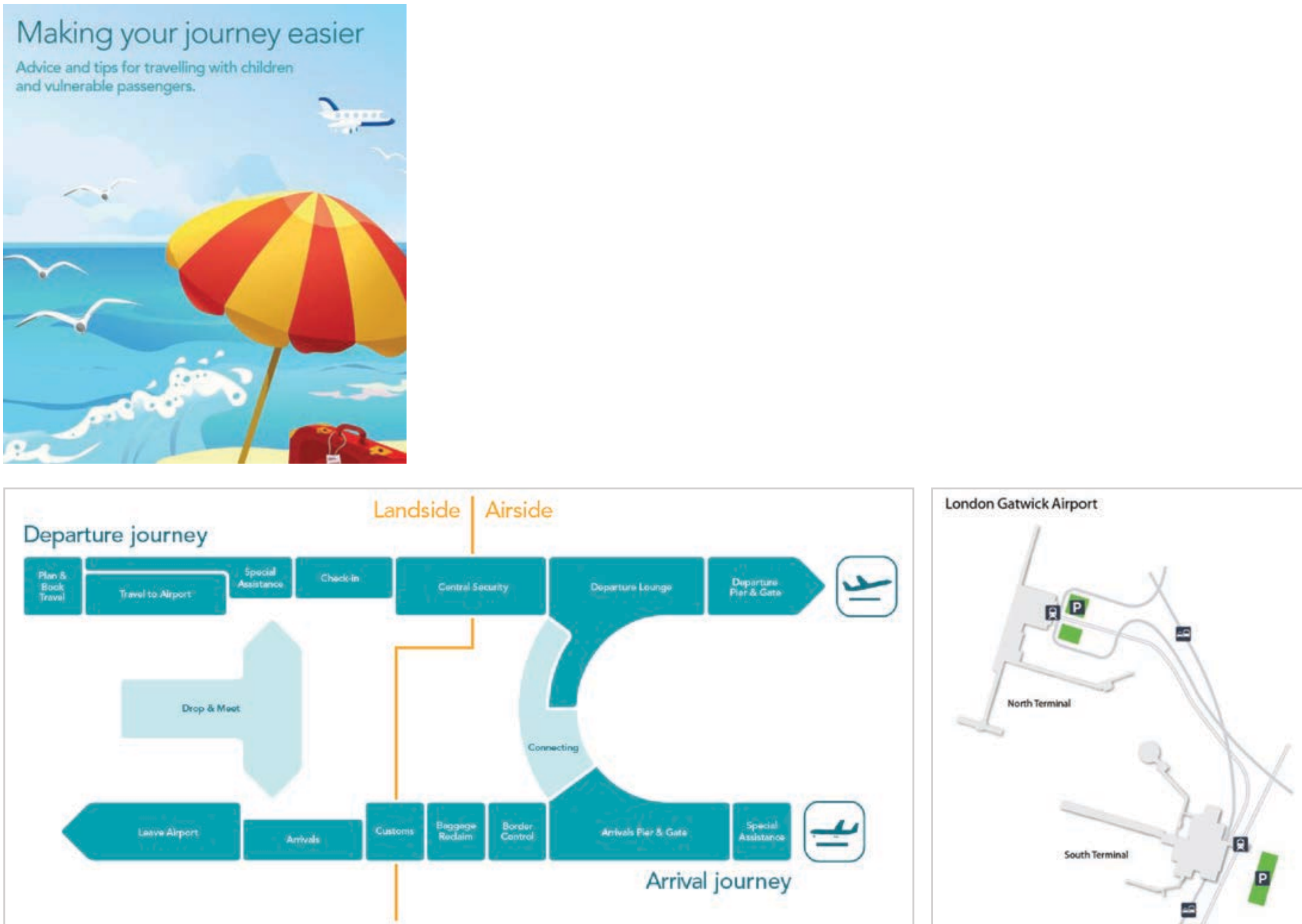
With connection transfer times as long as 90 minutes, this type of communication is very useful to older adults and passengers with disabilities. However, while a passenger who is blind can access the information on Heathrow Airport's website, it does not help them travel independently since they cannot see the "breadcrumb trail" of purple signs that do an excellent job of guiding other passengers through a very challenging environment. A mobile wayfinding application could enable a passenger who is blind to benefit from this pre-trip planning information.

Upon arrival, customers are immediately greeted by a series of purple signs that give all passengers the confidence that they are on the correct path as they wind their way to their connecting flight (see Figure 7-9).

Simple graphics can also help visually communicate potentially confusing wayfinding scenarios. For example, London Gatwick Airport is one of many airports that publish guides to help

Source: ACRP Project 07-13 Research Team

Figure 7-9. Purple signs at Heathrow Airport providing simple intuitive communication for connecting customers.



Source: London Gatwick Airport

Figure 7-10. ***London Gatwick Airport travel guide*** **(image at top),** ***simple diagram of customer journey segments at Gatwick Airport*** **(image at left),** ***plan view of Gatwick Airport*** **(image at right).**

travelers with disabilities plan their trip. In the guide, the graphic used to depict the customer journey at Gatwick Airport is not architecturally based but is designed to be customer-centric, which reflects the way most customers perceive their journey. Connections are shown as a simple transition from one pier to another (see Figure 7-10).

7.1 Airline Support (AS)

C-AS.01 Gate numbers are provided onboard the aircraft by flight attendants or by agents in the gate area after arrival, verbally or visually as needed.

C-AS.02 Gate numbers are sent by text message, or passengers can check flight information via mobile phone after arrival.

C-AS.03 Passengers consult the nearest FIDS after exiting the arriving gate.

Source: ACRP Project 07-13 Research Team

***Figure 7-11. FIDS at Amsterdam Airport Schiphol with walk times next to gate number* (photo at left) *and FIDS bank at Heathrow Airport with additional screens for maps, service desk information, and walk times* (photo at right).**

FIDSs that also include approximate walk times next to the connecting gate number equip aging travelers and persons with disabilities with the information they need to make a decision about whether to walk, ride, or request assistance. This information helps aging travelers and persons with disabilities take control of their wayfinding experience. FIDSs can also be bundled with additional information that will help customers understand their options and choices when making a connection (see Figure 7-11).

C-AS.04 Agents give directions to the connecting gate. (See Figure 7-12.)

C-AS.05 Passengers use a mobile application, if there is one, for directions/route to the connecting gate.

Source: Changi Airport, Singapore

Figure 7-12. Personnel stationed next to FIDS at key decision points.

C-AS.06 Airline service employees provide wheelchair assistance or escort from the seat or the door of the plane, as needed, to the connecting gate. Service by electric cart replaces wheelchair service for ambulatory passengers in some airports.

C-AS.07 In case of ad hoc request(s), an airline or service agent calls for additional personnel to provide assistance.

C-AS.08 Passenger wheelchairs are returned at the door of the plane. For those stowed as cargo, an elevator or lift near the jet bridge allows prompt delivery from the tarmac.

C-AS.09 In case of flight cancellation, the rebooking center is accessible with either a ticket agent or phone instead of/in addition to an inaccessible touch-screen kiosk. Alternatively, passengers can rebook by airline mobile application.

C-AS.10 Where possible, passengers with disabilities should be given priority in rebooking.

C-AS.11 A counter induction loop is installed at one rebooking counter, with priority access for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.

C-AS.12 Rebooking centers have appropriate directional and identification signage and appear on maps/directories.

C-AS.13 Staff from the airline service company are recalled by gate agents to provide an escort to the rebooking center and the new gate.

C-AS.14 Gate agents direct passengers to rebooking centers.

C-AS.15 A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues.

7.2 Gate Area (GA)

C-GA.01 At major decision points, multisensory destination/directional information is provided via a map, kiosk, or information booth.

C-GA.02 Directional and identification signs have fonts that are easily read, good contrast, non-glare, and allow close approach wherever possible.

C-GA.03 Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.

C-GA.04 Identification signs are visual and tactile, i.e., have raised characters and Braille, and are correctly positioned.

C-GA.05 Directional signs have large, unadorned, illuminated fonts. (See Chapter 3, Sections 3.2.1.5 and 3.2.1.6.)

C-GA.06 FIDSs are located at frequent intervals along concourses.

C-GA.07 FIDS are hung at eye level for close approach, with larger fonts, good contrast, and a slower refresh rate. (See Chapter 8, Section 8.7.)

C-GA.08 FIDS information is available via a mobile application or verbally via a dedicated telephone number.

C-GA.09 Visual paging is available at frequent intervals along concourses, e.g., built into FIDSs. Pages may also be provided on the airport website or via a mobile application.

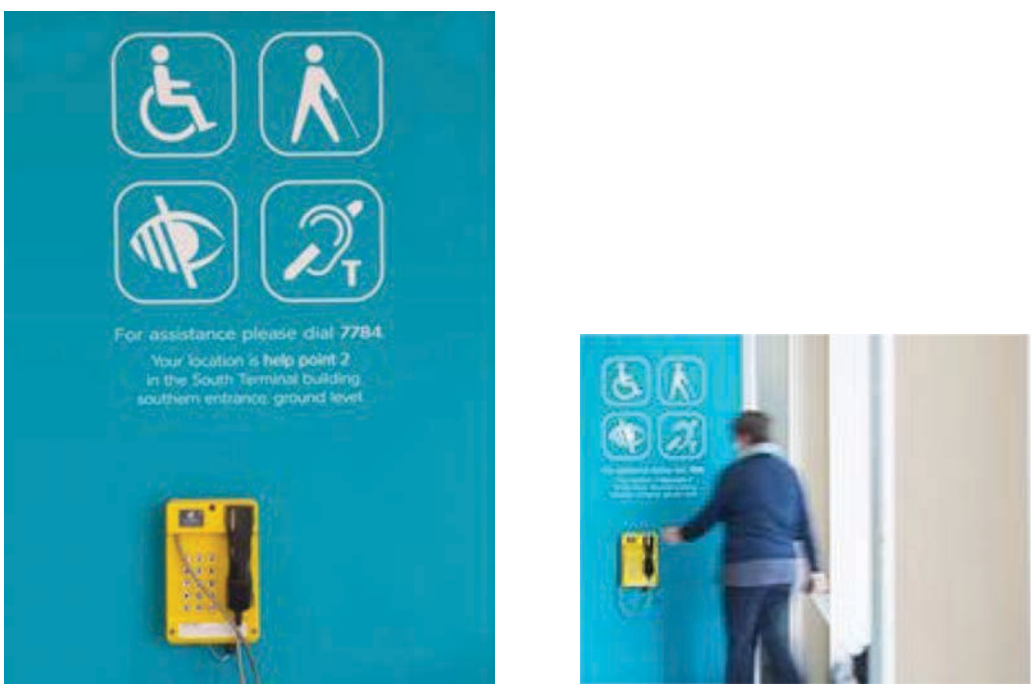
C-GA.10 The paging system allows passengers to request audible or visual page by phone, text, or email.

C-GA.11 Courtesy phones are located at regular intervals along the concourse, including at major decision points, and identified by visual and tactile signage.

In Europe, help points are used as an additional level of support for aging travelers and persons with disabilities (see Figure 7-13). Pictograms denote the service, while text information includes the location.

C-GA.12 Directional signage for gate numbers is located at regular intervals, at all entrances onto the concourse from security, and at all decision points/nodes.

C-GA.13 Signs indicating the direction to baggage claim/terminal exit are located at frequent intervals and outside restrooms.



Source: London Gatwick Airport

Figure 7-13. Help point at London Gatwick Airport.

C-GA.14 Good lines of sight allow travelers to see a series of gate numbers along the concourse, i.e., gate numbers are not blocked by other signage or architectural elements.

C-GA.15 Gate numbers follow a regular pattern, e.g., even on left, odd on right.

C-GA.16 Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path, e.g., where there are long corridors not adjoining holding areas.

C-GA.17 Differences in floor texture and color help provide an edge for wayfinding and distinguish the concourse walkway from holding areas.

C-GA.18 Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.

C-GA.19 Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.

C-GA.20 Accessible routes coincide with, or are located in, the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.

C-GA.21 Where elevators are not near or in sight of stairs and escalators, directional signage is provided.

C-GA.22 Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floors is preferable to a beeping sound.

C-GA.23 There are no objects protruding more than 4 inches into the path of travel that are not cane detectable (lower edge 27 inches or less above finished floor), e.g., fire extinguishers, pay phones, drinking fountains.

C-GA.24 Overhead clearance is 80 inches minimum, and there are no unenclosed stairs or escalators without a rail or barrier underneath.

C-GA.25 An audible signal alerts passengers to the end of moving walkways.

C-GA.26 Accessible means of egress (evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) have appropriate identification and directional signage in view from concourse walkways and/or holding rooms.

C-GA.27 Signs at exit doors and areas of safe rescue are tactile as well as visual. Instructions for summoning assistance in areas of safe rescue are also tactile with an accessible two-way communication system in place.

C-GA.28 Airport, airline, and concessions staff have training on the AEP and how to assist passengers with disabilities in case of emergency.

C-GA.29 Visual and audible signaling systems are under central control to help direct people along best route. Push notification sends emergency information and directions to mobile phones.

C-GA.30 Correctly oriented "You Are Here" illuminated map with large font designed for close approach shows connecting gate information and facilities and services on the airside. (See Chapter 3, Section 3.4.1.3).

7.2.1 Gate Area—People Movers

C-GA.31 Where people movers to or along the concourse are optional, dynamic signage indicates flights or gates for which the tram or monorail ride is recommended. Walking times/distances are provided.

C-GA.32 Station and other announcements on the automated people mover are both visual and virtual.

C-GA.33 A designated seating area and wheelchair area with grab bar are provided in the cars.

C-GA.34 Effective directional signage is in place, especially where a level change is involved.

7.2.2 Gate Area—Points of Interest

C-GA.35 On long concourses, maps with point-of-interest directories are placed at regular intervals.

C-GA.36 SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.

C-GA.37 An airport information desk or international Traveler's Aid counter offers video remote interpreting service.

C-GA.38 Restrooms, companion restrooms, and drinking fountains are grouped at frequent intervals along concourses, with men's and women's facilities in a standard relation to each other, e.g., men's to left of women's.

C-GA.39 Restaurants, food kiosks, and convenience stores are distributed along concourses to provide close access from all gates.

C-GA.40 Restaurant menus are in large print, Braille, or posted in an accessible format online.

C-GA.41 For electronic menus, e.g., on an iPad, accessibility features such as VoiceOver are enabled and the device allows close approach for easy viewing.

C-GA.42 Restaurants that have wall menus also have a large print copy available on request.

C-GA.43 Restaurant staff will read the menu.

C-GA.44 Restaurant staff willingly accommodate service animals.

C-GA.45 Aisles in stores and spaces between tables in restaurants have a clear width of 36 inches.

C-GA.46 Restaurant and retail staff have disability awareness training including how to guide persons who are blind.

C-GA.47 VIP lounges are fully accessible, have appropriate directional and identification signage, and are identified on the airport access database, maps, and directories.

7.2.3 Gate Area—SARAs

C-GA.48 SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.

C-GA.49 Where SARAs are only available landside, service companies provide escort or wheelchair assistance out and then back through security.

C-GA.50 A TSA policy is in place to allow people traveling with service/emotional support animals to bypass the line on return.

7.2.4 Gate Area—Hold Room

C-GA.51 Gate agents provide confirmation that the passenger is at the correct gate as well as expected boarding and departure time.

C-GA.52 The quality of the PA system and terminal acoustics allow announcements in the gate area to be easily understood.

C-GA.53 Gate areas have induction loops to allow PA announcements to be transmitted directly to persons using hearing aids with T-coils or cochlear implants. Graphic signage alerting passengers to the presence of the hearing loop is displayed on the podium.

C-GA.54 There is a general pre-boarding announcement for people with disabilities or personal notification by gate agents for those who self-identify as needing to pre-board.

C-GA.55 GIDSs have real-time information, including which rows are boarding.

C-GA.56 Passengers with sensory disabilities who self-identify must be provided prompt access to information provided other passengers, personally by the gate agent if no other means is employed, e.g., GIDS, text message, PA system, etc.

C-GA.57 Accessible recharging stations are available in the gate area for mobile devices and assistive equipment.

C-GA.58 TV monitors have high-contrast closed captioning enabled.

C-GA.59 Visual paging is built into TV monitors.

C-GA.60 A designated seating area for people with disabilities is located near the podium or boarding gate.

C-GA.61 Airline or service company personnel assist passengers with disabilities to the door of the plane or seat, as needed.

C-GA.62 Boarding bridge slopes should be as gentle as possible, with handrails at transitions and minimal gap/step into plane.

C-GA.63 Passenger wheelchairs may be used until the door of the plane, then gate-checked for stowage as cargo or if a manual chair or walker, may be stowed in the cabin on a first-come, first-serve basis. An elevator or lift near the jet bridge allows timely transfer of wheelchairs to the tarmac for stowage.

C-GA.64 A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues involving requested accommodations, assistive devices, carry-on baggage, denied boarding, etc.

7.3 Terminal Transportation (TT)

C-TT.01 Shuttle vans operating between concourses for customer convenience are accessible, have appropriate directional and identification signage, and are identified in the access database and on airport maps.

The logistics of connecting between different terminals can be daunting. Virtual information, as shown in Figure 7-14, can be an excellent means of communicating the best way to transfer from one terminal to another.

7.4 Airline Support (AS)—Same Terminal, Different Airline

C-AS.16 Gate numbers are sent by text message from the departing carrier, or passengers check flight information via mobile phone after arrival.

C-AS.17 Passengers consult nearest FIDS after exiting the arriving gate.

C-AS.18 Agents give directions to the connecting gate.

C-AS.19 Passengers use a mobile application, if any, for directions/route to the connecting gate.

Source: ACRP Project 07-13 Research Team

Figure 7-14. Animated, dynamic "Making Connections" map at Boston Logan International Airport.

C-AS.20 Airline service employees provide wheelchair assistance or escort from the seat or door of the plane, as needed, to the connecting gate. Service by electric cart replaces wheelchair service for ambulatory passengers in some airports.

Airlines or airports may provide areas of assistance for passengers to wait between flights. For example, airlines like Lufthansa provide an area of assistance at Munich Airport. Airports such as London Gatwick offer special assistance drop-off points (see Figure 7-15). Note, however, that while such holding areas provide some customers with a positive mindset where they feel listened to and treated like individuals, others may prefer to wait in a less segregated area such as a restaurant. For this reason, ACAA Subpart B on "Nondiscrimination and Access to Services and Information" specifies that carriers cannot require passengers "to remain in a

Source: London Gatwick Airport

Figure 7-15. Special assistance drop-off point at London Gatwick Airport.

holding area or other location in order to receive transportation, services, or accommodations" [§382.33(3)].

C-AS.21 In case of ad hoc request(s), an airline or service agent calls for additional personnel to provide assistance.

C-AS.22 The passenger's wheelchair, if any, is returned at door of plane. For mobility equipment stowed as cargo, elevator or lift near jet bridge allows prompt delivery from tarmac.

C-AS.23 In case of a missed or cancelled connection, the rebooking center for the departing carrier is accessible with either a ticket agent or phone instead of/in addition to an inaccessible touch-screen kiosk, or the traveler can rebook by mobile application.

C-AS.24 Rebooking centers have appropriate directional and identification signage and appear on maps/directories.

C-AS.25 Staff from the arriving carrier's service company will provide wheelchair service or escort to the departing carrier's rebooking center and new gate.

C-AS.26 Passengers locate rebooking center for departing carrier and route to it on a mobile application.

CHAPTER 8

Wayfinding Technologies for Aging Travelers and Persons with Disabilities

8.1 Overview

Opportunities for air travel have grown significantly in recent years, with cheaper flights serving a wider range of destinations. For many people, this has made flying a more common experience. However, for people with a disability or mobility limitation, the prospect of attempting a trip by air can seem fraught with potential difficulties. In addition, an ever-growing aging population adds its own unique set of challenges for equitably accommodating all users in a manner that has come to be expected.

People with physical or cognitive limitations and/or disabilities continue to face challenges in accessing the full range of opportunities available to people who are nondisabled. Designing products and services that can be used by people with a wide range of abilities and disabilities is called universal design (described in detail in Chapter 2).

Congress has responded to the need to increase access to products and services for people with disabilities by passing legislation in a range of areas, including education, employment, transportation, assistive technology, and electronic and information technology. Some guarantee the civil rights of individuals with disabilities, others establish procurement requirements for specific agencies, while others impose accessibility requirements on producers of products and providers of services. Some legislation is at the federal level, and some is at the state level. Below are several relevant federal laws in the United States from the "2010 ADA Standards for Accessible Design" (https://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm):

> Section 504 of the Rehabilitation Act of 1973 requires that programs and services that receive federal funding make those options available to individuals with disabilities and provide reasonable accommodations. In 1986, Section 508 was added as an amendment to the Rehabilitation Act of 1973. Section 508 requires that electronic and information technology developed, procured, maintained or used by the federal government be designed to be accessible to people with disabilities. A final rule updating Section 508 ICT Standards was issued in January 2017.
>
> The Air Carrier Access Act (ACAA) of 1986, amended numerous times since 14 CFR Part 382 regulations were first promulgated in 1990, sets standards for accessible services and facilities in air travel. While it applies for the most part to airlines, its requirements also impact airports in a number of important areas including agreements for level boarding, communication access (e.g., captioning on TV monitors), service animal relief areas (SARAs), and most recently CUSS kiosks, as will be discussed shortly. Regulations affecting airports appear subsequently, or at the same time as in the case of self-service automated kiosks, as amendments to Section 504.
>
> The Americans with Disabilities Act (ADA) of 1990 and its 2008 amendments is civil rights legislation that builds on and extends the reach of Section 504. Note that standards for airports are issued by the Department of Transportation and differ in some instances from the Department of Justice ADA Standards. The ADA requires that public programs and services be accessible to people with disabilities and that they provide accessible, "effective communication," regardless of what medium is typically used for that communication. In addition, access to digital technology is emerging as a new frontier in the enforcement of civil rights for persons with disabilities.

Although laws like the ADA predate the digital revolution, they are applied to the products and services that have come out of the digital revolution, bounded variously by considerations of undue burden, infeasibility and fundamental alteration.

Some laws, like Section 508 of the Rehabilitation Act (29 U.S.C. § 794d) and the Twenty-First Century Communications and Video Accessibility Act (47 U.S.C. § 613), are specifically directed at the issue of making technology accessible to people with disabilities. This body of law makes up what can be commonly described as "digital disability rights." The gist of the law is this: the flexibility of digital information should end the separate and unequal treatment of persons with disabilities and give them the same opportunities as their nondisabled peers (Goldstein and Care n.d.).

In recent years, there has been an explosion of digital devices, software, and content in government, business, education, transportation, and social life. Because mainstream access was feasible for all of these technologies when developed, the digital revolution should have been a powerful engine for integration of people with disabilities through equal access to these enhancements of modern life. Unfortunately, only recently have developers of these technologies begun to recognize the benefits of and need for universal design of these technologies to permit access by people with disabilities.

The 2010 ADA Standards for Accessible Design set minimum requirements—both scoping and technical—for newly designed and constructed or altered state and local government facilities, public accommodations, and commercial facilities to be readily accessible to and usable by individuals with disabilities. The result of incorporating accessibility into technology is that

1. The user with a disability gets access to all of the same information or services with substantially equivalent ease of use,
2. The user with no disability has an enhanced ease of use without noticing it, and
3. The information or service provider gets a greater audience and a product that is easier to maintain (Goldstein and Care n.d.).

The following information will describe, by journey segment, some of the technologies encountered in the airport wayfinding travel experience, best practices for implementation, and how the principles of universal design can be incorporated to expand or enhance the capabilities of the technology to be inclusive of as many people as possible regardless of limitations or disabilities.

Virtual wayfinding systems encompass a diverse and rapidly changing set of wired and wireless communications-based information and electronics technologies.

Supporting technologies include the information systems that are needed, which essentially provide the interface and interaction between the data and the users of the data. Supporting technologies may include communications infrastructure, ITS field equipment, and airport network equipment and management.

8.2 Accessible Websites

8.2.1 Overview

The ability for passengers to plan in advance via digital media is becoming more and more common and effective. For older adults and passengers with disabilities, advance knowledge can greatly enhance the wayfinding experience that is part of their overall customer experience.

Understanding accessibility requires an awareness of the special needs of multiple user groups, including people with disabilities and mature users with age-related disabilities. A person with a disability may encounter one or more barriers that can be eliminated or minimized by the software or web developer, the assistive technology, or the underlying operating system software and hardware platform.

The four main categories of disabilities are visual, hearing, mobility, and cognitive, as discussed in detail in Chapter 2. Airport websites touch on the visual and virtual methods of communication and are critical tools in offering the first opportunities for consistency. Consistency in terminology, graphics and color all need to be carried through from the airport terminal to the website and vice versa. Landmarks can be identified on websites and used by people with disabilities for pre-trip planning and once again in an airport.

8.2.2 Application

Most airports, regardless of their size, have a website. The internet is a useful tool for airports to deliver key information to the traveling public. The primary information disseminated by airport websites includes:

- Directions to the airport
- Airport road information
- Access route conditions and delays
- Regional traffic information
- Information on ground transportation providers and services
- Parking information, including location, availability, rates by type, and shuttle access information
- Flight/gate information
- Cellphone lot information
- Security wait time
- Passenger pick-up information
- Location/wait time for baggage pick-up

The principles of universal design are not only for those professionals who design and build physical environments, but also for web developers, information architects, content managers, graphic designers, and writers constructing websites.

Web accessibility refers to the degree a site is accessible to and functional for the largest possible range of people. WCAG, as set out by the World Wide Web Consortium (W3C) Web Accessibility Initiative, are guidelines established for digital professionals in order to promote an inclusive digital society.

These guidelines cover a set of checkpoints outlined in four principles:

1. **Perceivability:** information and user interface components must be presentable to users in ways that aren't invisible to all their senses.
2. **Operability:** the interface cannot require an interaction that a user is unable to perform.
3. **Understandability:** the content, operation, or interface cannot be beyond their understanding.
4. **Robustness:** content must be interpreted reliably by a wide variety of user agents as they evolve, including assistive technologies.

8.2.3 Implementation

Airport website home pages should include a link for disability-related information and resources. Airline websites can also be a good source of information for pre-trip planning for those with accessibility needs, whether physical, sensory, or cognitive. As of December 12, 2015, ACAA regulations required all airline websites marketing to customers in the United States to provide similar accommodation request forms and to the meet accessibility requirements of the WCAG (WCAG 2.0 Level AA) on webpages providing core travel information and services. Full website accessibility was required by 1 year later, December 12, 2016.

Utilizing airport websites as part of pre-trip planning, travelers with special needs or disabilities can find accessibility information to assist them in planning their journey. Information on topics such as ground transportation, accessible parking, wheelchair assistance, service animal accommodation, accessible restrooms, and so forth, can normally be found via the link. Users can also view and download terminal maps and directories that can assist in familiarizing them with the airport layout before their arrival.

The following is a list of functional requirements for an airport website:

- User interface that intuitively guides users to the information they seek.
- Hierarchical menu.
- Map-based user interface for the provision of real-time (or near real-time) information on access route conditions (including construction, incidents, congestion, travel speeds, delays, and roadway weather conditions) and/or provision of a link to the local transportation agency's traveler information website.
- Real-time information on transit modes and/or provision of a link to the transit provider's website.
- Real-time information on parking facility status and availability.
- Real-time information on security wait times.
- Real-time information on flight and gate status.
- Static information on parking facility location and rates.
- Static information on cellphone lot locations and amenities.
- Static information on the location of passenger pick-up and drop-off.
- Personalized services that push information to the user based on a pre-determined user profile. Information shall be pushed to the user via email, text, and voice alerts.
- Capability to translate the information into multiple languages based on the user-selected preference.
- Compliance with the ADA and accessible by users with visual and hearing disabilities.
- Scalability to allow for expansion/changes to meet future traveler information needs (Elizer et al. 2012).

The U.S. Department of Health and Human Services has published an accessibility checklist to offer guidance to web developers (1194.22 Web-Based Intranet and Internet Information and Applications [Goldstein and Care n.d.]):

- Every image, video file, audio file, plug-in, etc., has an alt tag.
- Complex graphics are accompanied by detailed text descriptions.
- The alt descriptions describe the purpose of the objects.
- If an image is also used as a link, make sure the alt tag describes the graphic and the link destination.
- Decorative graphics with no other function have empty alt descriptions (alt= "").
- Add captions to videos.
- Add audio descriptions.
- Create text transcript.
- Create a link to the video rather than embedding it into webpages.
- Add a link to the media player download.
- Add an additional link to the text transcript.
- The page should provide alternative links to the image map.
- The <area> tags must contain an *alt* attribute.

- Data tables have the column and row headers appropriately identified (using the <th> tag).
- Tables used strictly for layout purposes do NOT have header rows or columns.
- Table cells are associated with the appropriate headers (e.g., with the ID, headers, scope, and/or axis HTML attributes).
- Make sure the page does not contain repeatedly flashing images.
- Check to make sure the page does not contain a strobe effect.
- A link is provided to a disability-accessible page where the plug-in can be downloaded.
- All Java applets, scripts, and plug-ins (including Acrobat PDF files and PowerPoint files, etc.) and the content within them are accessible to assistive technologies, or else an alternative means of accessing equivalent content is provided.
- When form controls are text input fields use the LABEL element.
- When text is not available use the title attribute.
- Include any special instructions within field labels.
- Make sure that form fields are in a logical tab order.
- Include a "Skip Navigation" button to help those using text readers.

If a site meets all these criteria, it is likely to be accessible to people with disabilities. The best test is to obtain feedback on the site's ease of use from people who are blind, deaf, and have physical disabilities, and then address their feedback with site improvements. When collecting feedback, ask users what type of adaptive technologies they use. This will allow you to configure the airport's website to meet the needs of a particular clientele and will help you direct resources toward the best compliance options.

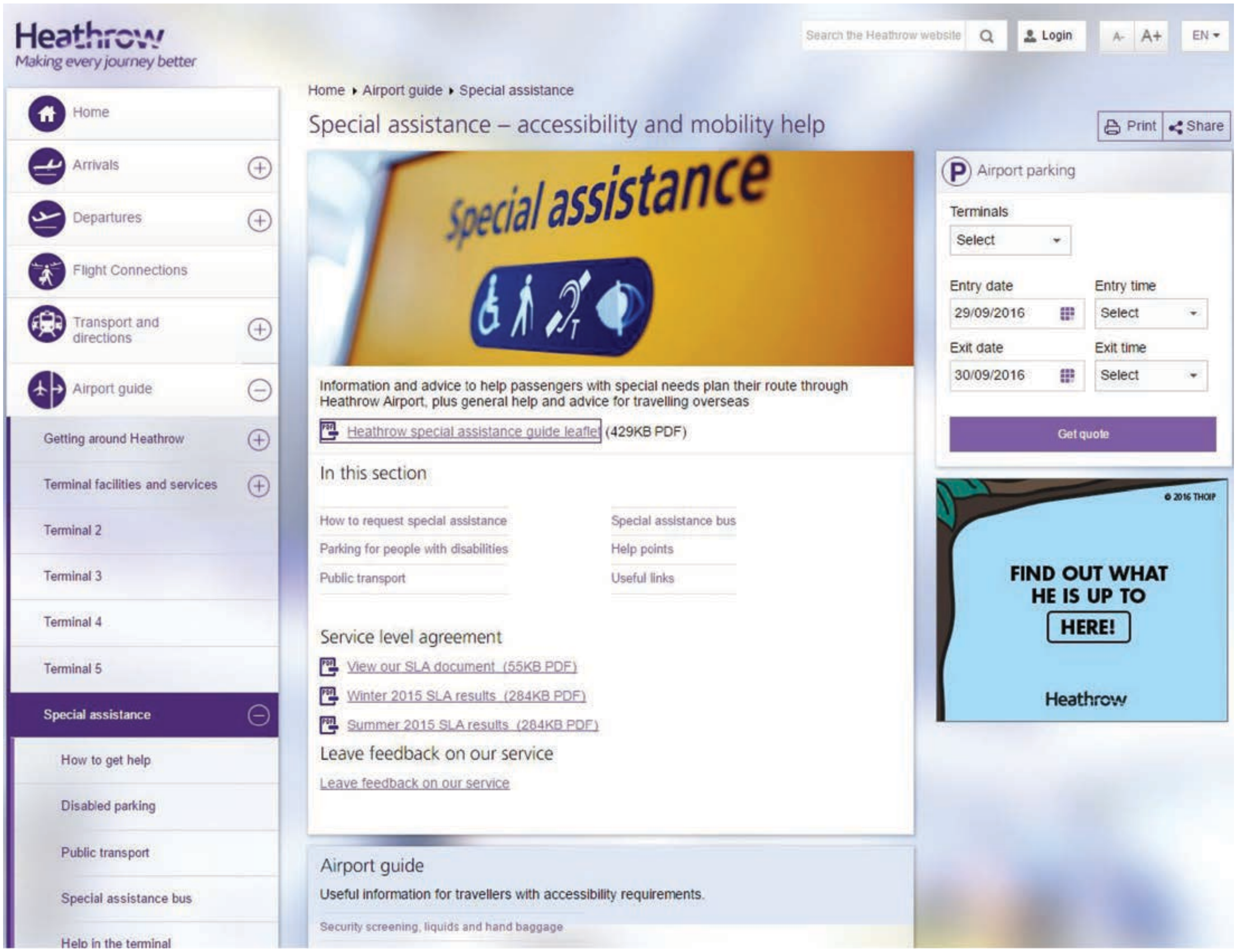
Heathrow Airport is a fine example of an organization committed to meeting legislated accessibility standards requirements and making every effort to ensure that its communications—including its website—are accessible to people with special needs, including those with visual, hearing, cognitive, and motor limitations.

Heathrow has endeavored to make its website adhere to the Priority 1 and 2 guidelines of the WCAG. (See Figure 8-1.) The site was built in consultation with AbilityNet, a body of website experts brought together by the Foundation for Communication for the Disabled and the Computability Centre—both leading charities working in the field of assistive technology for persons with disabilities.

Heathrow's website includes these navigation aids:

- The full site navigation is located on every page.
- A link to the home page is available on each page through the Heathrow logo.
- Navigation menus are marked up as HTML lists and styled with CSS.
- Many links have title attributes, which describe the link in greater detail.
- Links are written so as to make sense out of context.
- Link text is never duplicated. Two links on the same page with the same text always point to the same address.
- Some links, mostly to downloadable files such as PDFs, open a new browser window. There will always be a warning in either the text or the "title" attribute of the link.
- When the site is viewed in a text-only browser, the "skip to content" link becomes visible at the top of each page.
- Forms have their labels explicitly associated with their controls, aiding users of certain screen readers and speech browsers.

To provide additional help with finding content, every page of the site features a help link in the footer. The help section helps locate key information and includes a site map and search facilities.



Source: ACRP Project 07-13 Research Team

Figure 8-1. Heathrow Airport website accessibility page.

8.3 Mobile Wayfinding Applications

8.3.1 Overview

Smartphones and tablet personal computers have revolutionized mobile technology and the way we communicate today. They have also transformed the assistive technology market for people with disabilities. The introduction of third-party applications (software applications that run on mobile devices and tablets) has made a number of services available to users that device manufacturers never envisioned or could not have implemented alone. Applications are now available that have been designed to meet the needs of people with disabilities, making it cheaper, easier, and more efficient for people with disabilities to perform a wide range of tasks.

Recently, the potential of wayfinding and location-based technology has been recognized by the air transport industry, with the vast majority of airports exploring different ways of offering wayfinding in their terminals utilizing mobile applications. A number of indoor and outdoor mobile wayfinding applications have been developed for specific user groups, including the general public, people with mobility disabilities, and people with vision disabilities. However, to date, no application has been developed that provides essential route information in a way that is accessible to all users. Instead, users with disabilities are restricted to using specialized applications for people with disabilities.

Research shows that while several airport mobile applications provide a wealth of information and usability for general users, few have been designed with the purpose of also supporting users with disabilities. Clearly, an application that is useful to and usable by all users, versus many specialized applications to meet the needs of each specific user group, is not only practical and cost-effective, but it also has implications for participation by many more individuals.

Section 8.3 provides an overview of research intended to aid the industry in better designing and implementing mobile applications that take the needs of all user groups into consideration. Section 8.3.2 discusses recent developments in technology that are enabling a new generation of indoor navigation applications. Section 8.3.3 presents an industry scan of current airport navigation applications by the ACRP Project 07-13 research team that illustrates the shortcomings in current mobile applications for users with disabilities. Section 8.3.4 presents a set of research-based guidelines using universal design principles that will aid airports, airlines, and any other application developer in creating mobile application features that are usable for individuals with disabilities. The result of applying these best practices will be mobile applications with better usability and functionality for all users.

8.3.2 Positioning Technologies

Over the last decade, a number of technologies and approaches have been used to determine the location of mobile devices, including Bluetooth, Wi-Fi fingerprinting and triangulation, and a high-sensitivity global positioning system (GPS). Each has its own strengths, although precise and accurate indoor positioning is the largest weakness in these technologies. For an environment such as an airport, being able to reliably determine where a user is located and which direction they are facing is a key requirement for accurate navigation and wayfinding.

Recently, indoor beacon-based positioning has emerged as a potential technology to help fill this gap. Put simply, beacons are indoor proximity devices that come in various shapes and sizes. They can be as small as a Universal Serial Bus (USB) stick or larger and more visible. They transmit a signal using Bluetooth low energy (BLE), and the signal contains a unique identifier for that beacon. When a BLE-enabled device, such as a smartphone, moves within range of the beacon's signal, it can trigger an action, such as displaying a contextually relevant message on the phone. Beacons have enabled a new range of user interactions based on indoor proximity. Other promising indoor positioning systems such as visible light spectrum, which uses special light fixtures to determine device position, are also emerging. The downside of indoor positioning systems such as beacons and visible light is that they require infrastructure be installed at the location where the technology is to be used. However, at facilities such as airports, the benefits of such technology may outweigh the installation and maintenance costs.

Indoor positioning technologies can trigger an application on passengers' smartphones to send notifications to direct them to areas of interest and to provide additional information about their flights, such as boarding alerts and directions to the gate or baggage collection area. The application can also send promotional coupons as passengers enter a specific zone, such as a shop, café, or airport lounge. These features can help reduce congestion and bottlenecks, improving the passenger flow in airports by giving travelers accurate and timely information. Provision of accurate and timely information to passengers can, in turn, lead to smoother boarding and more on-time departures. Providing wayfinding information also means that passengers know how long it will take to get to the gate, increasing the time they spend in the retail area, which is good news for the airport's tenants. Ultimately, these technologies promise to enhance the wayfinding experience within an airport for all travelers. Features based on these technologies are starting to make their way into commercially deployed mobile applications for airports and airlines, which are discussed in the following section.

8.3.3 Airport Application Testing

As discussed earlier, current mobile applications for airport wayfinding do not meet the needs of users with disabilities. The ACRP Project 07-13 research team asked participants to download and test award-winning and industry-leading applications from airports around the world, such as the airport application at Amsterdam Airport Schiphol that is now on its fifth generation (see Figure 8-2).

The testing methodology has three users each download and test each airport's application and then rate its functionality or capability as it pertained to the universal design principles as good (4), fair (3), poor (2), and absent (1). The scores were averaged and applied to each category. A copy of the testing and comment form can be found in Appendix B, and a summary of results is shown in Table 8-1. In general, the applications tested demonstrated great usability for users without disabilities, but scored poorly for users with disabilities. (Usability scores shown in Table 8-1 are indicative of a user with a disability. Scores were not provided for a user without a disability.)

These results illustrate that most airport wayfinding applications are not currently designed to accommodate users with disabilities. However, with some modifications, these applications could be improved to not only better meet the needs of users with disabilities, but to increase the wayfinding utility for all users. Section 8.3.4 discusses a set of research-based guidelines that can help application developers who are creating or updating wayfinding applications avoid common pitfalls and achieve universal design principles in their applications.

8.3.4 Application Guidelines and Implementation

A number of indoor and outdoor mobile wayfinding and navigation applications have been developed for specific user groups, including the general public, people with mobility disabilities, and people with vision disabilities. However, to date, no single application has been developed that provides essential route information tailored to all users. Similarly, where applications have used alternative inputs (e.g., speech recognition) and outputs (e.g., voice output, high contrast) to provide accessible information for users with vision loss, no single application has been

Source: Amsterdam Airport Schiphol

Figure 8-2. Five generations of the Amsterdam Airport Schiphol airport application.

Table 8-1. Test results from airport application evaluation.

	Equitable Use		Flexibility in Use		Simple and Intuitive Use		Perceptible Information		Tolerance for Error*		Low Physical Effort		
Airport	Utility	Usability	Utility	Usability	Utility	Usability	Utility	Usability	Utility	Usability	Utility	Usability	AVG Score
5	3.00	1.40	1.00	3.00	1.80	2.30	1.00	1.60	1.00	1.00	2.00	2.00	**1.76**
3	3.00	2.20	1.00	2.60	1.75	2.00	1.00	1.30	1.30	1.00	2.00	1.80	**1.75**
2	2.00	1.60	1.00	3.00	1.75	2.00	1.00	1.60	1.00	1.00	2.00	2.00	**1.66**
4	3.00	1.20	1.00	2.00	1.50	2.00	1.30	1.30	1.00	1.00	2.00	2.00	**1.61**
1	2.00	1.60	1.00	1.60	1.50	2.00	1.00	1.50	1.00	1.00	2.00	1.80	**1.50**
6	2.00	1.20	1.00	2.30	1.75	2.30	1.00	1.30	1.00	1.00	1.00	1.75	**1.47**
11	2.00	1.20	1.00	2.00	1.66	2.30	1.30	1.30	1.00	1.00	1.00	1.75	**1.46**
10	2.00	1.00	1.00	2.00	1.80	2.30	1.30	1.30	1.00	1.00	1.00	1.75	**1.45**
7	2.00	1.00	1.00	2.30	1.75	1.90	1.00	1.10	1.00	1.00	1.00	1.75	**1.40**
9	2.00	1.00	1.00	2.00	1.80	1.90	1.00	1.30	1.00	1.00	1.00	1.75	**1.40**
8	2.00	1.00	1.00	2.00	1.75	1.90	1.00	1.30	1.00	1.00	1.00	1.75	**1.39**

*Tolerance for error features were tested - however, yielded very few results when not physically on-site at the airport.

developed that is usable by people with a wide range of physical, sensory, and cognitive abilities. Developing one application that is useful to and usable by all users rather than developing many specialized applications to meet the needs each specific user group is not only practical and cost-effective, it also has implications for participation of all individuals in society.

The goal of the guidelines in this section is to provide mobile application developers (e.g., airlines, airports, and third-party developers) with a set of principles and an accompanying checklist that they can reference when creating or improving wayfinding mobile applications in order to maximize the utility and usability for all travelers, especially travelers with disabilities. These guidelines are relevant regardless of the underlying positioning technology used to determine the user's location and orientation (e.g., beacon, Wi-Fi trilateration, visible light, or camera). The guidelines reinforce the extension of the seven principles of universal design (Connell et al. 1997) beyond the design of physical objects and spaces to the development of airport and other wayfinding applications. Each guideline discusses a general principle to be followed and is accompanied by a checklist of "Do's and Don'ts" to help make it easier for developers to organize and implement each concept. "Do's" are actions that developers should take to improve their application for travelers, while "Don'ts" are common pitfalls that developers should avoid.

In order to ensure that the guidelines are grounded in real-world conditions and environments as well as empirical evidence, the ACRP Project 07-13 research team tested a prototype wayfinding application that was based on the principles of universal design. Utility testing of this prototype application was conducted by the Georgia Tech Center for Assistive Technology and Environmental Access on-site in the Austin-Bergstrom International Airport in Austin, Texas. The utility testing included participants who were blind or had low vision, were deaf or hard of hearing, had mobility limitations, and/or were over 65—some with and some without reported limitations. Thus, the research team could observe the most common problems that these user groups encountered when navigating within an airport.

Separate usability testing of the prototype application was conducted at the Georgia Tech Center for Assistive Technology and Environmental Access and included participants who were blind or had low vision, participants who were deaf, and participants who had lower body mobility limitations or had cognitive limitations.

The following guidelines reflect the lessons learned by the research team that can help inform future wayfinding application development.

8.3.4.1 Design the Application for a Wide Range of Devices

Applications should be compatible with as many desktop and mobile devices as possible to accommodate needs for different size screens and interfaces.

DO	DON'T
✓ Design and test the application to run on small screens.	✘ Assume that the application will work equally well across all screen sizes.

8.3.4.2 Design the Application to Handle a Wide Range of Device Sensor Quality

The quality of device-based sensors (e.g., accelerometer, gyroscope, magnetometer, barometer, and light) that recognize environmental context or human movement, such as air gestures or orientation in the environment, can vary significantly among commercially available devices. Device limitations should be considered when planning application options and features. Typically, more expensive devices will contain better quality sensor hardware that is more precise and accurate in reflecting true user movement and orientation. This varying degree of accuracy can result in different degrees of usability when depending on the output of sensors in an application. For example, a "Look Around" feature could allow the traveler who is blind to self-orient and learn locations as they travel by pointing the mobile device in a particular direction to identify points of interest and the distance to each. This type of list could also be generated via a "What's Around Me?" button using the device's real-time position. However, if location and/or orientation data are of poor quality, incorrect information would be delivered to the user. If the application contains features that demand high-quality position/orientation data to function correctly, it may not be possible to offer the same feature set across all commercially available devices.

DO	DON'T
✓ Test orientation and movement-based features (e.g., instructions/pictures based on the direction the user is facing, augmented reality displays) on a wide range of devices (including devices that are low cost), across multiple platforms (e.g., Android and iOS), and devices running older versions of operating systems (e.g., Android 4.0, iOS 8). ✓ Anticipate that these features may not work equally well across all devices, and allow users to turn them off or provide manual input in place of sensors.	✘ Assume that orientation and movement-based features will work equally well across all devices, platforms, and operating system versions. ✘ Deploy features based heavily on device sensors as part of the main application experience that cannot be turned off or overridden with manual input. ✘ Tell users that the application will work on "most" mobile devices, without providing specific operating system versions or sample make/models.

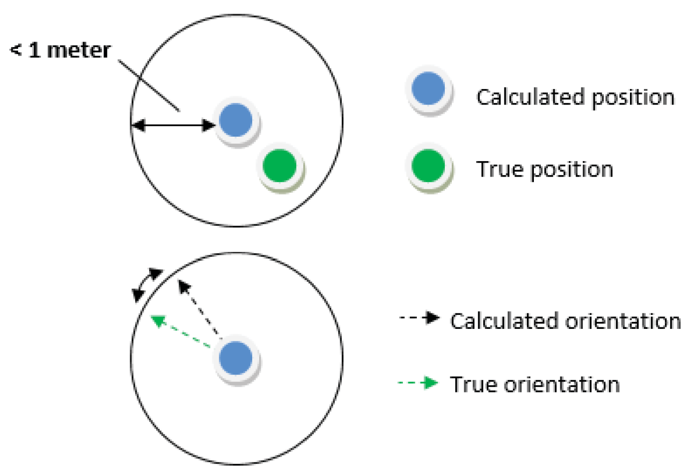
DO	DON'T
✓ Inform the user of any limitations they might encounter in sensor-based features via in-application informational dialogs (i.e., position accuracy and initiating the wayfinding functionality). ✓ Provide a list of sample devices on which the application was tested and works well, as well as a list of sample devices on which the application was tested and does NOT perform well, to allow users to anticipate how it will perform on their personal device.	✘ Push advertising and promotional information to devices with certain settings enabled.

8.3.4.3 Provide Accurate, Real-Time Position Data

Indoor positioning systems at airports must be able to provide accurate, real-time position data to the application once the device is on-site. Methods of obtaining position accuracy and range of accuracy include, but are not limited to: Wi-Fi, Bluetooth low-energy beacons, radio frequency identification/near field communication (RFID/NFC), visible light positioning, or a combination of technologies. A mobile application must be appropriately designed to utilize the supportive technology infrastructure, and position accuracy and range of accuracy become critical measurements required to initiate wayfinding. Information about the accuracy/uncertainty of the position and orientation of the device should be communicated to the user. The specific accuracy requirements suggested in the following "Do's" and "Don'ts" are based on expert opinion of the ACRP Project 07-13 research team.

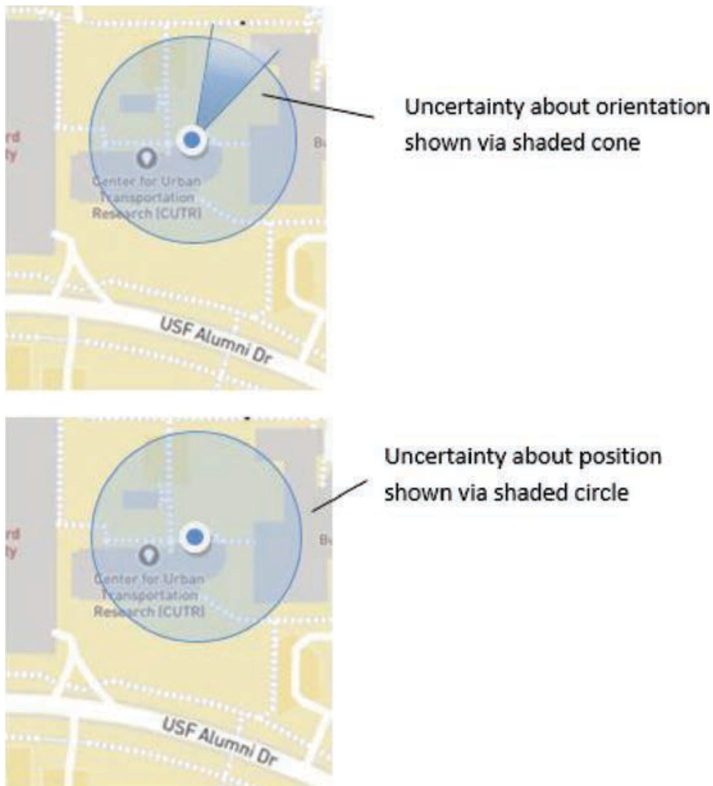
DO	DON'T
✓ Expert opinion suggests providing 1 meter or better of position accuracy. ✓ Expert opinion suggests providing 10 degrees (out of 360 degrees) or better of orientation accuracy. (See Figure 8-3.) ✓ Information about the accuracy/uncertainty of the position should be communicated to users (e.g., show a shaded circle surrounding the position on a map) to indicate how accurate that position might be. (See Figure 8-4.)	✘ Assume all indoor positioning systems will give better than 1 meter accuracy and 10 degrees orientation accuracy on all commercially available devices. ✘ Assume the application will work equally well at all facilities. ✘ Assume users understand why certain versions of technology (e.g., Bluetooth 4.0) are required.

DO	DON'T
✓ Ensure that any features based on indoor positioning system infrastructure are tested on-site with a wide variety of devices (e.g., high cost and low cost devices, different operating system versions) before offering these features to users. ✓ Provide a list of facilities/indoor positioning systems at which the application was tested to users so they have appropriate expectations for where the application will work well and are able to plan ahead. ✓ If the feature relies on a certain version of a wireless technology (e.g., Bluetooth 4.0), provide that information to users.	✗ Show/use location and orientation information without showing an indication of the accuracy of those values.



Source: ACRP Project 07-13 Research Team

Figure 8-3. Images explaining position and orientation accuracy.



Source: ACRP Project 07-13 Research Team

Figure 8-4. Images showing how to represent position and orientation accuracy to users.

8.3.4.4 Maximize the Active Areas of the Screen

Include an option to limit and/or block unwanted information on a screen, thus enabling active areas of the screen to be as large as possible, providing users with reasonable operating focus, and reducing the display complexity for users with intellectual disabilities.

DO	DON'T
✓ Dedicate the largest portion of the screen to the activity the user is currently focused on.	✘ Use a large portion of screen space for a feature the user isn't using.
✓ Allow the user to hide portions of the screen that aren't relevant to their current activity.	✘ Provide a fixed display without the ability to hide lower priority information.

8.3.4.5 Provide Multimodal Input and Output (I/O) Methods

Provide multimodal input methods such as touch screen (tap, lifting finger off screen); speech recognition and gestures, including 3-D touch gestures with use of fingers, such as pinching and scrolling for magnification and navigation, or hard-pressing to reveal more information about an item; and 3-D air gestures, such as swipe, circle, or zoom, that involve free movement in space.

Provide options for simultaneous visual (e.g., icons, text, and color), audio, and tactile outputs for redundant cueing. Provide information that accommodates a wide range of abilities, such as highly detailed descriptions for users who are blind, a visual/map-based system for people who have hearing loss, and information on where to locate a wheelchair for people with ambulatory limitations.

DO	DON'T
✓ Use as many different I/O modes as possible. ✓ Provide as many modes as possible that will ensure privacy (e.g., non-verbal I/Os such as keyboard, touch screen, or physical button directional arrows [e.g., D-pad]), when desired. ✓ Allow users to provide input via a user profile. ✓ Support and test standardized key input from Bluetooth-enabled devices to maximize the number of accessories that can be used as input devices. ✓ Allow users to block/opt-out of advertising and promotional information that interferes with wayfinding functionality.	✗ Force the user to use a single mode of input (e.g., touch screen and keyboard). ✗ Provide only visual output. ✗ Provide only speech-based input or auditory output. ✗ Push unsolicited advertising and promotional material that can interfere with the communication of wayfinding instructions.

8.3.4.6 Provide Flexible Application Settings to Support the Appropriate Range of User Needs and Functionality Preferences

Application settings/preferences should be based on a wide range of types of abilities (e.g., vision, hearing, motor, and cognition) and levels of ability (e.g., how much one can see or hear), rather than general categories of impairment (e.g., blind or deaf).

Maximize the legibility of essential information by making digital buttons and text as large as possible. Information should be obvious when possible, and, taking the device's zoom feature into consideration, all relevant information should fit on each screen to avoid having to scroll down. When it is not possible to fit all the information on one screen, it should be clear both visually and through text-to-speech that there is more information. Provide alternate text color and size options to meet individual preferences and abilities. Use different vocal tones for different types of information, such as directions and landmarks. Provide compatibility with a variety of techniques or devices used by people with sensory limitations, such as ASL, voice recognition, or speech output.

The W3C recommends the following contrast ratios for body text and image text:

- Small text should have a contrast ratio of at least 4.5:1 against its background.
- Large text (at 14 point bold/18 point regular and up) should have a contrast ratio of at least 3:1 against its background.
  (https://www.w3.org/TR/UNDERSTANDING-WCAG20/visual-audio-contrast-contrast.html)

Provide choice in moving forward and back between screens, including scrolling as well as touch buttons such as "forward/next" or arrows.

Allow users to "hyper-personalize" the application via a user profile that accounts not just for their specific abilities but also preferences (e.g., family restrooms versus wheelchair stall). This also requires a level of facility detail built into the application data that includes specifics, such as family restroom versus restroom.

The default for "usability" options such as text-to-speech, audio, and high contrast should be basic preferences that are always turned on rather than turned off.

These options should be located in application settings, rather than hidden accessibility features.

DO	DON'T
✓ Provide a range of functionality in application settings. ✓ Ensure ranges can be easily adjusted by users with a range of capabilities (e.g., users with visual or fine motor control disabilities).	✗ Provide yes/no options for specific disabilities: **Visual Disability** **☒ - Do you have a visual disability?** **Auditory Disability** **☒ - Do you have an auditory disability?** **Intellectual Disability** **☒ - Do you have an intellectual disability?**

DO	DON'T
VISUAL ✓ Provide simultaneous visual (e.g., icons, text, color), audio, and tactile outputs for redundant cueing. ✓ Label visual controls with text as indicated on each platform (Android, iOS) so platform-specific text-to-speech interactions can be used whenever possible. ✓ Maximize contrast between foreground essential information (icons, text, etc.) and background (e.g., white or yellow on black, dark gray or blue).	**VISUAL** ✗ Put light text on a light background. ✗ Put dark text on a dark background. ✗ Make text unnecessarily small. ✗ Make important text small. ✗ Make unimportant text large.

DO	DON'T
✓ Provide range of font sizes, contrast options, size of objects, and amount of information on screen. **Very small font---X---Very large font** **Normal contrast---X---High contrast** **Normal text---X---Very large text** ✓ Put dark text on a light background or light text on a dark background. ✓ Make text as large as possible. ✓ Comfortably fit text and buttons into a single screen view. ✓ Size text according to importance.	

DO	DON'T
AUDITORY ✓ Provide a range of volume, frequency, voice output type, speed of voice output, and repetition controls. **Quiet---X---Very loud** **Only important directions---X---Announce all information** **Very slow---X---Very fast** **Announce once---X---Repeat announcements until user signals to stop** ✓ How well can you hear? **Can't identify sounds---X---Can easily identify sounds** ✓ Use different vocal tones for different types of information, such as directions and landmarks.	**AUDITORY** ✘ Use a monotonous voice for all instructions and information. ✘ Use a single volume level without letting the user adjust it.

DO	DON'T
TACTILE ✓ Types and intensity of vibration **No vibration---X---Vibrate for all prompts**	**TACTILE** ✘ Provide range controls using sliders that require fine motor control and cannot be changed via buttons or external controllers. ✘ Support only devices with small screens. ✘ Prevent swiping in between screens.

DO	DON'T
COGNITIVE ✓ Detail of information shown on screen? **Simple---X---Very detailed**	**COGNITIVE** ✘ Display a large amount of unnecessary detail on the screen.

DO	DON'T
DISPLAY ✓ How well can you see up close? **Can't identify objects---X---Very clear** ✓ How well can you see far away? **Can't identify objects---X---Very clear**	**DISPLAY** ✘ Force users to scroll down through a lot of information. ✘ Cram too much text or too many buttons into a screen view so they can't easily be distinguished or tapped.

DO	DON'T
ON-SCREEN CONTENT ✓ How much information do you prefer to see on a screen? **Show me one thing at a time---X---Show as much information on each screen as possible**	**ON-SCREEN CONTENT**

DO	DON'T
POINTS OF INTEREST ✓ Preferred Restroom ✓ Family Restroom	**POINTS OF INTEREST** ✘ Assume all users will want to use ADA-specific bathrooms and other infrastructure.

DO	DON'T
INTERFACE DESIGN ✓ Dropdown menu or selectable icon/symbol. ✓ Allow backward/forward movement via screen swipes. ✓ Support desktop and mobile devices of varying screen types, including large displays that are easier to see and interact with/touch.	**INTERFACE DESIGN**

8.3.4.7 Provide Simple Navigation Instructions

Instructions should be simple and to the point. Include directional information necessary to get from one point to the next. Omit unnecessary information. Provide contextual information only as needed to clarify directions. Use pictures when possible to help describe an area or location. While this makes it easier for many users, especially those with intellectual disabilities, to quickly understand the information, pictures will also need to be accompanied by textual description for people who cannot see them.

DO	DON'T
✓ Provide a picture and a text description of that picture to aid in wayfinding. ✓ Provide clear, precise textual descriptions when appropriate, such as: "Turn left at the concourse walkway and walk for 100 feet."	✘ Show only a picture, which can't be seen by users with low or no vision. ✘ Provide only text, which is difficult for many users, especially those with intellectual disabilities, to understand. ✘ Provide incomplete, variable text descriptions, such as: "There will be a concourse up ahead. You should turn left at this concourse. After turning left, you should walk for approximately 100 feet."

8.3.4.8 Provide Information in Order Consistent with Order of Use and Importance

Show information to the user in the order in which they will need it. Put important information first, followed by less important information.

DO	DON'T
✓ Information on screen should read top to bottom for ease of scrolling. ✓ Next/Continue button should be at bottom.	✘ Locate "next" button at top of screen forcing someone to scroll up from the bottom.

8.3.4.9 Provide Choice in Wayfinding Directions

Provide a choice in wayfinding directions by including multiple frames of reference for orienting travelers, such as compass heading (e.g., "Walk north 100 feet") or orientation ("Walk straight 100 feet") by using device internal positioning method(s).

For directions based on orientation, technology must be sufficiently sensitive and reliable to ensure that the user is facing in the correct direction or that the directions are given in such a way as to orient the user.

DO	DON'T
✓ Provide a compass image that utilizes multimodal outputs to indicate direction. **In application settings:** **Preferred direction –**compass heading ("Walk north 100 ft").	✘ Assume the user will always want to use compass heading directions. ✘ Assume that the user is oriented in the right direction.

8.3.4.10 Provide Alternative Ways to Receive Airport Information

Provide alternative outputs (e.g., text, vibration, and flashing light) for receiving visual (e.g., signs, interactive displays) and auditory (e.g., announcements, beeping for scanned boarding pass) airport information from signage.

DO	DON'T
✓ In application settings: **Notifications** **Preferred method:** ☒ - **Audio** ☒ - **Flashing light** ☒ - **Text in notification window** ☒ - **Vibration**	✘ Provide one method of notification and rely on system defaults to provide audio or vibrations.

8.3.4.11 Advance Planning

The ability to plan in advance is very important to both persons with disabilities and older travelers. Wayfinding apps should allow users to map their routes before arriving at the airport and know both distances and approximate times needed to/from the gate. This reduces anxiety and allows users to make an informed decision on whether, for example, wheelchair assistance is necessary. Maps of facilities should accurately match the airport itself, and the map should be updated as the facilities change.

DO	DON'T
✓ Allow users to plan trips before they arrive and provide distance and time required to travel from one point to another. ✓ Provide sample origin and destination inputs so users can plan a test trip and become accustomed to the application without needing to know a specific origin and destination at an actual airport. ✓ Allow users to test the "real-time" navigation feature of the system before they arrive at the airport so they can become familiar with the information and controls. ✓ Make sure the map in your application matches the actual condition on-site and continue to update the map as the facilities change. ✓ Provide multimodal inputs and outputs.	✘ Require that trips be planned to or from "My Location." ✘ Require the user to know a specific origin and destination at an actual airport before they can plan a sample trip. ✘ Require that the user be at an airport before any of the "real-time" navigation features are shown. ✘ Allow the airport map within the application to become outdated. ✘ Rely on only visual information.

8.3.4.12 Always-On Mode

The default for "usability" options such as text-to-speech, audio, and high contrast should be basic preferences that are always turned on rather than turned off. These options should be located in application settings instead of hidden in accessibility features.

DO	DON'T
✓ In application settings: **Audio** ☒ **- Announce directions out loud (default on)** ☒ **- Text in notification window** ☒ **- Vibration**	✘ Provide one method of notification and rely on system defaults to provide audio or vibrations. **Accessibility** ☒ **- Enable text-to-speech for users who are blind or print-disabled (default off)**

8.3.4.13 Simple Directions and Instructions

Directions and destinations should avoid unfamiliar terminology that is not commonly used.

DO	DON'T
✓ Water Fountain	✘ Hydration Station
✓ Restroom/Bathroom	✘ Lavatory
✓ Boarding Area	✘ Terminal

Convey wayfinding information using as many multisensory cues as possible including tactile (floor or wall) information, colors, sounds, temperature, volume, and smell. This should be balanced with the need to keep directions as brief as possible. One possible design is to provide an initial brief instruction to the user, with the ability to access more detailed information if the user desires it.

DO	DON'T
✓ Provide a summary of instructions first and follow up with long details if the user asks for it: **"Turn left at the red concourse walkway and walk for 100 feet."** **"Turn where the flooring changes from tile to carpet."** **"You may smell a cinnamon roll shop near your upcoming turn."** **"You may hear a smoothie blender near your upcoming turn."** ✓ When introducing the application features to the user, explain how detailed instructions can be accessed during navigation (e.g., double-tapping on screen). The above details given to the user can be prioritized and/or shown/hidden based on the user's preference for receiving information via in-application settings: **Navigation Instructions** **I would like to receive details about landmarks when prompted, including:** **☒ - Tactile transitions (e.g., carpet to tile)** **☒ - Smells (cinnamon roll shops)** **☒ - Sounds (smoothie blender)** **☒ - Temperature (cold hallway)**	✘ Provide extremely detailed directions without giving the user an initial short summary first: **"Turn left at the red concourse walkway, where there is a transition of flooring to carpet near a cinnamon roll shop and smoothie shop and walk for 100 feet."** ✘ Provide extremely detailed directions without giving the user an option in settings for what they would like to hear details about.

8.3.4.14 Seamless Integration of Outdoor and Indoor Navigation

Allow users to move seamlessly from outdoor GPS navigation to the indoor navigation system provided by the airport. The fact that separate positioning technologies are implemented for indoors versus outdoor navigation should be completely transparent to the user if possible.

DO	DON'T
✓ Continue to give navigation instructions as the user moves from outdoors to indoors and vice versa. ✓ Focus on user-facing instructions based on the capabilities of the positioning systems that may have differing accuracies and not positioning system technology implementation differences ("In this airport we can provide you information about nearby points of interest, but cannot provide step-by-step navigation instructions"). ✓ Extend your positioning system into exterior areas with poor GPS signal access (e.g., outdoor parking garages).	✘ Force the user to download and use a separate application for indoor and outdoor navigation. ✘ Expose the user to detailed nuances of the positioning system implementation ("The Wi-Fi trilateration-based positioning system in this airport is accurate to 15–30 meters"). ✘ Assume that outdoor positioning technologies (e.g., GPS) will work well in covered areas (e.g., garages). ✘ Allow the airport map within the application to become outdated. ✘ Rely on only visual information.

8.3.4.15 Adaptable to User's Pace

Each screen should clearly specify its purpose and indicate what is on the next screen and what was on the previous screen, providing full context for where the user is within the application. The application should be adaptable to the user's pace, such as letting the user control progress within the application so they have adequate time to read the text for popups that appear. In other words, popups should not automatically disappear based on a timer or user's physical progress—the dismissal of the popup should be controlled by the user, or the user should have an easy way of retrieving the information after it disappears. The same requirement applies to voice output.

DO	DON'T
✓ Provide manual controls so users can control "next" or "back" movement through the application and review information about where they've been or where they are headed. ✓ If information prompts disappear on their own, provide an easy and intuitive way that users can retrieve the information they just missed.	✘ Force the user to download and use a separate application for indoor and outdoor navigation. ✘ Expose the user to detailed nuances of the positioning system implementation ("The Wi-Fi trilateration-based positioning system in this airport is accurate to 15–30 meters").

8.3.4.16 Alternative Destinations

Do not assume that the departure gate is always the primary or immediate destination. Applications should provide information about alternative destinations (e.g., what's nearby). This could be done on a map with text and audio description of points of interest. Maps are a good way to communicate information visually, but for a portion of the population (including users with low or no vision), maps are not useful navigation aids. Note that use of a mobile device may not be permitted in certain areas (e.g., security). Allow for random access to destination directions to enable users to locate destinations in any order (e.g., restroom).

DO	DON'T
✓ Show a "Nearby" list AND map with point-of-interest names. ✓ Allow users to easily pick a new destination during navigation. ✓ Allow users to easily pause and resume the navigation within the application if they are interrupted.	✘ Show only a map with no text representation of information. ✘ Show only text with no map representation. ✘ Make the user search through an alphabetized directory to find points of interest. ✘ Force the user to complete their current navigation session to their destination before starting a new one. ✘ Assume the user can always respond to prompts, especially near security areas. ✘ Reset the application state to the beginning if the user hasn't recently interacted with the device.

8.3.4.17 Platform Consistency

Navigation within the application should be consistent with the latest design guidelines for the particular mobile phone platform:

- **iOS**
  https://developer.apple.com/library/ios/documentation/UserExperience/Conceptual/MobileHIG/index. html
- **Android**
  http://developer.android.com/design/index.html

Accessibility guidelines for each platform should also be followed except where they are superseded by these guidelines:

- **iOS**
  https://developer.apple.com/accessibility/ios/
- **Android**
  https://material.google.com/usability/accessibility.html
  https://developer.android.com/guide/topics/ui/accessibility/index.html

iPhone users are accustomed to iPhone applications typically providing similar options for navigation within the application, and Android users are accustomed to Android applications typically providing similar options for navigation within those applications. However, adopting Android in-application navigation design in an iPhone application would be confusing to iPhone users, as would adopting iPhone in-application navigation design in an Android application. Where possible, use familiar and existing conventions for the location of buttons for the specific platform, such as “previous” and “next” buttons in corners, “< and >” for next screen, and the use of color-coded drop pins and dots to indicate beginning, current, and destination locations on the map. Icons should be familiar and consistent with user expectations and consistent with the design guidelines for the particular mobile phone platform. As with in-application navigation, using Android icons in an iPhone application would be confusing to iPhone users, as would using iPhone icons in an Android application.

DO	DON'T
✓ Use iOS standard icons in iOS applications. ✓ Use Android standard icons in Android applications. ✓ Use Android application design conventions. ✓ Include in-application navigation for Android applications. ✓ Use iOS application design conventions (including in-application navigation) for iOS applications.	✘ Use the same icons and in-application design and navigation design across Android and iOS. ✘ Use non-Android icons (iOS, generic) on Android. ✘ Use non-iOS icons (Android, generic) on iOS. ✘ Use non-Android in-application design and navigation on Android. ✘ Use non-iOS in-application design and navigation on iOS. ✘ Reset the application state to the beginning if the user hasn’t recently interacted with the device.

8.3.4.18 Warning of Errors

Provide multimodal (e.g., visual, tactile, and/or audio) warnings (outputs) to identify errors during wayfinding. Geofencing is a technique through which users, when they enter a particular space or pass by a particular landmark, can be given a notification to validate the wayfinding route as they navigate the airport.

DO	DON'T
✓ Provide sensing capability to identify a traveler’s current location and orientation on an interactive plan of the airport.	✘ Assume the user can find their location on a map without assistance. ✘ Assume the user is familiar with security procedures.

DO	DON'T
✓ Incorporate user tips to facilitate getting around the airport, such as before going through security (have your ID out, wheelchair may cause delay, etc.), finding where to park, and accessing assistance, etc.	✘ Assume the user knows how to access assistance.
✓ Include map/interactive directional map to see progress and correct mistakes.	✘ Assume the user can "figure it out" if something goes wrong with directions, or there is an error in real-time positioning.
✓ Add an auto timer for the user's flight departure to avoid missing a flight.	✘ Go long periods of time without any visual, audio, or tactile feedback indicating that the user is on the right or wrong path.
✓ Identify each gate that is passed along the route to confirm users are on the correct path and to discourage unconscious actions.	✘ Assume the user remembers when their flight departs.
✓ Incorporate real-time data (when available) about the status (open/closed) of security checkpoints and vertical transitions (e.g., escalators, elevators).	✘ Assume that facilities such as security checkpoints or elevators are always open.
✓ Provide photos and descriptions of places that line up with the angle the user is facing.	✘ Provide photos or descriptions of places that don't line up with the angle the user is facing.
✓ Provide visual, tactile, and/or audio verification outputs to affirm or confirm a selection (e.g., text/audio saying "Finding a restroom").	✘ Provide vague descriptions of places.
✓ Provide concise and redundant route details, including the provision of landmarks, distance, and orientation (e.g., "walk straight for 20 feet until you reach the drinking fountain").	✘ Assume the user always picks the correct option, and proceed without confirming their selection.
✓ Automatically select the units for distance based on the locale that the user has selected on the mobile device (e.g., use "imperial" for U.S. English locale), but also offer a manual option to choose metric or imperial.	✘ Provide vague directions without referencing distance or landmarks (e.g., "walk forward").
	✘ Always use the same unit type (imperial, metric) without a user option to change it.

8.3.4.19 Low Physical Effort

Design user interactions with the user interface to be efficient and comfortable and involve a minimum of fatigue.

DO	DON'T
✓ Locate buttons along the top, bottom, and sides of the interface where they can be easily found and pressed.	✗ Locate buttons in the middle of the interface where interaction isn't obvious.
✓ Define the order for screen reading elements to match the logical order in which the information should be presented to the user.	✗ Read elements on the screen out of logical order.
✓ When re-opening the application after an accidental shutdown, bring the user back to where they left off.	✗ When re-opening the application after an accidental shutdown, restart the application at the first screen.
✓ Minimize scrolling and other repetitive actions such as double tap and hitting "next" after every direction.	✗ Require interactions with the screen when they aren't needed.
✓ Maximize accuracy by making buttons as large as possible and with sufficient space between them.	

8.4 Accessible Help/Call Points

8.4.1 Overview

Accessible help/call points are easy-to-use communication devices that provide arriving travelers needing accessibility information or assistance with a connection to a remotely located service provider. Help/call points offer verbal and virtual communication with the airport. These devices can provide convenient points at which people with disabilities can initiate their wayfinding experience upon their arrival to the terminal.

8.4.2 Application

Accessible help/call points are usually in the form of totems or kiosks and are normally positioned near main airport terminal entrances or sometimes even in accessible car parking facilities. Help/call points can be used by those with disabilities to announce their arrival at the airport and to request a wheelchair, electric cart, escort, or other assistance to further their journey into the terminal and eventually to their departure gate.

Help/call points should be identified with international accessibility symbols to clearly indicate their purpose and should be placed so that they are easily accessed by travelers with mobility issues (wheelchairs, walkers, canes, etc.) yet do not present an obstruction to normal pedestrian traffic flow when in use.

8.4.3 Components

Components of a help/call point include the following:

- Analog, Voice over Internet Protocol (VoIP), or wireless telephone in a vandal- and weather-resistant enclosure
- Installation that is highly visible and well-marked
- Single or dual autodial buttons
- Raised text button legend with Braille
- Enabled for hearing loop
- Hands-free operation
- Audio-visual ring indicator
- Connection to a central monitoring station

8.4.4 Implementation

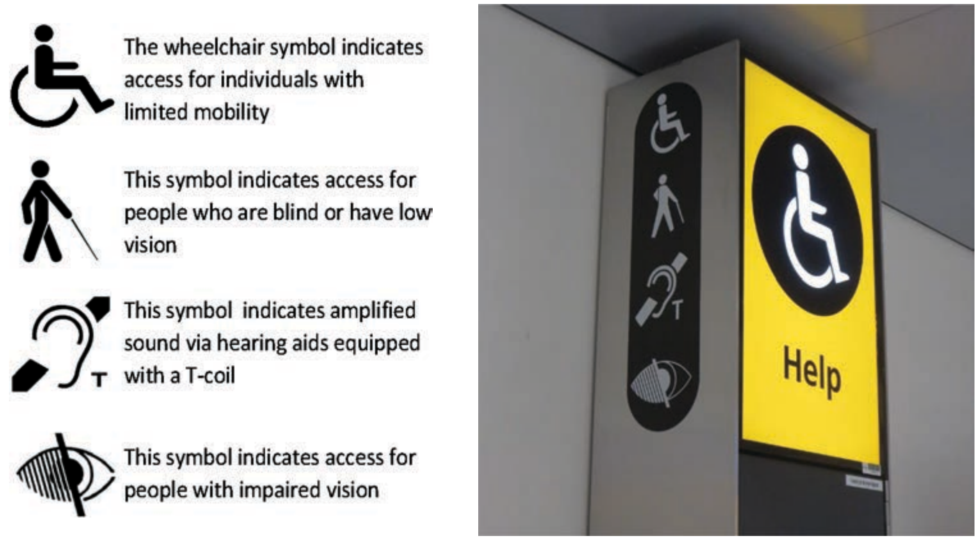
Help/call points can be connected via a range of technologies—VoIP, global system for mobile communications (GSM), integrated services digital network (ISDN), and public switched telephone network (PSTN)—utilizing dedicated or shared infrastructure.

In their simplest form, help/call points present a single, clearly labeled button that, when pressed, rings down to a central location associated with the department or staff that is responsible for offering information or accessibility services. Other configurations may present an interactive screen that allows more choices for requesting the desired information or service. These devices can be fitted with Braille overlays or hearing loops to increase their accessibility and usability for those with vision or hearing disabilities (see Figure 8-5).

Signage and instructions for use should be clear and easy to understand. Screens, handsets, buttons, or other methods of input or interaction should be within easy reach, involve low physical effort, and work intuitively for the user. Identify help points using symbols that indicate the disabilities that the help point serves (see Figure 8-6).

Source: London Gatwick Airport (LGW), Charles de Gaulle Airport (CDG), and Madrid Barajas Airport (MAD)

Figure 8-5. Examples of accessible curbside help/call points at London Gatwick, Charles de Gaulle, and Madrid Airports.



Source: ACRP Project 07-13 Research Team

Figure 8-6. Symbols used to help identify call points for help.

8.5 Interactive Kiosks

8.5.1 Overview

Interactive kiosks are computer terminals utilizing specialized hardware and software that provide self-service access to information and applications (see Figure 8-7). A longtime common amenity in airports, interactive kiosks can reduce interaction times, enhance security, and provide greater convenience for many users. However, as the reliance on kiosks to provide services to the public increases, the importance of providing kiosks that are accessible to people with disabilities increases as well. Both physical design and the user interface of these machines

Source: Dallas Fort Worth (DFW), Dubai (DXB), Pittsburgh (PIT)

Figure 8-7. Interactive kiosks at Dallas Fort Worth International Airport, Dubai International Airport, and Pittsburgh International Airport.

can pose a wide variety of problems for users with various types of disabilities if accessibility features are not implemented correctly.

In general, it appears that most of the accessibility concerns relating to automated public kiosks fall into two broad categories:

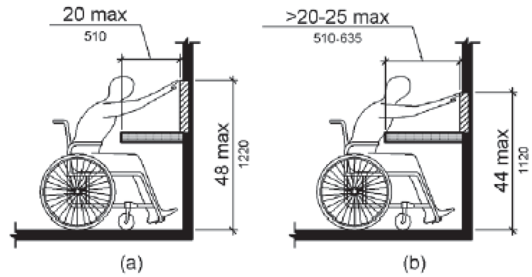
- **Kiosk environment and structure.** This includes the location of the kiosk and providing ease of access for all people, including individuals who use wheelchairs, aging travelers, and people with vision loss. It also covers the physical structure of the kiosk, such as the height and angle of the screen and keyboard, as well as the provision of headphone outputs and in some cases assistive keyboards.
- **Screen interface.** This includes the size and color of the text and buttons on the screen, clear identification of form inputs, the use of language that is easy to understand, and the provision of audio alternatives for all information or functionality conveyed by images or text. In addition, users should be able to increase the amount of time needed to complete a task and be able to review, verify, or revise any transactions.

As part of the U.S. DOT effort to ensure equal access to air transportation for all travelers, it is requiring automated airport kiosks to be accessible to passengers with disabilities. Under the new rule (issued jointly as 14 CFR Part 382/399 and 49 CFR Part 27), automated kiosks installed at U.S. airports for services such as printing boarding passes and baggage tags must be accessible to passengers with disabilities until at least 25 percent of all kiosks at each airport location are accessible. In addition, 25 percent of kiosks at each airport location must be accessible within 10 years. The U.S. DOT will continue to require carriers to ensure equivalent service (e.g., permitting the passenger to go to the front of the line at the ticket counter or providing airline personnel to assist with the kiosk). Carriers and airports must enter an agreement allocating responsibility for meeting the accessibility criteria for joint-use kiosks that carriers own, lease, or control with the airport operator.

With this in mind, airport decision-makers should carefully choose their kiosk vendors and equipment to ensure that the devices utilize principles of universal design to meet the accessibility mandates while providing the access necessary to allow individuals with disabilities to interact independently and use the full range of services without having to ask for assistance.

The ADA states there must be clear accessibility to the kiosk, i.e., enough room so a person in a wheelchair can maneuver to the screen and gain access. ADA Standards require a clear floor or ground space directly in front of the kiosk for persons in wheelchairs that is a minimum of 30 inches by 48 inches. With regard to access to the touch screen and components, the law provides ranges of maximum and minimum height for components with unobstructed and obstructed forward reach and unobstructed and obstructed side reach. “Unobstructed reach” can be defined as a kiosk system that has no large, protruding extension that would prevent or hinder a person interacting with the component. “Obstructed reach” is defined as a kiosk system that would contain a large shelf/counter, and/or have a recessed monitor that would limit access to the component by the user. Front-reach and side-reach access standards as defined in ADA 2010 Standards are the following (see Figures 8-8 and 8-9):

- Front-reach unobstructed access—Minimum of 15 inches from the floor and maximum of 48 inches high from the floor.
- Front-reach obstructed access—Setback of zero to 20 inches with a maximum of 48 inches high from the floor for the component. The law will allow a setback of 25 inches, but the maximum height drops to 44 inches high from the floor.
- Side-reach unobstructed access—Maximum of 48 inches from the floor.
- Side-reach obstructed access—Setback of zero to 10 inches with a maximum of 48 inches from the floor for the component. If the setback is within the range of 10 inches to 24 inches, then the maximum height drops to 44 inches from the floor.



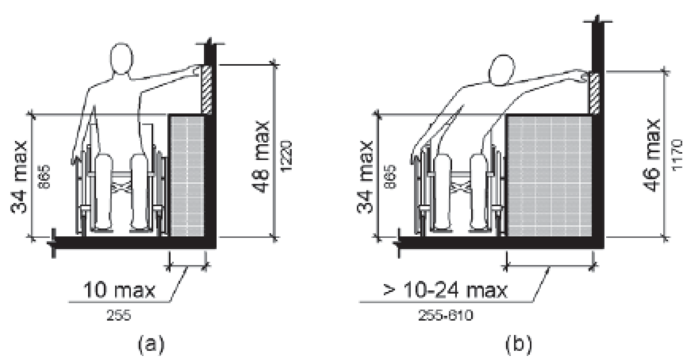
Source: https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/ada-standards/chapter-3-building-blocks

Figure 8-8. Obstructed High Forward Reach.

Placement of components also determines maximum height. A shelf should range from 28 inches to a maximum of 34 inches from the floor (ADA Standards §902.3). This should serve as a good benchmark for input components such as a keyboard, credit-card reader, PIN pad, etc. Additionally, guidance may be necessary for the placement of individual components or functions outside of simple access to the kiosk and its components. For example, if the kiosk has a telephone handset, then ADA specifies the type of handset and functional requirements needed. Likewise, if the application has audio, then ADA defines how to address individuals who are hard of hearing. Lastly, signage elements for components and directions placed on the kiosk will require raised characters and other provisions listed in ADA Chapter 7. These new ADA Standards were adopted by the Department of Justice in September 2010 and went into effect March 15, 2012, replacing the original ADA Standards.

New Section 504 design standards for automated airport kiosks (49 CFR Part 27), while referencing the ADA 2010 Standards mentioned above, include additional detailed requirements with regard to operable parts, privacy, output (speech, captioning, tickets and boarding passes), input (controls, alphabetic keys, numeric keys, function keys, contrast, and tactile symbols), and display screen (visibility, characters, Braille instructions, and biometrics). For example, with regard to visibility, "The display screen must be visible from a point located 40 inches (1015 mm) above the center of the clear floor space in front of the automated kiosk" [§27.71[7](i)].

Designers of any self-contained automated kiosk may also want to refer to the new Section 508 Information and Communication Technology (ICT) Standards and Guidelines published on January 18, 2017 (36 CFR Part 1194) on which the Section 504 requirements are based.



Source: https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/ada-standards/chapter-3-building-blocks

Figure 8-9. Obstructed High Side Reach.

These technical standards touch on additional issues such as control of animation and seizure flash threshold for visual outputs, which the U.S. DOT did not initially include in its requirements for airport automated kiosks.

In summary, as ADA and U.S. DOT standards and rules apply to any kiosk project in the United States, airport operators should work with these governing agencies when designing and implementing interactive, non-transactional wayfinding kiosks. Federal regulatory requirements can be complicated and understanding them and determining how to meet them can be challenging, so it is important that airports conduct proper research to determine whether kiosks meet ADA and Section 504 standards. Airports are encouraged to use the "if then" process for every component and function and to build a matrix to ensure compliance, such as the following:

- If the kiosk uses a touch screen, then the maximum height of the monitor should not exceed 48 inches.
- If using a touch screen, then these (specify) type(s) of touch technologies comply with ADA and Section 504.
- If the kiosk uses a shelf, then the maximum height of the shelf should not exceed 34 inches.
- If the kiosk uses a telephone handset, then the height shall conform to ADA guidelines (ADA, Chapter 3, 308 Reach Ranges) and audio controls must meet guidelines (Chapter 7, 704 Telephones).

The process of understanding ADA and Section 504 requirements can be overwhelming, but with proper research and planning, compliance with federal standards can be accomplished.

8.5.2 Application

While there are a multitude of interactive kiosk airport applications, this discussion will focus on informational/wayfinding kiosks.

Interactive wayfinding takes traditional wayfinding to an entirely new level, integrating technologies such as touch screens, radio frequency identification (RFID), and barcode scanners. Touch screens have enabled a whole new level of self service, allowing travelers to independently select a destination from a map or list and have the system create a map to the endpoint, factoring in things such as multiple floors, multiple regions, and multiple buildings. Additionally, some software solutions that power interactive wayfinding kiosks use conditional formatting and are able to react to things such as elevator operation times or conditions, making the system choose an appropriate route based on current conditions.

8.5.3 Components

Common kiosk components include the following:

- **Touch monitor.** A touch monitor consists of a touch-sensitive transparent screen placed over a cathode ray tube (CRT) monitor or flat panel display monitor. Pictures or text on the screen instruct users to select or "touch" an option. Touch monitors are used in approximately 75 percent of all kiosk installations because of their ease of use, durability, and reliability.
- **Enclosure.** Whether it's a compact wall unit or a stand-alone installation, every kiosk must have an enclosure, and it must be made of sturdy, durable materials designed to withstand abuse. Typically, kiosk enclosures are made of metal, but wood, plastic, or fiberglass may also be used. The kiosk location (indoor versus outdoor, for example) and type of installation (stand-alone, wall-mounted, or tabletop) help to determine the type of enclosure that is needed.
- **Application software.** The kiosk's software application must attract users to the kiosk, accomplish the kiosk's stated objectives, be easy to use, and incorporate built-in reporting

mechanisms that provide feedback about which parts of the application are used, how long users stay at the kiosk, and other data. Many kiosk developers are using their website as the basis for their kiosk application.

- **Computer.** The kiosk application's requirements determine the computer hardware requirements. At a minimum, a kiosk computer should support full-motion video, digital audio, and network connectivity.
- **Printer.** The kind of printer a kiosk needs depends on the kiosk's function. Kiosks most often use printers to print receipts, tickets, boarding passes, luggage tags, maps, and product information.
- **Infrastructure.** In addition to the components listed above, a kiosk hardware deployment will also require the related facilities infrastructure to provide power and communications to the device. This would normally include a dedicated electrical outlet with the associated conduit and wiring back to a distribution panel in a nearby electrical room. Data connectivity for the kiosk is normally a cabled connection back to a nearby telecommunications room or data closet. In some cases, depending on the use and owner of the kiosk system, this can be an airline-owned and -maintained network or, as is becoming more common, an airport-owned and -maintained network infrastructure.
- **Database.** A database is defined as an organized collection of data that supports processes requiring information. In a digital signage database, this can consist of links to text, images, connections to other databases, etc. Common links required for a successful interactive program are to the airport's Airport Operational Database (AODB) and to a flight information aggregator.

8.5.4 Implementation

There are two types of implementation when deploying a digital interactive program: physical and logical deployment. The kiosks must be physically located where they get good passenger traffic yet don't cause backups. Secondly, building and implementing the signage content requires a background in database knowledge and how an airport database operates in order to produce the data flow required for an interactive display.

8.5.4.1 Physical

Location and convenience are key factors when determining placement of kiosks in any planned deployment. The primary purpose of self-service kiosks is convenience, but if the kiosk isn't placed in a convenient location, the kiosk inherently is no longer convenient. If a kiosk is placed in an out-of-the-way location or consistently has long lines, then consumers will naturally look for a more convenient option. The main aspects to be considered in the placement of kiosks are visibility, accessibility and movement of passenger traffic, and comfort and privacy of the passenger.

Kiosks should be designed with functionality that eliminates or minimizes barriers to use for people with disabilities and mature users with age-related limitations. Ideally, interactive kiosks will

- Provide accessibility features for people with disabilities.
- Support interfaces commonly used by screen readers.
- Allow operation using only the keyboard.
- Allow the user to request more time to complete timed responses.
- Support customization of display attributes such as color, contrast, and font size.
- Communicate all information independently of color.
- Support interfaces commonly used by screen magnifiers.

- Provide documentation in an accessible format.
- Support alternatives to audio information.
- Support adjustable volume control.

8.5.4.2 Logical

In order to build and deploy dynamic content for an interactive directory, a network of data repositories must exist to store the information and make the kiosks operate according to their design. Because of the level of personalized information delivered to the passenger, many forms of data acquisition must occur. In this acquisition process, it is better to replicate information than to duplicate it. Utilizing airport resources, such as the AODB, and storing assets specific to the interactive directory at a separate location create a clean and highly responsive interactive kiosk.

An AODB is a relational database that serves as a central repository and translator for all essential airport information systems in a real-time environment. The AODB streamlines and minimizes data entry, increases operational effectiveness, and ensures accuracy by cross-referencing information between various systems. The system increases overall efficiency and performance of operations by providing historical and real-time airport information and compiling the information into a single database. While each airport's use is unique, the AODB processes tasks and data for the support of various users in three main categories: aircraft, passengers, and resource management.

In the category of aircraft, the AODB processes tasks and data for

- Air traffic control systems
- Slot assignment systems
- Resource allocation systems
- Aeronautical fixed telecommunications network
- Seasonal flight scheduling
- Daily flight schedule processing

In the category of passengers, the AODB processes tasks and data for

- FIDSs
- GIDSs
- BIDSs

In the category of resource management, the AODB processes tasks and data for

- Property management
- Baggage handling systems
- Check-in and gate resource allocation
- Billing
- Reporting

A relational database is used to organize data into tables of columns and rows in order to compare and make logical connections between the data in the form of queries to complete a task, whether it be for billing an airline for time spent at a jet bridge or charging a concession rent for occupying a space. All the "individual" tables relate to one another and are used for scheduling, reporting, and/or billing.

A typical AODB for a mid- or large-sized airport can be complex and cumbersome, which leads to maintenance difficulties. The AODB drives production of information for airport operations and therefore is an important asset to preserve and to maintain. Maintaining an acceptable operating size is important for the health of the database and operation of the facility.

Because of the critical nature of an AODB and the impact it has on the airport's operation, it is not an ideal location in which to store the assets and information required for a digital passenger wayfinding and information system. Depending on the size of the facility and program, a digital signage database (DSDB) can become complex enough on its own. Once established, the CMS can query the AODB as a data source and extract data from specific tables, at specific times, without the need to store that data long term. One example is boarding/flight information data. If a passenger has the ability to input information about their upcoming flight, the CMS will process this information and, through a data source connection to the AODB, be able to obtain and display the information requested, omitting the need to store that information locally in the DSDB.

A DSDB structure will vary among applications, but on the most basic level it will consist of data with some type of meaning stored within a table. Whether these data are a universal naming convention path linking to a multimedia asset or plain text, they are simply data. Metadata are what gives these data meaning. Metadata loosely means "data about data" and is defined as structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource.

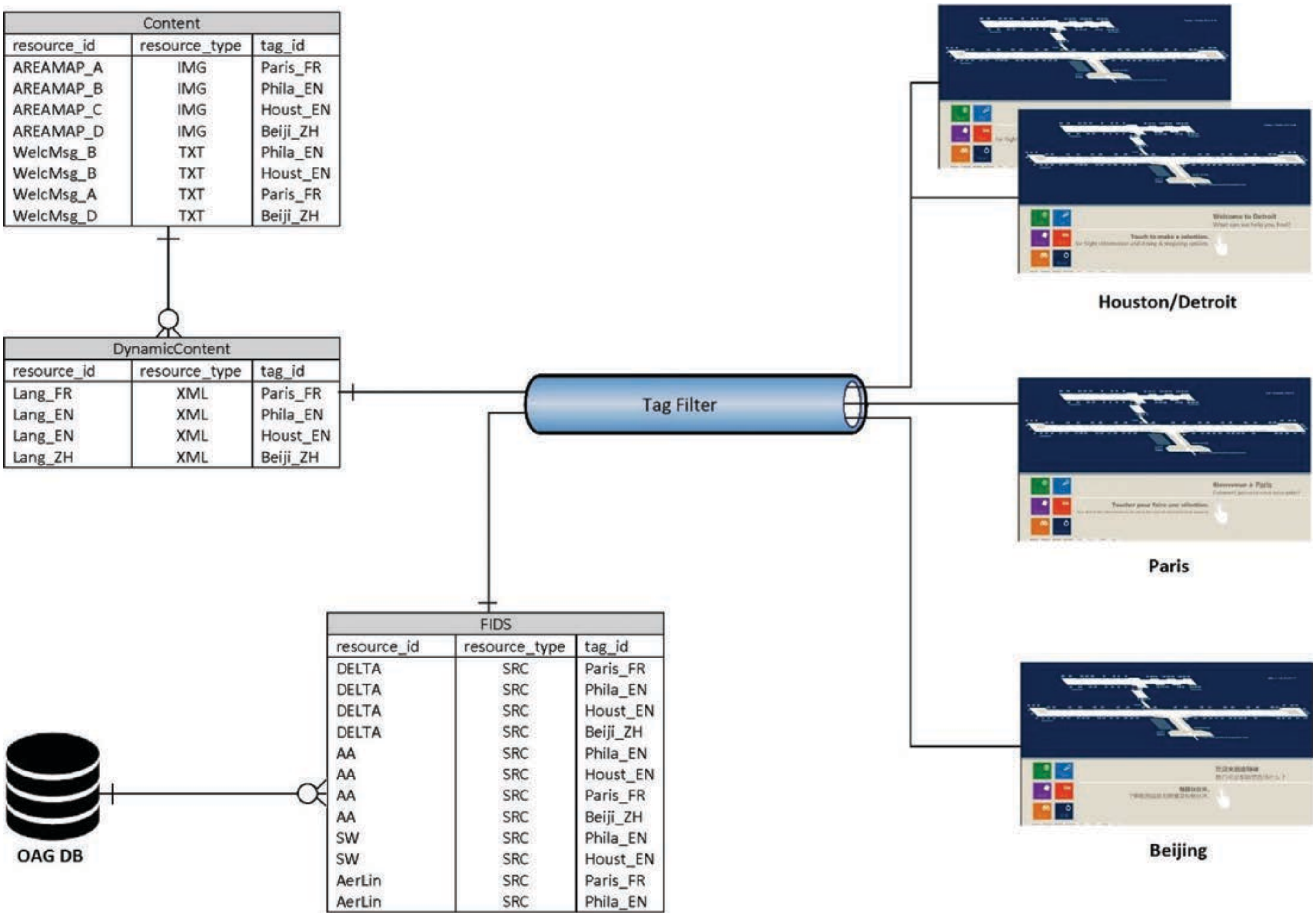
An example of metadata can be drawn from a streaming music service. A listener can enter an artist's name or a music genre and a song that fits that description plays. When that song completes, another song fitting the provided description will play after that and so on. The song is the data and the information the listener enters is metadata (and the service matches the metadata of one song to another using an algorithm to create a playlist) that populates an array of songs—or data—that the listener will enjoy.

Traditionally, the primary usage of metadata in a digital signage environment is for playlist or channel assignment, typically in an enterprise deployment. Organizations with multiple sign deployments clustered across the United States or worldwide can take advantage of doing content updates based on region or organization type. Parameters are assigned linking content to a region and updated automatically, saving the content developer from having to assign specific content to each individual location.

Figure 8-10 shows an example of relational tables in a fictional DSDB. Each table stores a piece of data, whether image, text, or link to another database with a metadata tag. This tag defines the location of the display where that particular content is destined to go. The tag filter represents how the CMS scheduling tool correctly routes each piece of content to the proper display.

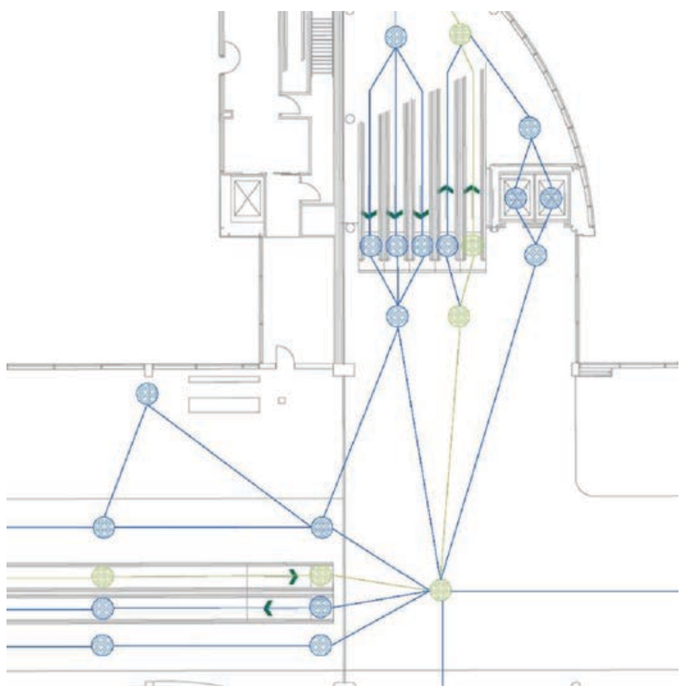
On a more granular level, the use of metadata in a database can help turn a static wayfinding display into an intelligent wayfinding tool, much like streaming music providers use metadata to create playlists. Instead of metadata being used to separate displays by region, it can be used within a database as an associative trigger.

Through the use of metadata, an asset like an escalator can become a tool to direct passengers. As illustrated in Figure 8-11, the passenger is being directed to use the closest escalator as a means to transition to the level below via breadcrumb-trail-style navigation. By correlating the last "breadcrumb" at a decision-making point with the status of the escalator/elevator, the filter will direct the passenger to use whichever vertical transportation option is in an "on" state. During a maintenance event when an escalator may be shut down, the status converts to an "off" state, and will direct a passenger to a different vertical transportation option (see Figure 8-12). This same principle can be applied to a passenger requiring special accommodations. By indicating in the CMS that the passenger requires a wheelchair-accessible route, the system will analyze the metadata associated with each vertical transportation option and select the proper route. This type of system would need some type of human-machine interface (HMI) device at the display so that the passenger is able to interact and the CMS can offer a solution. Typically, an interactive or touch screen is the most common HMI for this application.



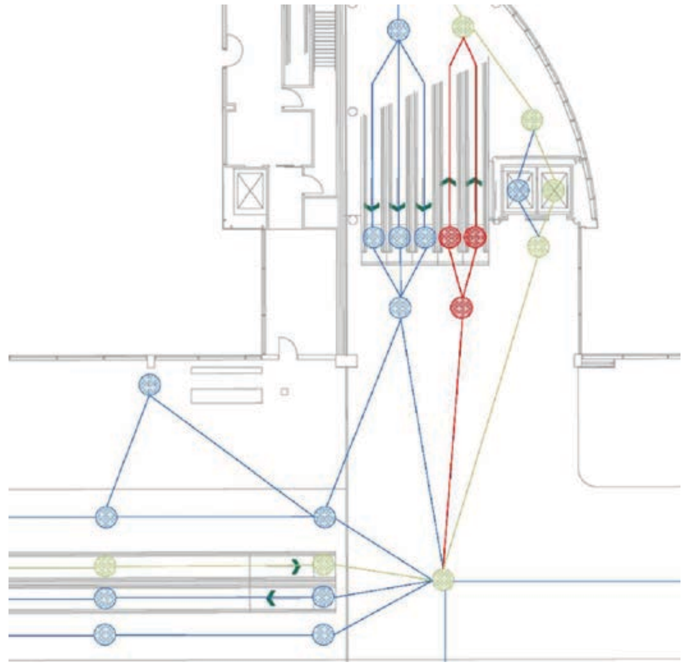
Source: ACRP Project 07-13 Research Team

Figure 8-10. Database interconnectivity diagram using metadata.



Source: ACRP Project 07-13 Research Team

Figure 8-11. Depiction of route programming in a CMS with operational escalators.

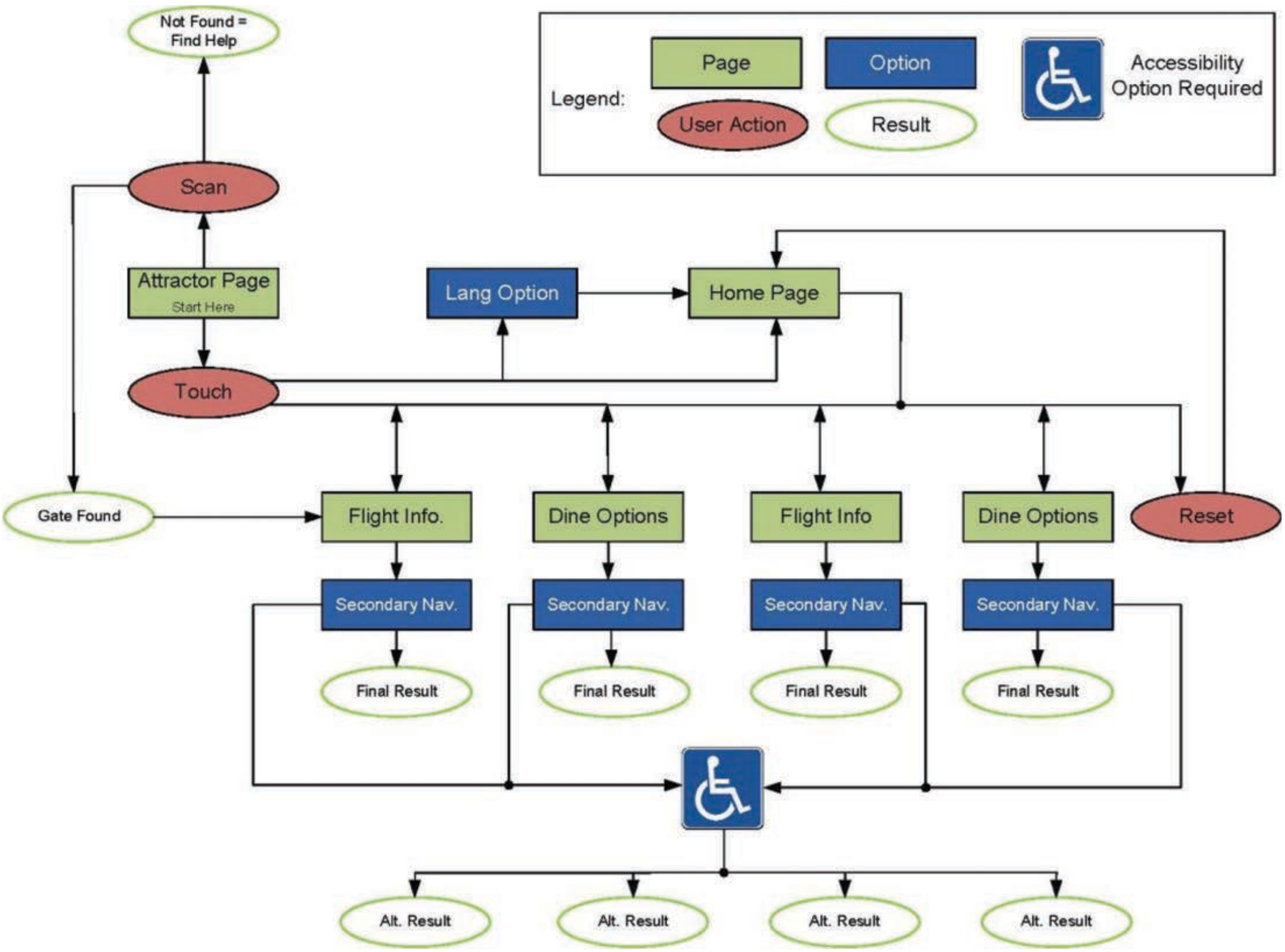


Source: ACRP Project 07-13 Research Team

Figure 8-12. Depiction of route programming in a CMS with escalators out of order or an alternate route request. Passenger is rerouted to the elevators.

A data flow diagram is a visual representation of the method by which data are delivered to a passenger through a graphical interface. Typically, a similarly designed system requires an input device through which a passenger offers the system information in order for it to provide a customized response. That information can be a gate number, flight number, or a particular location they are seeking. The system can then offer the best way to get to a gate or other location, as well as walk times and operating hours (if applicable). If the passenger enters accessibility requirement information into the system, such as the need for an elevator to transverse levels, the system can account for this and automatically redirect. This capability was illustrated previously with the breadcrumb trails. Alternately, other accommodations can be dispatched to the passenger's location, such as airport wheelchair services, airport police, or general assistance. Integrating a voice communication system allows a passenger to speak to airport staff if the visual communication system is not helpful.

Figure 8-13 shows a database integration and data flow diagram. This data flow diagram takes into consideration that the display is touch-integrated, and there is a device that allows the passenger to scan their boarding pass. If the DSDB is programmed to communicate with a flight information aggregator such as OAG, once the user's flight number/destination is inserted or scanned, the DSDB can query the OAG database and instantly provide that passenger with personalized information about their trip. Once the flight information is found, the passenger is able to see where their gate is on a map and watch the system draw a line to the gate, indicating the best way to get there and how long it will take to walk or if they need to request assistance. Indicating shopping and dining options along the way provides yet another valuable service to passengers.



Source: ACRP Project 07-13 Research Team

Figure 8-13. Example of a data flow diagram for an interactive display with a boarding pass scanner.

8.6 Digital Wayfinding Directories

8.6.1 Overview

Digital signage is the management and delivery of digital video, audio, and information through a network to display devices to attract or reach a captive audience.

The term "digital wayfinding directory" refers to any network of displays, usually LCD or LED screens, which display static, dynamic, or interactive content utilized to assist a traveler in the process of navigating their way through a built environment (see Figure 8-14).

Digital wayfinding signage is quickly emerging as an efficient way of enhancing the travel experience from the customer's point of view, providing them with helpful maps, directions, and information to assist them as they navigate through the airport. This use of digital technology can greatly reduce the traveler's stress and frustration, as well as save them time, while making the process of assisting travelers easier for airport and airline employees. Airports have discovered

Source: ACRP Project 07-13 Research Team

Figure 8-14. Digital wayfinding signage at Boston Logan International Airport.

that the travel experience can be greatly improved through the use of digital wayfinding signage (Slawsky December 30, 2010).

Fortunately, wayfinding systems have grown and improved significantly over the past few years. Design professionals and assistive technology specialists have found an increasing number of ways to combine different types of environmental "cues" to enhance wayfinding for people with disabilities.

The result of these improvements is not only better wayfinding for people who are blind or have mobility limitations, but better wayfinding for a wide range of populations including aging travelers, people with learning or cognitive disabilities, and non-English speakers. The principles behind wayfinding systems for the general population and for people with disabilities are becoming integrated into a universal design model, one in which the focus of design is how to use combined systems to support and enhance wayfinding for everyone (Brinkhoff 2016).

8.6.2 Application

There are three types of digital wayfinding signage:

1. **Static.** Static digital wayfinding signs include maps or simple directions with words and arrows. There's no way for a person to necessarily "request" routes or other specific information, but components like color, graphics, feeds, and animation can make these maps much more engaging and informative than a print sign.
2. **Dynamic.** Dynamic digital wayfinding signage is a little more in-depth. It can provide realistic views of locations with multiple stories or levels and can also change based on database updates. These signs can highlight specific locations that correspond with a directory listing displayed on screen to allow travelers to easily identify where they are and where they need to go.
3. **Interactive.** Interactive digital wayfinding signage actually allows the traveler to request specific information. Using a touch-screen display, travelers can enter their current location and where they want to go, and the sign will give step-by-step directions and even graphically show the path on a digital map.

Recent technological developments allow for mobile integration. Any device that can be connected to the internet (i.e., smartphones and tablets) can be synced to the signage system, and the viewers can send a request to the signage via text. Specific step-by-step directions can then be sent to the mobile device by text or email. This can be also done with QR (quick response) codes, where the viewer scans the code with their mobile device to get access to maps and directories (*mediaPanel* July 28 2015).

8.6.3 Components

The digital wayfinding signage network is made up of six major components:

1. **Content.** Content represents the maps, directories, messaging, and information to be delivered. It may include pre-recorded information, news feeds, or even advertising.
2. **Servers.** Servers are the computers where content is stored, managed, and distributed to players via a network.
3. **Content management software.** This is specialized software used to schedule the delivery and play of the content at multiple devices, as well as to monitor performance and track and report on the execution of the scheduled events. Most content management software also includes authoring features, and most include screen formatting and production capability for screen crawlers and other information feeds.
4. **Distribution network.** The distribution network provides the delivery and feedback infrastructure to pass information to and from the display locations. The network can take multiple forms; for example, it could be internet, LAN, WAN, or wireless.
5. **Media players.** Players are typically personal computers or special purpose media personal computers used to store and deliver content to the display devices on the defined timetable.
6. **Display devices.** These may be LCD, LED, or plasma displays, kiosks or CRT devices. The displays may be touch screen or have touch overlays to provide touch-interactive wayfinding. There is no "one size fits all" with digital signage.

Effectively assembling the components into a working digital signage network requires an audio/video and systems integrator who understands the available products and how to design and integrate them to meet customers' particular needs.

8.6.4 Implementation

Implementing airport information technology systems should involve four major integrated processes—planning, design, construction, and commissioning (Airport Consultants Council January 2012).

The main steps involved in creating and deploying digital wayfinding signage are

- Identify goals, including what other information wayfinding should provide or link to.
- Decide whether interactive or non-interactive signage is wanted.
- Do the maps.
- Determine what other informational or promotional content will be used.
- Decide where to position wayfinding displays. Likely locations include high-traffic areas, such as entrances and exits; doors and reception areas; and major branch points like lobbies and elevator/stair/escalator areas.
- Determine structural requirements for installation of the displays and the chosen mounting method. Ensure that final installation will meet ADA compliance or other accessibility requirements.
- Determine power and data requirements for the chosen display configuration and how to provide the needed infrastructure (conduits, cabling, etc.) at the designated locations.

- Implement the physical hardware and perform thorough testing to confirm operation.
- Maintain the databases (Dern November 4, 2013).

Implementing a digital signage network can be a complex undertaking. A major difficulty is that it requires multiple, diverse skills and capabilities. Content providers, who are typically marketing or advertising agencies, don't normally understand information technology (IT), networking, and professional audio/video (A/V) technologies. IT professionals don't usually understand content or professional A/V technologies. And professional A/V system integrators don't typically understand content creation. These diverse areas of expertise need to be assembled into a working team to achieve success. Partner integration and project management skills are needed to establish the structure and communications necessary for creative, effective, and efficient execution of the project. It's a production, and the producer is critical to the success of the project.

Once a decision has been made to install digital signage, a multidisciplinary team must be assembled. One entity must assume the role of project integrator. This company or individual will be responsible for bringing together the necessary partners and resources at the right time to make the project successful. The project integrator will coordinate initial activities, such as defining goals, budgets, needs analysis, bids and contracts, and project milestone schedules. Once the project is underway, the project integrator will manage the project and coordinate messaging, content development, IT requirements, software selection and training, selection and procurement of hardware and display devices, and system integration and installation.

Digital wayfinding signage projects go through a phased development process. The major phases are described briefly below. Large implementations will normally be broken down into a pilot test project and then refined prior to a larger scale rollout. The pilot process is used to obtain customer feedback and confirmation of design and functional intent before rolling out on a large scale.

8.6.4.1 Phase 1—Needs Analysis and Consultation

The work done in this phase pays for itself several times over in later phases by preventing mistakes and miscommunication of desired results. The needs analysis is an evaluation and planning phase. Client needs are identified and documented through an extensive, formal needs analysis. Goals and objectives are defined at this time and preliminary budgets are developed to ensure that all involved clearly understand the scope and financial investment required to be successful. The important point is to be sure to set goals to accomplish before beginning. Here are some possible objectives for a digital wayfinding signage project:

- Improve user experience
- Provide interactive user experience
- Provide user self service
- Communicate with users
- Improve efficiency by central updating and distribution of information.

It's important to define the project success metrics so that provisions can be made to capture the necessary performance data during the implementation phase. Site surveys can be conducted to determine traffic patterns, utility connections, internet accessibility, sight lines, site lighting, ambient light and noise conditions, as well as display locations and types.

8.6.4.2 Phase 2—Design

The design phase consists of two parts:

1. Technical design, which includes the architecture and specification of servers, content management software, distribution network, and display components of the system. Technical

design will also include how to accommodate merchandising or real-time features associated with the network.

2. Content development, which includes developing the video and audio messages as well as branding and entertainment or information features. Content is the single most important factor in the success of a digital signage program. Conduct an inventory of current digital assets from advertising, website, and product videos to see what is usable and what can be repurposed. Factors such as viewer attention span, directed audio, interactive information, and location-specific factors all need to be considered. In addition, data from inventory and POS systems may also be used to provide near real-time merchandising and promotion.

As mentioned in Section 8.2.2, WCAG 2.0 define how to make digital content more accessible to people with disabilities. Accessibility involves a wide range of disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities. Although these guidelines are geared specifically toward web content, any information displayed digitally should be designed with consideration of these guidelines that focus on contrast and text sizes for individuals with disabilities.

People with low vision may not see digital images in the same way as other people. Some see only small portions of a display at one time. Others cannot see text or images that are too small. Additionally, others can only see digital content if it appears in specific colors. For these reasons, many people with low vision require high contrast between background and text and specific colors and fonts. For example, many people with low vision need to use high-contrast settings, such as bold white or yellow letters on a black background. Others need just the opposite—bold, black text on a white or yellow background, while some must use softer, more subtle color combinations. WCAG 2.0 require that foreground and background colors have a minimum 4.5:1 contrast ratio, which ensures that text color is significantly different from the background color for clarity.

The Detroit Metropolitan Airport launched a digital signage program in 2015 in which forty-six 84-inch displays, two 98-inch displays with boarding pass scanners, and four 55-inch interactive kiosks with boarding pass scanners were installed to replace the legacy printed maps that had been scattered throughout the airport. There was a focused effort to create new maps utilizing the existing color scheme but in such a way as to maximize contrast while presenting an aesthetically pleasing product. Following the basic standards described in WCAG, the creative team decided to use a dark blue background, a flat, white-color map, and bright colors to indicate the "You Are Here" marker and separate shopping, dining, and ground transportation services.

The large size of the displays allows a passenger in the back of a group of people to adequately see the display, and, if they cannot, there is another one only a few yards away. Prior to launching the program, all the content was developed and vetted through a passenger survey program where feedback, including color scheme, visual acuity, and content were analyzed by passengers from all demographics. Figure 8-15 shows an example of digital static display content developed with visually appealing color for contrast and categorization. All the content is stored in the CMS's digital signage database with an API for the signage administrator to easily make quick content changes and updates.

8.6.4.3 Phase 3—Integration and Implementation

The integration phase is really when all the work comes together in the commissioning and operation of the digital wayfinding signage network. System components are integrated and tested and then installed in the field. Determine whether or not to contract the content scheduling, content deployment and system operation with a network operating center or host it in-house. If it is in-house, staff should be trained in content scheduling and system operations.

Source: Detroit Metropolitan Airport

Figure 8-15. Digital static directory display.

In a large-scale system deployment, the initial implementation will be a pilot project in one or more representative locations. The pilot is tightly managed and controlled so that maximum learning can occur and be incorporated as the system is refined and rolled out on a larger scale later. Both the system and the messaging will be tested. As the system is implemented, information from sources such as sales data by time period and customer surveys regarding impressions and buying habits should be actively collected.

8.6.4.4 Phase 4—Measurement, Evaluation, and Rollout

Each day of operations yields data and new insights that are refined into the rollout strategy and plan. The measurements made during the implementation of the pilot project are used to project the expected impact of the rollout on the organization as a whole. Measurements in areas such as sales increase by time period, cross sells, operations improvement, customer satisfaction, brand awareness and customer experience can all be measured to evaluate the previously established return on investment (ROI) and justify continued deployment. While the initial implementation is underway, the planning for the longer term rollout can be initiated. Operations, service, and training plans are developed for the rollout. Finally, as all are prepared, the actual rollout plan is implemented. The same process of needs analysis, design, content development, and implementation is continued as the system is continually refined and refreshed.

8.6.4.5 Conclusion

The potential benefits from a full-scale digital wayfinding signage implementation are measurable and significant (see Figures 8-16 and 8-17). The design and implementation of a digital wayfinding signage network is complex and requires the participation of a team of partners with

Source: San Francisco International Airport

Figure 8-16. Digital wayfinding signage at San Francisco International Airport.

multiple and diverse skill sets. The required commitment is also significant. Having a solid, well-thought-out plan, with quantifiable objectives and an understanding of how ROI can be obtained and measured is a good starting place (CDS Office Technologies 2011).

8.7 FIDS

8.7.1 Overview

The display of flight information is extremely important for an airport. Without the right flight information, passengers don't know where to go and when their flight will depart. Visitors are uncertain about the arrival time of their relatives, and airport personnel are not informed about internal flight details.

Source: St. Louis International Airport

Figure 8-17. Digital wayfinding signage.

For an airport, it's crucial that people are informed with flight information that is both accurate and up-to-date. To achieve this, nearly every airport nowadays has a FIDS.

Some airports have special variants of a FIDS like a BIDS or a GIDS. Other airports use a generic term like passenger information display system to indicate their system. There are also airports where major airlines have their own FIDSs.

FIDSs are ideal for all aspects of information presentation at the airport by providing travelers with relevant information that's timely, accurate, and easy to understand.

A FIDS can be customized to serve a number of specific functions, including:

- Displaying the most up-to-date flight status information available including delays/cancellations.
- Directing travelers to the correct gate and hold room area.
- Providing security information and instructions.
- Displaying weather/traffic so travelers can plan ahead.
- Directing travelers to parking facilities, ground transportation centers, and car rentals.
- Promoting other airport or hotel services on the same screen with the flight information.
- Displaying visual pages.
- Displaying emergency notifications and instructions.

Last-minute gate changes can be confusing for all travelers, especially the aging travelers and persons with disabilities. These customers need to be promptly addressed with a triggered visual page displayed on the FIDS and GIDS and an associated auto-triggered audio page to alert them of the flight information changes.

8.7.2 Application

The FIDS screens are usually professional, intelligent monitors in portrait or landscape orientation with a built-in or attached appliance.

FIDSs could be improved at many airports. Location, position, height, and angle can make accessing information difficult. Glare caused by nearby light sources, poor contrast, and small font sizes can make them unreadable.

Providing access to users with disabilities is not just a good idea, it's fast becoming the law. Making a few adjustments and adhering to most of these guidelines will help all users:

- Ensure that text is easily visible at a reasonable distance from the sign.
- Always ensure that text colors have high contrast with the background color.
- Avoid dark backgrounds with neon colors and white characters.

8.7.3 Components

The FIDS is a key component of the airport's integrated operational systems and is directly connected to the AODB and resource management. The closely coupled system allows for the automated display of critical information to those who need it, when they need it, with little or no manual intervention.

The FIDS design is composed of a control center, distribution servers, input terminals, and display technology. The FIDS control center is responsible for storing, processing, and transferring all data (flight and general information). The processed information is sent by the FIDS via a LAN to the connected distribution servers. This is performed in real time in order to ensure that the users of display media are supplied with high-quality, consistent information. This information is then processed and transferred to the corresponding display devices by the distribution server.

The most visible part of a FIDS is the digital screens found all around an airport terminal—overview screens in the arrival and departure hall, screens above the check-in counters, and screens at the gates and baggage belts. Ideally, every place where a passenger is expected to make a decision or to look for information should have one or more screens.

The FIDS communicates and supports most any type of display device, such as CRT monitors, LCD flat panels, plasma displays, split flap boards, and LED signage.

8.7.4 Implementation

For text displayed on a FIDS, keep font sizes large, especially for main messages. To test size, create a test screen with lines of different font sizes and have people view the screen at the farthest practical distance. Remember, too, that people may view the screen as they pass by. The exception to this would be screens meant for interaction, where the user is standing directly in front of the sign. Even in this case, however, keep in mind viewers with older eyes or low vision. As a general rule of thumb, text height should be 1 inch in size for every 10 feet of distance from the screen.

Serif fonts work well for long text passages, but digital signs are the wrong medium for paragraphs of text. It's best usually to stick with sans-serif fonts.

The ADA specifies requirements for signage, but it does not specifically address digital signage. It not only specifies requirements for the visual aspects of signage, but also the implementation of Braille and audio to address the needs of individuals who are deaf or blind or have other disabilities. The language of the requirements is detailed and complicated. It continues to be updated and is likely to address the specifics of digital signage in the near future.

There is a table within the ADA Standards that dictates visual character height for accessible communication elements. These guidelines can also be used as a baseline for digital signage (see Table 8-2).

Table 8-2. Visual character height.

Height to Finish Floor or Ground from Baseline of Character	Horizontal Viewing Distance	Minimum Character Height
40 inches (1015 mm) to less than or equal to 70 inches (1780 mm)	less than 72 inches (1830 mm)	5/8 inch (16 mm)
	72 inches (1830 mm) and greater	5/8 inch (16 mm), plus 1/8 inch (3.2 mm) per foot (305 mm) of viewing distance above 72 inches (1830 mm)
greater than 70 inches (1780 mm) to less than or equal to 120 inches (3050 mm)	less than 180 inches (4570 mm)	2 inches (51 mm)
	180 inches (4570 mm) and greater	2 inches (51 mm), plus 1/8 inch (3.2 mm) per foot (305 mm) of viewing distance above 180 inches (4570 mm)
greater than 120 inches (3050 mm)	less than 21 feet (6400 mm) and greater)	3 inches (75 mm)
	21 feet (6400 mm) and greater	3 inches, plus 1/8 inch (3.2 mm) per foot (305 mm) of viewing distance above 21 feet (6400 mm)

Source: United States Access Board 2010, Table 703.5.5. Visual Character Height.

Digital signage placement is just as important as the relevance of content on the screen because a screen that is placed where it cannot be viewed is ineffective. Signage placement decisions involve a number of factors like size and positioning of the screen, layout of the establishment, and the height of potential viewers.

The intent in establishing best practices for screen placement is to place screens where targeted audiences will be able to view them. To determine the best practice for screen placement, one must understand the geometry of angular relationships and how things are viewed.

Where a screen is placed and the angle at which it addresses its viewing audience, can be almost as important as the content playing on screen, and the optimal angle and placement is different for virtually everyone. This makes it difficult for store planners and venue owners preparing for a digital signage deployment.

8.7.4.1 The Screen

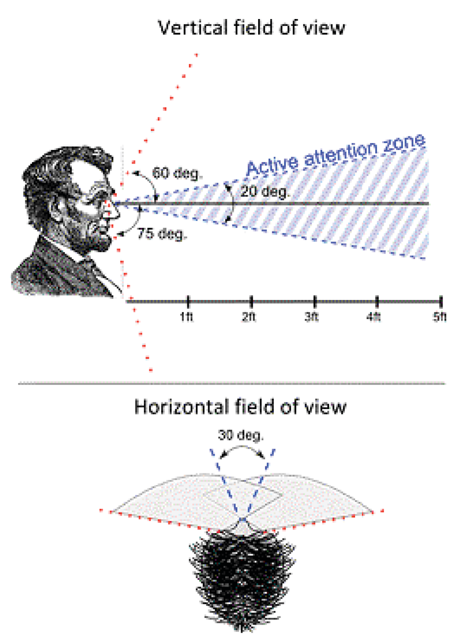
Studies point to three aspects of viewing angles that apply to digital screens:

- Angle of the screen—the angle at which the screen is positioned.
- Angle of incidence—the angle that a viewer's head has to turn to see the sign.
- Correction angle—the angle at which a screen is positioned to compensate for other objects that may prevent a viewer from seeing the screen.

8.7.4.2 The Viewer

The following are characteristics of vision for an individual:

- Field of view—the typical angle of view of a person with normal vision (see Figure 8-18).
- Line of sight—for a person of normal vision, direct line of sight is the straight line that extends from a point at the nose as centered between the eyes.
- Vertical view—the viewing area that extends about 60 degrees above and 75 degrees below the line of sight.
- Horizontal view—the viewing area that extends about 90 degrees to the left and 90 degrees to the right of the line of sight.



Source: ACRP Project 07-13 Research Team

Figure 8-18. Field of view.

Table 8-3. Optimal screen heights.

Distance Away (feet)	Optimal Height (feet)
5	1.82
10	3.64
20	7.28

Source: Media Sign Pro

- Attention zone—the viewing area that extends 20 degrees vertically and 30 degrees horizontally about the line of sight.

The geometry of angular distances dictates that in order for a screen that is placed 20 feet away from a viewer to fall within the viewer's attention zone, the screen has to be placed at a height that is within 7.28 feet of eye level of the viewer. The height is calculated as follows:

$$\text{height (h)} = \tan(\text{angle of attention zone}) * \text{distance away} = \tan(20\text{ degrees}) * 20\text{ feet}$$
$$= 0.364 * 20 = 7.28$$

Optimal heights for screens placed 5, 10, and 20 feet away from a viewer are shown in Table 8-3. If the average viewer is presumed to be 5 feet, 8 inches tall, then signage would ideally have to be less than (5.8 + 7.28) 13 feet off the floor in order to fall within the average viewer's attention zone.

Efforts to situate signage displays in the best position relative to viewers and traffic patterns have to take into consideration the realities of facility layouts. Layouts include fixtures, spacing, lighting, and other distractions that capture a viewer's attention or distort a viewer's view.

8.8 Hearing Loops

8.8.1 Overview

A hearing loop is a wire (induction loop) that circles a room and is connected to a sound system. The loop transmits sound electromagnetically. The electromagnetic signal can then be picked up by a tele-coil in a hearing aid or cochlear implant.

In many countries, induction loops are already the standard solution for helping people who are hard of hearing to gain fair access, and these devices can be found installed in most public environments.

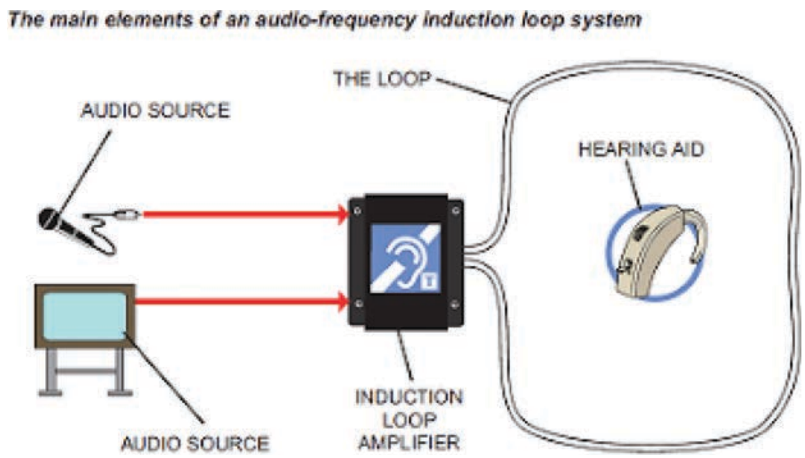
8.8.2 Application

To use a hearing loop, the t-switch on the hearing aid or cochlear implant must be flipped on to activate the tele-coil. Usually, no additional receiver or equipment is needed. Using a tele-coil and hearing loop together is seamless, cost-effective, and unobtrusive and no additional equipment is needed. Hearing loops are also called audio-induction loops, audio loops, or loops. If a hearing aid doesn't have a tele-coil, a headset plugged into a loop receiver will be needed to achieve the same effect.

8.8.3 Components

An audio-induction loop system consists of four parts (see Figure 8-19):

1. One or more sound sources—the sounds that a person would want to listen to directly, for example, your television, hi-fi system, computer, telephone, a microphone, or alerts such as a doorbell or fire alarm.



Source: www.c-tek.uk

Figure 8-19. Typical hearing loop system.

2. An induction loop amplifier—a special amplifier that is connected to the various sound sources and amplifies the sound as an electrical signal into a loop.
3. A wire loop—a loop connected to the induction loop amplifier, which goes around the area in which the system will be used—for example, around the outside edge of a room, or around a small area such as a chair or sofa. The loop transmits the sound as a completely safe and invisible magnetic field in the area above the loop.
4. Receivers, usually hearing aids—a small coil picks up the sounds broadcast through the loop. Coils—sometimes known as "T-coils" or "tele-coils"—are often found within hearing aids, either with a small switch marked "T" or automatically switching when a signal is sensed by the device.

Once an induction loop system has been installed and set up, it should require no attention, adjustment, or maintenance. At any time, a user can switch their hearing aids or use their receivers to hear the sounds being broadcast into the loop system.

8.8.4 Implementation

Implementation of a hearing loop involves installing the amplifier and the loop:

- **Installing the amplifier.** Find a suitable location for the amplifier at which there is access to power, to cables from the sound sources, and for the loop cable.
- **Installing the loop.** A room loop is a loop of wire usually placed around the wall or skirting board around the edge of the room. A wire can also be used around a smaller area underneath carpet or a rug or under the floor in larger spaces such as airports. Because the wire can be installed under a floor, an airport may plan to make the installation when it installs new terrazzo floors. The loop must cover the whole area in which the user needs to hear the sound from the induction loop.

Signage should also be installed to notify users that hearing loops are available at the airport (see Figure 8-20).

8.9 Visual Paging

8.9.1 Overview

Where event schedules, announcements, pages, and emergency conditions are broadcast through PA systems, the same information in visual form should be provided to individuals

Source: Gerald R. Ford International Airport (GRR) and Domodedovo-Moscow International Airport (DME)

Figure 8-20. Hearing loops at Gerald R. Ford International Airport and Domodedovo-Moscow International Airport.

who are deaf or hard of hearing through monitors, electronic message boards, or other forms of dynamic displays in order to provide equal access.

Passenger paging systems are those systems used to communicate information to the passenger. Traditionally, this system was the "white paging phone" and the audio system required to broadcast messages throughout the airport. These systems are installed inside buildings in almost all passenger areas and used by the airport staff, airlines, and public authorities. Today, these systems are expanding to include a visual paging component for those who are deaf or hard of hearing.

8.9.2 Application

Visual paging displays can be located anywhere in the airport. The visual paging displays provide visual message text, consistent with ADA regulations, for all announcement and message types. In addition, these displays can show advertising and revenue-generating digital media. The displays can show these and other types of visual pages:

- Security checkpoint instructions
- Terminal-wide informational messages
- Courtesy announcements
- Final call messages
- Emergency messages
- Advertisement media
- Public service messages

GIDSs are located behind the gate ticket counter and anywhere in the gate/hold room areas. A GIDS provides not only visual paging but also gate, airline, and flight status information.

Source: ACRP Project 07-13 Research Team

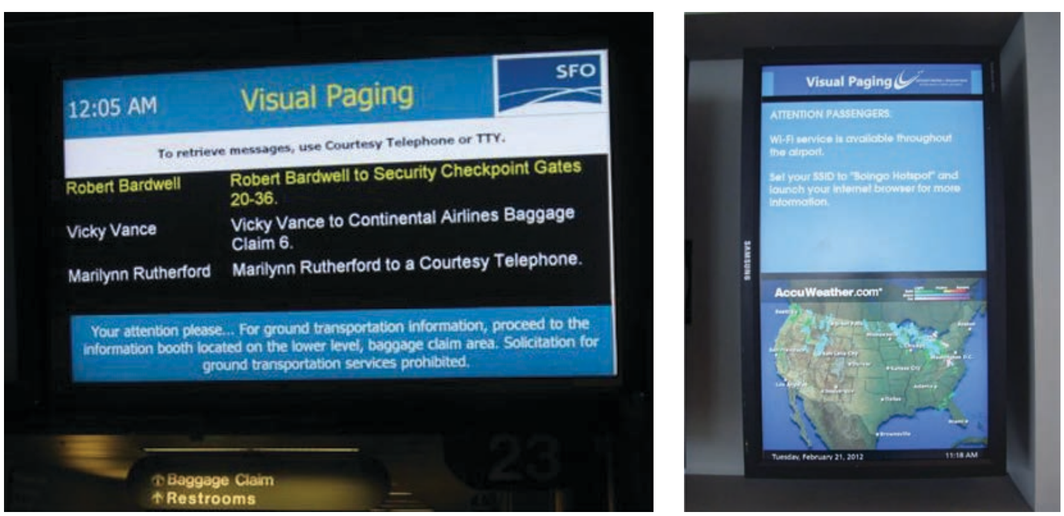
Figure 8-21. Visual paging screens at Philadelphia International Airport.

The displays can show

- Gate status graphical display
- Flight status graphical display
- Airline information
- Boarding process status
- Boarding by row number
- Destination city weather maps

8.9.3 Components

Normally, a visual paging component is integrated with the audio-based overhead PA system and the visual-based digital signage network (see Figures 8-21 and 8-22). This setup allows the



Source: ACRP Project 07-13 Research Team

Figure 8-22. Visual paging screens at San Francisco International Airport and Detroit Metropolitan Airport.

same information broadcast in an audio announcement to be delivered in a visual format so that travelers who are deaf or hard of hearing can also receive the message.

The main components of a visual paging system consist of

- Digital visual paging displays
- Centralized system controller
- Networked software
- Ethernet switch

8.10 MNSs

8.10.1 Overview

An MNS is an integrated platform to deliver messages to a small or large group of people. MNSs utilize visual (virtual) and verbal (audible) announcements to manage people's actions during irregular operations, specifically, emergency operations. An MNS provides incident-specific guidance to those in danger and delivers messages offering the best course of action for incidents such as

- Fire
- Natural disaster
- Shooters
- Terrorist events
- Weapons of mass destruction
- Security breach

An MNS utilizes multiple integrated systems to offer guidance, including the fire alarm system, the PA system, and the dynamic signage system. The fire alarm system will be deployed using two color strobes as opposed to traditional single color strobes (see Figure 8-23). These will indicate a fire (normal clear strobe) and non-fire event (amber strobe). The dynamic signage system in this case can include the FIDS, BIDS, GIDS, dynamic directories, and visual paging displays. The PA system can also include hearing loop systems. MNSs use the three Vs of communication to deploy area-specific messages to all people. MNSs are particularly important to passengers with disabilities. Because the emergency notifications utilize more than one medium, they are accessible to passengers with vision, hearing, and cognitive disabilities.

8.10.2 Application

MNSs can be implemented throughout the airport (see Figure 8-24). The major systems that will act as both input and outlet for information to passengers will include the fire alarm system,

Source: BICSI

Figure 8-23. Multicolored fire alarm system strobes deployed at Dane County Regional Airport.

PA is used for Fire Alarm Annunciation

Airport	Primary	Secondary
CDG (Charles De Gaul)	Primary Means of Emergency Notification including Fire	
DOH (Doha)	Primary Means of Emergency Notification including Fire	
JFK (T4)		Secondary Means of Emergency Notification
Denver	Primary Means of Emergency Notification including Fire	
Orlando MCO		Secondary Means of Emergency Notification. Currently being Upgraded to be the primary means.
DFW Dallas Ft Worth	Primary Means of Emergency Notification including Fire	
Frankfort Germany Airport	Primary Means of Emergency Notification including Fire	
New York City Transit Authority	Primary Means of Emergency Notification including Fire	

Source: Innovative Electronic Designs

Figure 8-24. Examples of airports that have implemented MNS.

security system, visual paging system, data network, and dynamic messaging system. The MNS will deliver messaging via

- Intelligible voice communications
- Visible signals (fire alarm system strobes)
- Text (LED boards)
- Graphics (digital signage)
- Radio
- Cellphone
- Text message to mobile device

The fire protection system, or sprinkler systems, will also come into play when designing or implementing an MNS. Similar to a paging system, MNSs need to be zoned in order to be able to provide different instructions to passengers depending on where an event takes place. For example, an event in the terminal or ticketing area of an airport causing an evacuation of that area would require different instructions to those in concourse areas, particularly if the egress path is toward the event. Those passengers would be given instruction to shelter in place or look forward to more instruction. Often times, these mass notification zones are based on fire protection zones, with a fire emergency dictating which way to evacuate a facility versus shelter in place.

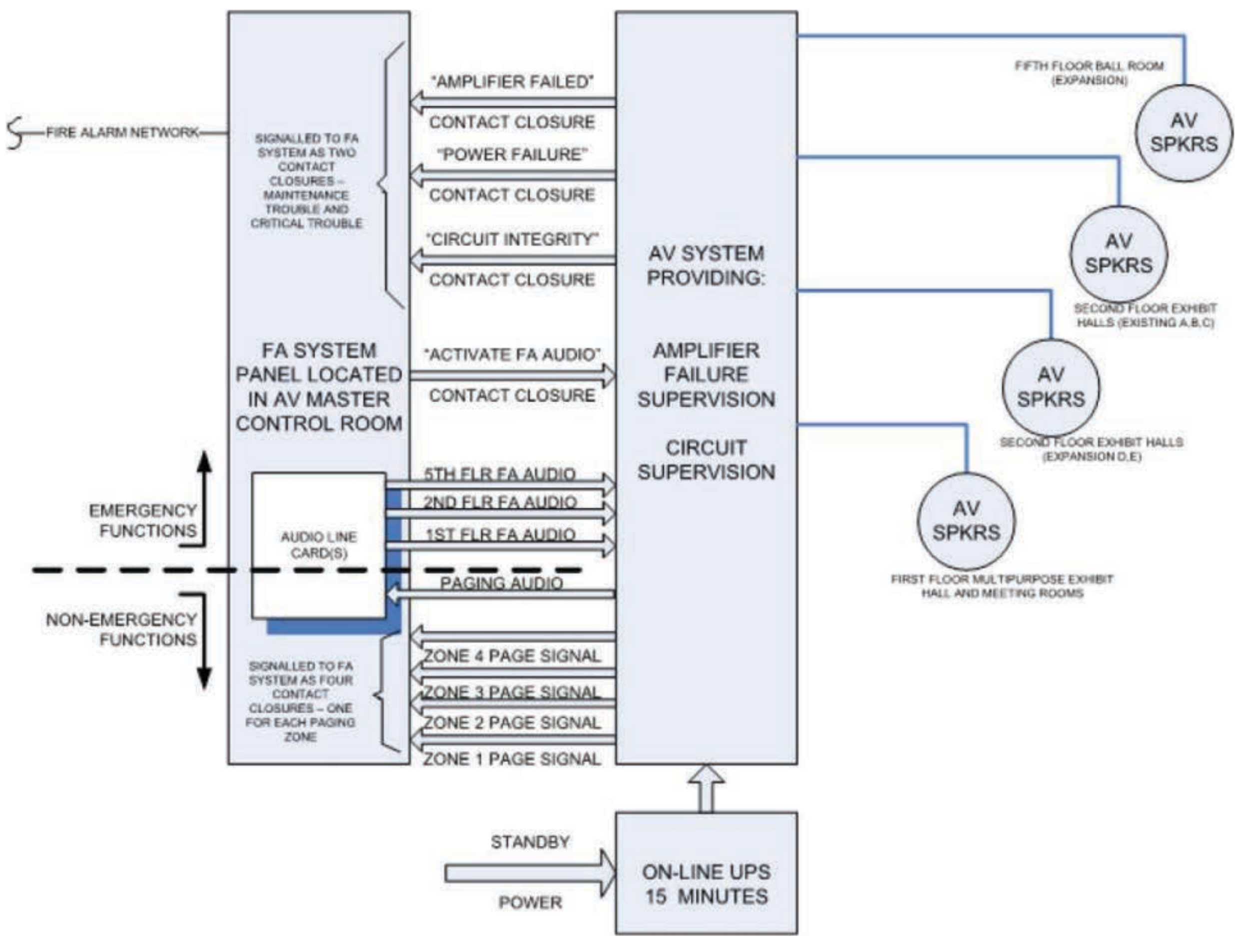
Several factors should be considered when designing or planning to deploy an MNS. Some of these include acoustics, speaker selection, coverage area, cabling infrastructure and power reliability, and backup. Research shows that intelligibility has the biggest effect on the success of an MNS, for multiple reasons. Because mass notifications take over a facility's or an area's entire announcement system, the clarity of that message is critical. A non-intelligible message will also be unclear over hearing loop systems. The NFPA defines intelligible as "capable of being understood, comprehensible, and clear." Messages should be intelligible from multiple sources, including pre-recorded, synthesized, and live messaging. Intelligibility testing for MNSs is currently defined in NFPA 72 Appendix D. Testing includes and assumes messages are in the listener's native language and assumes normal hearing:

- Signal-to-Noise Ratio
  – Voice announcement should average 15 dB over ambient
- Frequency Range
  – 400–4,000 Hz
- Speech Transmission Index
- Distortion
  – >15 percent distortion considered non-intelligible

The visual messaging portion of an MNS also needs to be intelligible. This is achieved with full-screen, high-contrast messaging, visible and readable for users with low vision. Visual displays should follow the same contract guidelines as visual messaging displays. However, MNS messages should not be combined with other messages and should occupy the entire display or group of displays.

8.10.3 Components

The diagram presented in Figure 8-25 illustrates the number of components in an MNS. An MNS is an integration of base building systems such as fire alarm, security, and public address



Source: Case Study, Pennsylvania Convention Center

Figure 8-25. MNS diagram.

that is enhanced with the integration of visual messaging systems, mobile applications, and hearing loops. All of these systems should follow relevant best practices.

The main components of the system include

- Data networks
- Network cabling systems
- Fire alarm system notification devices
- Public address system, speakers, mic stations, text-to-speech stations
- Digital displays
- LED boards
- Mobile applications
- Digital directories
- Emergency and UPS power

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Acronyms

ACAA	Air Carrier Access Act
ADAAS	Americans with Disabilities Act Accessibility Standards
ADHD	Attention deficit hyperactivity disorder
AED	Automated external defibrillator
AEP	Airport evacuation plan
AODB	Airport operational database
API	Application programming interface
ASL	American Sign Language
A/V	Audio/video
BIDS	Baggage information display system
BLE	Bluetooth low energy
CAA	Civil Aviation Authority (UK)
CDG	Charles de Gaulle Airport
CEA	Changi Experience Agent
CMS	Content management system
COPD	Chronic obstructive pulmonary disease
CRO	Complaint resolution official
CRT	Cathode ray tube
CSA	Customer service agents
CUSS	Common-use self-service
CVG	Cincinnati/Northern Kentucky International Airport
DFW	Dallas Fort Worth International Airport
DSDB	Digital signage database
FIDS	Flight information display system
FTE	Future travel experience
GIDS	Gate information display system
GIS	Geographic information system
GPS	Global positioning system
GSM	Global system for mobile communications
HLAA	Hearing Loss Association of America
HMI	Human-machine interface
ICT	Information and communication technology
IDS	Information display system
IROPS	Irregular operations
ISDN	Integrated services digital network
IT	Information technology
LAN	Local area network
LCD	Liquid crystal display

LED	Light-emitting diode
LOS	Level of service
LPR	License plate recognition
MNS	Mass notification system
NFC	Near field communication
NFPA	National Fire Protection Association
O&M	Orientation and mobility
PA	Public address
PRM	Persons with reduced mobility
PSS	Passenger support specialist
PSTN	Public switched telephone network
QR	Quick response
RERC	Rehabilitation Engineering Research Center
RFID	Radio frequency identification
RIAS	Remote infrared audible signage
ROI	Return on investment
SARA	Service animal relief area
SSCP	Security screening checkpoint
SUN	Survey of user needs
TGSI	Tactile ground surface indicator
TTY	Text telephone for the hearing impaired
UK	United Kingdom
USB	Universal Serial Bus
VLC	Visible light communication
VoIP	Voice over internet protocol
VRI	Video relay interpreting
W3C	World Wide Web Consortium
WAN	Wide area network
WCAG	Web Content Accessibility Guidelines
WHO	World Health Organization
YVR	Vancouver International Airport

APPENDIX A

Wayfinding Accessibility Audit Checklist

While there are wayfinding analyses that touch on accessibility, and there are accessibility audits that touch on wayfinding, heretofore, there has not been a consolidated audit that truly merges both issues into an all-inclusive assessment. This wayfinding accessibility audit checklist includes wayfinding strategies and accessibility features relevant to the passenger's specific disability. To conduct a successful wayfinding accessibility audit, the following key factors must be evaluated:

- Type of passenger: departing, arriving, or connecting
- Passenger journey touch points
- Type of disability or functional limitation
- The three Vs of communication: visual, verbal, and virtual
- Standards and/or regulations that apply

Figure A-1 is a color-coded key to the checklist and overview of the contents in each section. Each section is numbered to correspond with the chapter content in the guidebook and can be cross-referenced for additional details and information.

Chapter 4: Airport Planning and Design Considerations (P)

Section #	Section Description	Section Code
4.1	Airport Planning and Design	PD
4.2	Staff Training	ST
4.3	Database Environment/Management	DB
4.4	Website	WS
4.5	Mobile Application	MA
4.6	Call Center	CC

Chapter 5: Departing Customer Journey (D)

Section #	Section Description	Section Code
5.1	Departure Arrival Points	AP
5.2	Parking	PK
5.3	Rental Car	RC
5.4	Lobby Area	LA
5.5	Ticketing	TK
5.6	Security Checkpoint	SC
5.7	Vertical Transition	VT
5.8	Gate Area	GA
5.9	Airline Support	AS
5.10	International Flights - Passport Control	IN

Chapter 6: Arriving Customer Journey (A)

Section #	Section Description	Section Code
6.1	Airline Support	AS
6.2	Gate Area	GA
6.3	Baggage Claim	BC
6.4	Lobby Area	LA
6.5	Ground Transportation	GT
6.6	Rental Car - On-site and Remote	RC
6.7	Parking	PK
6.8	International Flights	IN

Chapter 7: Connecting Customer Journey (C)

Section #	Section Description	Section Code
7.1	Airline Support - Same Airline / Same Terminal	AS
7.2	Gate Area	GA
7.3	Terminal Transportation	TT
7.4	Airline Support - Same Terminal / Different Airline	AS

Source: ACRP Project 07-13 Research Team

Figure A-1. Color-coded key to the Wayfinding Accessibility Audit Checklist.

Chapter 4

Wayfinding Accessibility Audit Checklist

PLANNING (P)

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
Section 4.1: Planning and Design (PD)								
P-PD.01	The requirements of populations with special needs are addressed during project planning and design, and persons with these disabilities are included in the planning and design process.	**Visual Virtual Verbal**	X	X	X	X	*Canadian Transportation Agency, 2007; Federal Aviation Authority, 2016*	
P-PD.02	When developing new facilities (or technologies) or upgrading them, universal design principles are applied to ensure their use by all travelers to the greatest extent possible without needing specialized design.	**Visual Virtual Verbal**	X	X	X	X	*Canadian Transportation Agency, 2007; FAA, 2016*	
P-PD.03	Airports are designed intuitively to minimize reliance on signage; spatial organizations and architectural features support good wayfinding.	**Visual Virtual Verbal**	X	X	X	X	*Canadian Transportation Agency, 2007; Salmi, 2007; Levine, 2003*	
P-PD.04	Optimum lighting levels are provided throughout the airport at all times of day to support lip reading, reading signs, etc.	**Visual Verbal**	X	X				
P-PD.05	A comprehensive wayfinding system is implemented to minimize the need for asking for directions (based on the 3 Vs of communication).	**Visual Virtual**	X	X	X	X		
P-PD.06	Background noise levels are reduced by providing soundproofing in some areas, such as information desks, and through the selection of building materials.	**Verbal**		X	X			
P-PD.07	There are planned adjacencies at key decision nodes for information sources: Virtual, e.g., Flight Information Display Systems (FIDS); Verbal, e.g., staff positions and information desks; Visual, e.g., airport directories, etc. (Also ref. DLA.02).	**Visual Virtual Verbal**	X	X	X	X		
P-PD.08	Landmarks are incorporated during the planning and design process using distinct, recognizable shapes. Landmarks are located at key decision points so they are detectable from as many positions as possible without interrupting the path of travel. Landmarks are developed as part of a system to make different parts of the site as noticeable and memorable as possible. Where possible, primary landmarks incorporate tactile, sound and visual indicators.	**Visual Audible**	X	X	X	X		
P-PD.09	Signage is legible, uncluttered and easy to follow with no gaps or disconnects, and signage inventories are developed to remove redundant signs and reduce visual clutter.	**Visual**		X	X	X		
P-PD.10	Color is used to reinforce wayfinding but not as a primary wayfinding strategy.	**Visual**		X	X	X		
P-PD.11	Sign messaging uses plain language, not airline/airport jargon.	**Visual**		X	X	X		
P-PD.12	Large, unadorned, illuminated fonts are used for directional signs.	**Visual**	X	X	X	X		
P-PD.13	Symbols are used consistently with messaging on signs. Familiar or easy-to-learn pictograms are used to reinforce text and bypass language-based information.	**Visual**		X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
P-PD.14	Pictures are used on signs to help persons with intellectual disabilities navigate.	Visual		X	X			
P-PD.15	Arrows are consistently applied. Plain language is used: “straight ahead” instead of an arrow pointing up or down when there is risk of being confused with “upstairs” or “downstairs.” Conversely, the words “upstairs” or “downstairs” are used when communicating guidance through non-intuitive vertical transition wayfinding scenarios. Use of diagonal arrows is avoided when possible.	Visual		X	X	X		
P-PD.16	Vertical circulation devices such as stairs, escalators, and elevators are in close proximity and in easy view from entries and major nodes.	Visual	X	X	X	X		
P-PD.17	In multistory buildings, elements such as restrooms, elevators, and exits are organized in the same location on each floor.	Visual	X	X	X	X		
P-PD.18	“You Are Here” maps are designed with correct, forward-facing orientation to match the direction the viewer faces when using the map.	Visual		X	X	X		
P-PD.19	Maps and graphic information are used to communicate and emphasize the form of circulation at primary nodes rather than secondary nodes.	Visual		X	X	X		
Section 4.2: Staff Training (ST)								
P-ST.01	Staff are trained to speak clearly and face customers directly.	Verbal	X	X	X	X		
P-ST.02	Public announcements to support successful trip execution are made in both visual and audible formats. Staff training - audible formats include plain language, spoken clearly and slowly, so as to be more easily understood (Also ref. DGA.49).	Verbal	X		X	X		
Section 4.3: Database Environment / Management (DB)								
P-DB.01	Data environment, data management tools, and information management policies to manage all accessibility-related information for the airport are in place.	Virtual	X	X	X	X		
Section 4.4: Website (WS)								
P-WS.01	The airport website meets Web Content Accessibility Guidelines (WCAG) 2.0.	Virtual	X	X	X	X	*http://www.w3.org/WAI/intro/wcag.php*	
P-WS.02	The website is tested for functionality by users with a variety of disabilities.	Virtual	X	X	X	X		
P-WS.03	Where airports provide online visual maps for pre-trip planning, they are accompanied by text maps for travelers with print disabilities including vision loss.	Virtual	X					
P-WS.04	Directories give specific locations for points of interest: restaurants, stores, and services.	Virtual	X	X	X	X	Example: DFW https://www.dfwairport.com/services/	
P-WS.05	The airline terminal directory gives exact locations for check-in and ticketing counters and whether curbside check-in is available (and its specific location), as well as for baggage claim carousels.	Virtual	X	X	X	X		
P-WS.06	The home page includes a link for disability-related information and resources.	Virtual	X	X	X	X	Example: LAX http://www.lawa.org/welcomelax.aspx	
P-WS.07	There is a complete list of accessible airport services and facilities.	Virtual	X	X	X	X	28 CFR 35.163	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
P-WS.08	Telephone numbers (including TTY or relay service) where travelers with disabilities can receive assistance or get additional information are posted along with hours of service.	**Virtual**	X	X	X	X		
P-WS.09	Information on ground transportation options (public and private) includes details on accessibility and links to accessible providers.	**Virtual**	X	X	X	X		
P-WS.10	Where arrival points for ground transportation are remote from terminal entrances, distances or average walking times are listed and availability of moving walkways is indicated. The website also notes whether assistance and means to call for assistance (courtesy phone or kiosk) are available at these arrival points.	**Virtual**	X	X	X	X		
P-WS.11	Information on airport transportation options (between terminals, onsite parking, etc.) includes details on accessibility.	**Virtual**	X	X	X	X		
P-WS.12	Information is provided on whether connections between terminals (domestic or international) are located inside or outside of security and on estimated travel times.	**Virtual**	X	X	X	X		
P-WS.13	Where terminals or concourses within a terminal are connected by walkways only, distances or average walking times are listed and whether moving walkways are available.	**Virtual**	X	X	X	X		
P-WS.14	Distances/average walking times are provided from check-in to the furthest gate on each terminal concourse.	**Virtual**	X	X	X	X		
P-WS.15	Evacuation plans are included on the website: emergency exits and routes, evacuation elevators, areas of safe rescue, airport procedures in case of evacuation, staff training, etc.	**Virtual**	X	X	X	X	Example: LAX, http://www.lawa.org/ADA.aspx?id=1766#EPL	
P-WS.16	Online virtual tour for pre-trip planning is captioned (ex: Wayfinder on Massport's Boston Logan website)	**Virtual**	X	X	X	X	Example: CVG http://www.cvgairport.com/terminal/videos	
Section 4.5: Mobile Application (MA)								
P-MA.01	The airport mobile application follows "Mobile Web Best Practices."	**Visual Virtual Verbal**	X	X	X	X	*http://www.w3.org/TR/mobile-bp/* IBM has a new Mobile Accessibility Checker for Apple iOS and Google Android mobile applications	
P-MA.02	The application is tested for functionality by users with a variety of disabilities.	**Visual Virtual Verbal**	X	X	X	X		
P-MA.03	The application can detect device/passenger location, provide filtered information by proximity or category, create accessible route guidance and help the passenger navigate the airport. Location detection can be achieved through GPS, Wi-Fi, beacons, or other techniques.	**Visual Virtual Verbal**	X	X	X	X		
P-MA.04	The application provides a mechanism to filter information relevant to the passenger's disability and specific needs.	**Visual Virtual Verbal**	X	X	X	X		
P-MA.05	The application provides a "Help Me" function that enables the user to immediately communicate with airport accessibility staff or the call center (and staff can be notified of their communication preferences).	**Visual Virtual Verbal**	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
P-MA.06	Airport and airline applications are fully accessible for smartphone users who use VoiceOver (iOS) or TalkBack (Android)	Virtual	X				No current legal requirement but testing by the research team indicates minor changes are needed to make at least airline applications accessible to users who are blind.	
Section 4.6: Call Center (CC)								
P-CC.01	Staff has computer access to the accessibility database as well as real-time data on IROPS/emergencies.	Verbal	X	X	X	X		
P-CC.02	The call center has TTY or other means to communicate with people with hearing loss or speech disability such as a relay service, texting, or chat room.	Visual Virtual		X				
P-CC.03	The staff is trained in the use of the TTY, relay service, etc.	Visual Virtual Verbal		X				
P-CC.04	The staff has disability awareness training.	Visual Virtual Verbal	X	X	X	X		
P-CC.05	The staff is trained on how to correctly give directions to people with vision loss.	Verbal	X					
P-CC.06	Standardized directions for commonly requested routes are available in the accessibility database.	Virtual	X	X	X	X		
P-CC.07	The staff can assist/provide instructions to individuals using the website and mobile application.	Visual Virtual Verbal	X	X	X	X		
P-CC.08	The staff is fluent in English and other local languages and has access to interpreters for many languages through services like the AT&T language line.	Verbal	X	X	X	X		
P-CC.09	Airport brochures or other print information for distribution to the public are available in alternate formats (large print, Braille, digital via email, and digital via the website) as preferred and on request.	Visual Virtual	X				28 CFR Part 35.160 / 28 CFR Part 36.303	
Chapter 5								
Wayfinding Accessibility Audit Checklist								
DEPARTING PASSENGER (D)								
Section 5.1: Departures Arrival Points (AP) / 5.1.1 Curbside								
D-AP.01	Accessible drop-off points for people with disabilities have been designated by the airport, appear on web, mobile, and terminal maps and directories, and are appropriately signed for easy viewing from roadways.	Visual Virtual	X	X	X	X	Passenger loading zones scoping and design: 2010 ADAAS 209 and 503	
D-AP.02	Walking surfaces are stable, firm, and slip-resistant, inside and outside terminals and parking garages, and have no openings larger than 0.5".	Visual	X	X	X	X	2010 ADAAS 302.3	
D-AP.03	Visual and auditory signals are in place at pedestrian crossings with traffic lights, with adequate crossing time for those who move more slowly.	Visual	X	X	X	X		
D-AP.04	Where there are no signals, pedestrian crossing signs are prominently displayed for drivers and pedestrians. Raised pedestrian crossings help to slow traffic while providing level access. Speed bump signage and road markings are in place.	Visual Virtual	X	X	X	X		
D-AP.05	Pedestrian crossings have higher illumination levels and/or different colors.	Visual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-AP.06	Detectable warnings are in place at curb ramps and marked crosswalks.	Visual	X		X		*DOT ADA Standards (2006) 406.8 NPRM Public Rights of Way*	
D-AP.07	If the sidewalk is flush with the roadway, detectable warnings are in place along the entire edge.	Visual	X		X			
D-AP.08	At least one accessible route is provided within the site from accessible parking spaces and accessible passenger loading zones, public streets and sidewalks, and public transportation stops to the accessible building or facility entrance they serve.	Visual	X	X	X	X	2010 ADAAS 206.2.1	
D-AP.09	Assistance or means to request assistance is available outside the terminal, e.g., curbside check-in, accessible kiosk/call point or telephone identified by an easily visible and tactile sign.	Verbal Virtual	X	X	X	X		
D-AP.10	Directional and identification signs have fonts that are easily read, have good contrast, are non-glare and allow close approach wherever possible.	Visual	X	X	X	X	2010 ADAAS 703.5	
D-AP.11	Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.	Visual			X			
D-AP.12	Identification signs are visual and tactile, i.e., have raised characters and Braille and are correctly positioned.	Visual	X	X	X	X	2010 ADAAS 703	
D-AP.13	Service Animal Relief Areas (SARAs) are located as close as possible to terminal entrances with at least one accessible route (ref. DAP.08).	Visual	X	X	X	X		
Section 5.1: Departures Arrival Points (AP) / 5.1.2 Other Arrival Points								
D-AP.14	Other points of arrival are identified on airport maps, website, and mobile application, if provided.	Virtual	X	X	X	X		
D-AP.15	Means to request assistance is available at other points of arrival, e.g., accessible kiosk/call point or telephone identified by easily visible and tactile sign	Virtual Verbal	X	X	X	X	*For the DOT's definition of terminal entrances, see DOT FAQ 28. http://www.dot.gov/airconsumer/frequently-asked-questions-may-13-2009.* Under EC1107, means to request assistance is required at all points of arrival including accessible parking areas.	
D-AP.16	A seating area, with some seats signed for disability priority, is available for passengers waiting for assistance.	Visual	X	X	X	X		
D-AP.17	A staff member is on hand to direct passengers, e.g., at monorail stations.	Verbal	X	X	X	X	Examples: JFK, EWR	
D-AP.18	There is at least one accessible route from each remote arrival point to each airport terminal, with each element (walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADAAS.	Visual	X			X	2010 ADAAS 206.2.1	
D-AP.19	There are no objects protruding more than 4” into the path of travel that are not cane detectable (lower edge 27” or less above finished floor), e.g., fire extinguishers, pay phones, drinking fountains.	Visual	X				2010 ADAAS 307.2	
D-AP.20	Overhead clearance is 80” minimum and unenclosed stairs or escalators have a rail or barrier underneath.	Visual	X	X	X	X	2010 ADAAS 307.4	
D-AP.21	Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path.	Visual	X	X	X	X	No ADA standard. Building and Construction Authority. Code on Barrier-Free Accessibility in Buildings, Singapore, 2002, recommends seating areas no more than 30 m (328 ft) apart.	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-AP.22	Where there is more than one terminal connected to the arrival point, an airline directory (static or dynamic signage) is hung at eye level and has large fonts, good contrast, and no glare.	Visual Virtual	X	X	X	X	2010 ADAAS	
D-AP.23	Directional signs have large, unadorned, illuminated fonts.	Visual	X	X	X	X		
D-AP.24	Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.	Visual	X	X	X	X		
D-AP.25	Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts are in the same area as stairs and escalators.	Visual	X	X	X	X	2010 ADAAS 206.3	
D-AP.26	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
D-AP.27	Elevators meet Americans with Disabilities Act Standards (ADA Standards) for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.	Visual	X	X	X	X	2010 ADAAS 407, 408, 409, 708	
D-AP.28	Audible indicators outside elevators are loud enough to be heard over ambient noise.	Visual	X	X	X	X		
D-AP.29	Accessible means of egress (e.g., evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) are available and have appropriate identification and directional signage.	Visual	X	X	X	X	International Building Code (IBC)-2000 (including 2001 Supplement to the International Codes) and IBC-2003	
D-AP.30	Detectable warnings are in place at curb ramps, marked crosswalks, and wherever the accessible route crosses vehicular roadways in parking structures.	Visual	X		X		*DOT ADA Standards (2006) 406.8 NPRM Public Rights of Way*	
D-AP.31	Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.	Visual	X	X	X	X		
D-AP.32	An audible signal alerts passengers to the end of moving walkways.	Visual	X	X	X	X		
D-AP.33	Emergency communications equipment is provided at strategic locations wherever potential security or safety threats may exist and is identified by visual and tactile signage. Locations are noted in the access database and mobile application, if any.	Virtual	X	X	X	X	Standard for two-way communications system 2010 ADAAS 708	
Section 5.2: Parking (PK)								
D-PK.01	A smartphone application is available for locating parking spaces.	Virtual		X	X	X		
D-PK.02	A smart garage system aids in finding empty spaces.	Virtual		X	X	X		
D-PK.03	A smart garage car-finding system and smartphone application help customers find their cars.	Virtual		X	X	X		
D-PK.04	Accessible parking spaces in parking lots and parking garages adjacent to the terminal are connected by an accessible path of travel to terminal entrances with each element (walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADAAS.	Visual				X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-PK.05	Accessible parking spaces are located on the shortest possible route(s) to accessible terminal entrance(s) and dispersed if there is more than one accessible entrance.	Visual				X	2010 ADAAS 208.3.1	
D-PK.06	All accessible van spaces are grouped on one level in a multi-car parking facility.	Visual				X	2010 ADAAS 208.3.1	
D-PK.07	All accessible parking locations are identified in the airport access database, on maps and the mobile application, if any.	Visual Virtual				X		
D-PK.08	The number of accessible van and car spaces meets minimum local, state, or federal scoping (whichever is highest) and standards for size and identification signage.	Visual				X	2010 ADAAS 208.2	
D-PK.09	Directional signs are in place from the adjacent parking garage and parking lots to the closest terminal entrance.	Visual		X	X	X	2010 ADAAS 703	
D-PK.10	Accessible parking spaces are on the shortest possible accessible route to the shuttle bus stop, monorail station, or other accessible means of transportation linking parking lots to airport terminals.	Visual				X	2010 ADAAS 208.3	
D-PK.11	The number of accessible van and car spaces in remote lots meets minimum local, state, or federal scoping (whichever is highest) and ADA standards for size and identification signage.	Visual				X	2010 ADAAS 208.2	
D-PK.12	Accessible parking spaces do not have to be provided in each parking facility on the site but must have equivalence in terms of distance, parking fees, and user convenience. For areas where accessible parking may not exist, directional signage leading users to these accommodations is required.	Visual				X	2010 ADAAS 208	
D-PK.13	Shuttle bus stops and shelters meet ADA accessibility standards for dimension, paths of travel, and route signs. Bus schedules are not subject to signage standards.	Visual	X	X	X	X	2010 ADAAS 810.2, 810.3	
D-PK.14	Shuttle bus drivers have disability awareness training in assisting and communicating with people with disabilities.	Verbal	X	X	X	X	14 CFR Part 37	
D-PK.15	Stations and platforms or automated people movers meet ADA standards.	Visual	X	X	X	X	2010 ADAAS 810.5	
D-PK.16	Signage for station entrances, routes, and destinations and station names comply with ADA accessibility standards.	Visual Virtual	X	X	X	X	2010 ADAAS 810.6	
D-PK.17	Staff is available in stations and on platforms to provide assistance and directions.	Verbal	X	X	X	X	Examples: AirTrain, JFK, EWR.	
Section 5.3: Rental Car (RC)								
D-RC.01	There is at least one accessible route from the rental car facility to the airport terminal.	Visual	X	X	X	X		
D-RC.02	Directional signs are in place from the rental car drop-off area to the closest terminal entrance.	Visual	X	X	X	X		
D-RC.03	Facility entrances, paths of travel, counters, and other features meet ADA Standards.	Visual	X	X	X	X		
D-RC.04	An accessible means of transport links the rental car facility with airport terminals, e.g., shuttle bus, automated people mover.	Visual	X	X	X	X		
Section 5.4: Lobby Area (LA)								
D-LA.01	Wide automatic doors provide universal ease of access.	Visual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-LA.02	An information desk is located inside the terminal entrance and grouped with other information sources such as FIDSs, directories, or maps. If the airport has an information desk on the arrivals level only, directional signage for the information desk is prominently displayed at entrance(s) on the departures level.	Verbal Virtual	X	X	X	X		
D-LA.03	The information desk has prominent identification signage with a pictogram.	Visual	X	X	X	X		
D-LA.04	A counter induction loop is installed for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.	Verbal		X				
D-LA.05A	The information desk has video remote interpreting service.	Virtual Verbal		X				
D-LA.05B	Staff is fluent in English and other local languages and has access to interpreters for many languages through means such as the AT&T language line.	Virtual Verbal	X	X	X	X		
D-LA.06	A correctly oriented "You Are Here" illuminated map with large font designed for close approach is located at major decision points throughout the airport.	Visual Virtual	X	X	X	X		
D-LA.07	Seating areas, with some seats designated as disability priority, are located near the information desk and terminal entrances.	Visual	X	X	X	X		
D-LA.08	FIDS are located at frequent intervals.	Virtual	X	X	X	X		
D-LA.09	Visual paging is built into TV monitors.	Virtual		X				
D-LA.10	Escalators include visual reinforcement of operating direction.	Visual			X	X		
D-LA.11	Elevators have glass doors for open sight lines and ease of identification.	Visual			X	X		
D-LA.12	Primary entrance doors have clear identification of terminal, level, and a unique door number.	Visual	X		X	X		
D-LA.13	Self-identification is promoted and encouraged so that travelers are more likely to relay their disability-specific needs to staff. This can take place at any touch point: curbside check-in, lobby information desk, ticketing check-in, etc. Links are posted to TSA notification card that assures appropriate assistance.	Visual Verbal Virtual	X	X	X	X	Canadian Transportation Agency, 2007 - Self-identification is absolutely essential. Customers often think that by providing advance notice of a need for assistance that they will receive it, but we cannot identify customers on sight; customers often will only need/utilize assistance in one airport but not another; customers are offended when we proactively offer assistance.	
Section 5.5: Ticketing (TK)								
D-TK.01	Static or dynamic signage listing the location of each airline's ticket and check-in counters is hung at eye level and has large fonts, good contrast and no glare. This is available at each entry point.	Visual Virtual	X	X	X	X		
D-TK.02	Directional signs have large, unadorned, illuminated fonts.	Visual	X	X	X	X		
D-TK.03	Directional and identification signs include pictograms to improve comprehension by persons with intellectual disabilities and international travelers.	Visual			X			
D-TK.04	Lighting levels are optimal at all times of day throughout the terminal to support the reading of signs.	Visual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-TK.05	If installed after 12/12/2016, check-in kiosks meet new accessibility standards under 14 CFR Part 382, and fully accessible kiosks are identified with a wheelchair symbol.	Virtual	X	X	X	X	49 CFR Part 27.71 14 CFR Part 382.57	
D-TK.06A	A ticket agent is available to assist at check-in kiosks, or people with disabilities who cannot readily use the automated kiosks may go to the head of the line.	Verbal	X	X	X	X	14 CFR Part 382.57	
D-TK.06B	Crowd control barriers have a lower belt or rail that is cane (and guide dog) detectible, i.e., 27" maximum above the floor, on outermost lines adjacent to paths of travel.							
D-TK.07	A counter induction loop is installed at one check-in counter with priority access for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.	Verbal		X				
D-TK.08	An Airline complaint resolution official (CRO) is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues involving requested accommodations, assistive devices, checked baggage, etc.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153. A CRO must be made available at any point in the traveler's journey when a disability-related problem arises, as well as during the reservation and booking process.	
D-TK.09	Where baggage drop-off is not at the check-in counter, ticket agents provide directions or assistance.	Verbal	X	X	X	X		
D-TK.10	Where a terminal has multiple security check points, ticket agents direct passengers to the appropriate location.	Verbal	X	X	X	X		
D-TK.11	A seating area is available for passengers who need to wait for assistance from the airline/service company and designated as priority seating.	Visual	X	X	X	X		
D-TK.12	Accessible routes coincide with, or are located in, the same area as general circulation paths. Elevators and lifts are in the same area as stairs and escalators.	Visual	X	X	X	X	2010 ADAAS 206.3	
D-TK.13	Where elevators and lifts are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
D-TK.14	Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor levels is preferable to a beeping sound.	Visual	X	X	X	X		
D-TK.15	Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.	Visual	X	X	X	X		
D-TK.16	Accessible men's and women's restrooms, a companion restroom, and drinking fountains are located before security.	Visual	X	X	X	X		
D-TK.17	Visual and tactile signage for all permanent rooms and spaces, e.g., restrooms, is placed at the height and location specified under the ADA Standards. All accessible restrooms, not just companion/family facilities, are identified with a wheelchair symbol, especially in international airports/terminals.	Visual	X	X	X	X	2010 ADAAS 216.2, 703 (While ADA Standards do not require a wheelchair symbol identification where all restrooms in a facility are accessible, this may be confusing to foreign travelers to whom the lack of the wheelchair symbol means lack of accessibility ADAAG, 2010)	
D-TK.18	The maximum force for pushing or pulling open an interior door, e.g., to a companion restroom, is 5 lbs. (exception fire doors).	Visual	X	X	X	X	2010 ADAAS 404.2.9	
D-TK.19	FIDSs are hung at eye level for close approach with larger fonts, good contrast, and a slower refresh rate.	Virtual	X	X	X	X		

D-TK.20	FIDS information is available via a mobile application or verbally via a dedicated telephone number.	**Virtual**	X	X	X	X		

Section 5.6: Security Checkpoint (SC)

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-SC.01	There is a dedicated lane for employees and people with disabilities, clearly identified by signage *or* staff direct people with disabilities, or those who self-identify as needing the accommodation, to the front of the line.	**Visual**	X	X	X	X	Example, large overhead sign for these lanes at PHL.	
D-SC.02	Personnel are at lane entrances, and then TSA employees direct passengers to the correct lane.	**Verbal**	X	X	X	X	Note: Per the TSA, passengers with disabilities may use a non-dedicated lane provided it meets their accessibility requirements.	
D-SC.03	On request, TSA employees reconnect the passenger with their belongings on the belt, or collect the passenger's belongings from the belt, to ensure they are not lost or stolen during the screening process. Service company employees can also assist.	**Verbal**	X	X	X	X		
D-SC.04	Passenger Support Specialists (PSSs), trained TSA disability experts, are available to resolve problems or complaints or provide additional assistance.	**Verbal**	X	X	X	X		
D-SC.05	If there is no SARA installed airside, a TSA policy is in place to allow people traveling with service/emotional support animals to bypass the line on return.	**Verbal**	X	X	X	X	49 CFR Part 27.71 requires SARAs airside with limited exceptions.	
D-SC.06	Directional signs have large, unadorned, illuminated fonts.	**Visual**	X	X	X	X		
D-SC.07	An airline directory (static or dynamic signage) is hung at eye level and has large fonts, good contrast and no glare.	**Visual** **Virtual**	X	X	X	X		
D-SC.08	FIDS are located at security exit points.	**Virtual**	X	X	X	X		
D-SC.09	Visual paging is built into TV monitors or FIDS.	**Virtual**		X				

NOTE: For **International Passengers**, reference ***International Flights (IN)—Passport Control*** section below.

Section 5.8[1]: Gate Area (GA)

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-GA.01	At major decision points, multisensory destination/directional information is provided via a map, kiosk, or information booth.	**Visual** **Virtual** **Verbal**	X	X	X	X		
D-GA.02	Directional and identification signs have fonts that are easily read, good contrast, non-glare, and allow close approach wherever possible.	**Visual**	X	X	X	X	2010 ADAAS 703.5	
D-GA.03	Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.	**Visual**			X			
D-GA.04	Identification signs are visual and tactile, i.e., have raised characters and Braille, and correctly positioned.	**Visual**	X	X	X	X	2010 ADAAS 703	
D-GA.05	Directional signs have large, unadorned, illuminated fonts.	**Visual**	X	X	X	X		
D-GA.06	FIDSs are located at frequent intervals along concourses.	**Virtual**	X	X	X	X		
D-GA.07	FIDSs are hung at eye level for close approach with larger fonts, good contrast and a slower refresh rate.	**Virtual**	X	X	X	X		
D-GA.08	FIDS information is available via a mobile application or verbally via a dedicated telephone number.	**Virtual**	X	X	X	X		

1 Section 5.7: Vertical Transition does not appear in the checklist because it reviews items D-AP-25, D-TK.12, D-AP.26, D-TK.13, D-AP.31, D-TK.15, D-LA.10, and D-LA.11, which already appear in Sections 5.1, 5.5, and 5.4 of the checklist.

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-GA.09	Visual paging is available at frequent intervals along concourses, e.g., built into FIDSs. Pages may also be provided on the airport website or via a mobile application.	Virtual		X			Example: MSP posts all pages on its website.	
D-GA.10	The paging system allows passengers to request audible or visual page by phone, text, or email.	Virtual Verbal	X	X	X	X		
D-GA.11	Courtesy phones are located at regular intervals along the concourse, including at major decision points, and are identified by visual and tactile signage.	Verbal	X	X	X	X		
D-GA.12	Directional signage for gate numbers is located at regular intervals, at all entrances onto the concourse from security, and at all decision points/nodes.	Visual	X	X	X	X		
D-GA.13	Signs indicating the direction to baggage claim/terminal exit are located at frequent intervals and outside restrooms.	Visual	X	X	X	X		
D-GA.14	Good lines of sight allow travelers to see a series of gate numbers along the concourse, i.e., gate numbers are not blocked by other signage or architectural elements.	Visual	X	X	X	X		
D-GA.15	Gate numbers follow a regular pattern, e.g., even on left, odd on right, and are distinguished by a zone identifier, not just a number, e.g., A5 on the A concourse.	Visual	X	X	X	X		
D-GA.16	Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path, e.g., where there are long corridors not adjoining holding areas.	Visual	X	X	X	X	No ADA standard. Building and Construction Authority. Code on Barrier-Free Accessibility In Buildings, Singapore, 2002, recommends seating areas no more than 30 m (328 ft) apart.	
D-GA.17	Differences in floor texture and color help provide an "edge" for wayfinding and distinguish the concourse walkway from holding areas.	Visual	X		X			
D-GA.18	Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways and stairs.	Visual	X	X	X	X		
D-GA.19	Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.	Visual	X	X	X	X		
D-GA.20	Accessible routes coincide with, or are located in, the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.	Visual	X	X	X	X	2010 ADAAS 206.3	
D-GA.21	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
D-GA.22	Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floors is preferable to a beeping sound.	Visual	X	X	X	X	2010 ADAAS 407, 408, 409, 708	
D-GA.23	There are no objects protruding more than 4” into the path of travel that are not cane detectable (lower edge 27” or less above finished floor), e.g., fire extinguishers, pay phones, and drinking fountains.	Visual	X				2010 ADAAS 307	
D-GA.24	Overhead clearance is 80” minimum, and there are no unenclosed stairs or escalators without a rail or barrier underneath.	Visual	X	X	X	X	2010 ADAAS 307.4	
D-GA.25	An audible signal alerts passengers to the end of moving walkways.	Visual	X	X	X	X		
D-GA.26	Accessible means of egress (evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) have appropriate identification and directional signage in view from concourse walkways and/or holding rooms.	Visual	X	X	X	X	International Building Code (IBC)-2000 (including 2001 Supplement to the International Codes) and IBC-2003.	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-GA.27	Signs at exit doors and areas of safe rescue are tactile as well as visual. Instructions for summoning assistance in areas of safe rescue are also tactile with an accessible two-way communication system in place.	Visual Virtual Verbal	X	X	X	X	2010 ADAAS 216.4, 703.1, 703.2, 703.5, 708	
D-GA.28	Airport, airline and concessions staff have training on the Airport Evacuation Plan (AEP) and how to assist passengers with disabilities in case of emergency.	Verbal	X	X	X	X	ACRP Reports 112, 73, 95	
D-GA.29	Visual and audible signaling systems are under central control to help direct people along best route. Push notification sends emergency information and directions to mobile phones.	Visual Virtual	X	X	X	X		
D-GA.30	Where people movers to or along the concourse are optional, dynamic signage indicates flights or gates for which the tram or monorail ride is recommended. Walking times/distances are provided.	Virtual	X	X	X	X	Example: FIDSs at DTW display a tram icon for flights from distant gates.	
D-GA.31	Station and other announcements on the automated people mover are both visual and audible.	Virtual	X	X	X	X	Example, MCO	
D-GA.32	A designated seating area and wheelchair area with grab bar are provided in the cars.	Visual	X	X	X	X		
D-GA.33	Effective directional signage is in place, especially where a level change is involved.	Visual	X	X	X	X		
D-GA.34	On long concourses, maps with point-of-interest directories are placed at regular intervals.	Virtual	X	X	X	X		
D-GA.35	SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.	Visual	X	X	X	X	49 CFR Part 27.71. Also see FAA Draft Advisory Circular AC-150/5360-14A, Appendix A for proposed standards for SARAs.	
D-GA.36	Staff are available who can speak in sign language and know how to identify and reach those who need this service. If no staff member is versed in sign language, remote Interpreting (at airport information desk or Traveler's Aid) enables communication with travelers who are deaf.	Virtual Verbal		X			Example, SFO	
D-GA.37	Restrooms, companion restrooms, and drinking fountains are grouped at frequent intervals along concourses with men's and women's facilities in a standard relation to each other, e.g., men's to the left of women's.	Visual	X	X	X	X		
D-GA.38	Restaurants, food kiosks, and convenience stores are distributed along concourses to provide close access from all gates.	Visual	X	X	X	X		
D-GA.39	Restaurant menus are in large print, Braille, or posted in an accessible format online.	Visual Virtual	X				28 CFR Part 36.303	
D-GA.40	For electronic menus, e.g., on an iPad, accessibility features such as VoiceOver are enabled, and the device allows close approach for easy viewing.	Virtual	X					
D-GA.41	Restaurants that have wall menus also have a large print copy available on request.	Visual	X					
D-GA.42	Restaurant staff will read the menu or assist with electronic menus.	Verbal						
D-GA.43	Restaurant staff willingly accommodate service animals.	Verbal	X	X	X	X	28 CFR Part 36.302	
D-GA.44	Aisles in stores and spaces between tables in restaurants have a clear width of 36".	Visual	X			X	2010 ADAAS 403.5.1	
D-GA.45A	Restaurant and retail staff have disability awareness training, including how to guide people who are blind.	Verbal	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-GA.45B	ATMs and currency exchange counters meet ADA accessibility standards.						2010 ADAAS 707 and 904	
D-GA.46	VIP lounges are fully accessible, have appropriate directional and identification signage, and are identified on the airport access database, maps, and directories.	Visual	X	X	X	X		
D-GA.47	Gate agents provide confirmation that the passenger is at the correct gate as well as expected boarding and departure time.	Verbal	X	X	X	X		
D-GA.48	The quality of the PA system and terminal acoustics allow announcements in the gate area to be easily understood.	Visual	X	X	X	X		
D-GA.49	Gate areas have induction loops to allow PA announcements to be transmitted directly to persons using hearing aids with T-coils or cochlear implants. Graphic signage alerting passengers to the presence of the hearing loop is displayed on the podium.	Verbal		X				
D-GA.50	There is a general pre-boarding announcement for people with disabilities *or* personal notification by gate agents for those who self-identify as needing to pre-board.	Verbal	X	X	X	X	14 CFR Part 382.93	
D-GA.51	Gate Information Display Systems (GIDSs), have real-time information, including which rows are boarding.	Virtual		X	X	X		
D-GA.52	Passengers with sensory disabilities who self-identify are provided prompt access to information given to other passengers, personally by the gate agent if no other means is employed, e.g., GIDS, text message, PA system, etc.	Virtual	X	X			14 CFR Part 382.53	
D-GA.53	Accessible recharging stations are available in the gate area for mobile devices and assistive equipment.	Visual	X	X	X	X		
D-GA.54	TV monitors have high contrast closed captioning enabled.	Virtual		X			14 CFR Part 382.51	
D-GA.55	Visual paging is built into TV monitors.	Virtual		X				
D-GA.56	A designated seating area for people with disabilities is located near the podium or boarding gate.	Visual	X	X	X	X		
D-GA.57	Airline or service company personnel assist passengers with disabilities to the door of the plane or seat, as needed.	Verbal	X	X	X	X		
D-GA.58	Boarding bridge slopes are as gentle as possible, with handrails at transitions and minimal gap/step into plane.	Visual	X	X	X	X	FAA Advisory Circular 150/5220-21C Aircraft Boarding Equipment	
D-GA.59	Passenger wheelchairs may be used until the door of plane then gate-checked for stowage as cargo, or manual chairs or walkers may be stowed in the cabin on a first-come, first-serve basis. An elevator or lift near the jet bridge allows safe and timely transfer of wheelchairs to the tarmac for stowage.	Verbal				X	14 CFR Part 382 Subpart I – Stowage of Wheelchairs, Other Mobility Aids, and Other Assistive Devices	
D-GA.60	A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues involving requested accommodations, assistive devices, carry-on baggage, denied boarding, etc.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153.	
Section 5.9: Airline Support (AS)								
D-AS.01	In case of flight cancellation, the rebooking center is accessible with either a ticket agent or phone instead of/in addition to an inaccessible touch-screen kiosk. Alternatively, passengers can rebook by airline mobile application.	Virtual Verbal	X	X	X	X		
D-AS.02	Where possible, passengers with disabilities are given priority in rebooking.	Verbal	X	X	X	X	In Europe, priority is mandated under EC 261/2004.	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
D-AS.03	A counter induction loop is installed at one rebooking counter with priority access for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.	Verbal		X				
D-AS.04	Rebooking centers have appropriate directional and identification signage and appear on maps/directories.	Visual Virtual	X	X	X	X		
D-AS.05	Staff from the airline service company are recalled by gate agents to provide an escort to the rebooking center and the new gate.	Verbal	X	X	X	X		
D-AS.06	Gate agents direct passengers to rebooking centers.	Verbal						
D-AS.07	A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153.	
Section 5.10: International Flights (IN)—Passport Control								
D-IN.01	There is a dedicated lane for employees and people with disabilities, clearly identified by signage, or staff direct people with disabilities or those who self-identify as needing the accommodation to the front of the line.	Visual Verbal	X	X	X	X		
D-IN.02	Personnel at lane entrances direct passengers to the correct lane.	Verbal	X	X	X	X		

Chapter 6

Wayfinding Accessibility Audit Checklist

ARRIVING PASSENGER (A)

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
Section 6.1: Airline Support (AS)								
A-AS.01	Baggage claim information is provided on board aircraft by flight attendant or by agent in gate area after arrival, verbally or visually as needed.	Verbal	X	X	X	X	14 CFR Part 382.69, 382.119	
A-AS.02	Baggage claim information is sent by text message, or the passenger can check carousel location via mobile phone after arrival.	Virtual	X	X	X	X		
A-AS.03	Agent gives directions to baggage claim.	Verbal	X	X	X	X		
A-AS.04	Passenger uses mobile application for directions/route to baggage claim.	Virtual	X	X	X	X		
A-AS.05	Airline service provider meets plane and provides wheelchair assistance or escort from seat or door of plane, as needed, to baggage claim. Service by electric cart replaces wheelchair service for ambulatory passengers in some airports.	Verbal	X	X	X	X	14 CFR Part 382.91	
A-AS.06	In case of ad hoc request(s), airline or service agent calls for additional personnel to provide assistance.	Verbal	X	X	X	X		
A-AS.07	Passenger's wheelchair, if any, is returned at door of plane. For those stowed as cargo, elevator or lift near jet bridge allows prompt delivery from tarmac.	Verbal				X	14 CFR Part 382.125(c)	
A-AS.08	A CRO is available in person or remotely (e.g., by phone, TTY, text) to resolve issues involving damage or loss of an assistive device, assistance in the terminal, etc.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153. A CRO must be made available at any point in the traveler's trip when a disability-related problem arises as well as during the reservation and booking process.	

NOTE: For International Passengers, reference *International Flights (IN), Immigration* and *Baggage Claim* below.

Section 6.2: Gate Area (GA)

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-GA.01	Signs indicating direction to baggage claim/terminal exit are in easy view on exit from each gate area.	**Visual**	X	X	X	X		
A-GA.02	Signs indicating direction to baggage claim/terminal exit are located at frequent intervals and outside restrooms.	**Visual**	X	X	X	X		
A-GA.03	At major decision points, multisensory destination/directional information is provided via map, directory, kiosk, or information desk.	**Visual Virtual Verbal**	X	X	X	X		
A-GA.04	Directional and identification signs have fonts that are easily read, have good contrast, are non-glare, and allow close approach wherever possible.	**Visual**	X	X	X	X	2010 ADA Accessibility Standards (ADAAS) 703.5	
A-GA.05	Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.	**Visual**			X			
A-GA.06	Identification signs are visual and tactile, i.e., have raised characters and Braille and correctly positioned.	**Visual**	X	X	X	X	2010 ADAAS 703	
A-GA.07	FIDSs are located at frequent intervals along concourses (for passengers who need to check on other arriving flights).	**Virtual**	X	X	X	X		
A-GA.08	FIDSs are hung at eye level for close approach, with larger fonts, good contrast, and slower refresh rate.	**Virtual**	X	X	X	X		
A-GA.09	FIDSs information is available via mobile application or verbally via dedicated telephone number.	**Virtual**	X	X	X	X		
A-GA.10	Visual paging is available at frequent intervals along concourses, e.g., built into FIDS. Pages may also be provided on the airport website or via a mobile application.	**Virtual**		X				
A-GA.11	Paging system allows passengers to request audible or visual page by phone, text, or email.	**Virtual Verbal**	X	X	X	X		
A-GA.12	Courtesy phones are located at regular intervals along concourse including major decision points and identified by visual and tactile signage.	**Verbal**	X	X	X	X		
A-GA.13	Differences in floor texture and color help provide an "edge" for wayfinding and distinguish the concourse walkway from holding areas.	**Visual**	X		X?			
A-GA.14	Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.	**Visual**	X	X	X	X		
A-GA.15	An audible signal alerts passengers to the end of moving walkways.	**Visual**	X	X	X	X		
A-GA.16	Accessible means of egress (e.g., evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) have appropriate identification and directional signage in view from concourse walkways and/or holding rooms.	**Visual**	X	X	X	X	International Building Code (IBC)-2000 (including 2001 Supplement to the International Codes) and IBC-2003	
A-GA.17	Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.	**Visual**	X	X	X	X	2010 ADAAS 206.3	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-GA.18	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
A-GA.19	Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.	Visual Verbal	X	X	X	X	2010 ADAAS 407, 408, 409, 708	
A-GA.20	Audible indicators outside elevators are loud enough to be heard over ambient noise.	Visual	X	X	X	X		
A-GA.21	Signs at exit doors and areas of safe rescue are tactile as well as visual, and instructions for summoning assistance in areas of safe rescue are also tactile with accessible two-way communication system in place.	Visual Virtual Verbal	X	X	X	X	2010 ADAAS 216.4, 703.1, 703.2, 703.5, 708	
A-GA.22	Airport, airline, and concessions staff have training on the Airport Evacuation Plan (AEP) and how to assist passengers with disabilities in case of emergency.	Verbal	X	X	X	X	ACRP Reports 112, 73, 95	
A-GA.23	Visual and audible signaling systems are under central control to help direct people along best route. Push notification sends emergency information and directions to mobile phones.	Visual Virtual	X	X	X	X	ACRP Report 112	
A-GA.24	Where people movers to or along the concourse are optional, dynamic signage indicates flights or gates for which the tram or monorail ride is recommended. Walking times/distances are provided.	Virtual	X	X	X	X	Example: FIDSs at DTW display a tram icon for flights from distant gates.	
A-GA.25	Station and other announcements on the automated people mover are both visual and virtual.	Virtual	X	X	X	X	Example, MCO	
A-GA.26	A designated seating area and wheelchair area with grab bar are provided in the cars.	Visual	X	X	X	X		
A-GA.27	Effective directional signage is in place, especially where a level change is involved.	Visual	X	X	X	X		
A-GA.28	On long concourses, maps with point-of-interest directories are placed at regular intervals.	Virtual	X	X	X	X		
A-GA.29	SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.	Visual	X	X	X	X	49 CFR Part 27.71. Also see FAA Draft Advisory Circular AC-150/5360-14A, Appendix A for proposed standards for SARAs.	
A-GA.30	Restrooms, companion restrooms, and drinking fountains are grouped at frequent intervals along concourses with men's and women's facilities in a standard relation to each other, e.g., men's to left of women's.	Visual	X	X	X	X		
A-GA.31	ATMs and currency exchange counters meet ADA accessibility standards.	Virtual	X	X	X	X	2010 ADAAS 707	
A-GA.32	Large, easy-to-read signs with pictograms identify each exit from concourse/secure area and warn that there is no return after exit.	Visual	X	X	X	X		
A-GA.33	TSA agent is positioned to ensure that exiting passengers do not attempt to reenter concourse/secure zone.	Verbal	X	X	X	X		
Section 6.3: Baggage Claim (BC)								
A-BC.01	Directional signage for baggage carousels, e.g., by number, is prominently displayed at each entrance to baggage claim from concourse/secure zone.	Visual Virtual	X	X	X	X		
A-BC.02	Correctly oriented "You Are Here" illuminated map with large font designed for close approach shows facilities and services on terminal arrivals level including baggage claim.	Visual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-BC.03	An accessible directory (large font, high contrast, and hung at eye level for close approach) lists arriving flights and carousel assignments.	Virtual	X	X	X	X		
A-BC.04	Airport or airline staff are available to give information/directions.	Verbal	X	X	X	X		
A-BC.05	Baggage claim information is sent by text message, or passenger can check carousel location via mobile application after arrival.	Virtual	X	X	X	X		
A-BC.06	Number of each carousel is prominently displayed and clear lines of sight allow easy viewing on entry to baggage claim.	Virtual	X	X	X	X		
A-BC.07	Dynamic signage at each carousel lists the flight(s) assigned to it. If carousel signage does not allow close approach by passenger, e.g., is placed in the center of carousels, font size and contrast allow easy viewing from a distance.	Virtual	X					
A-BC.08	Flat carousels without a raised edge to keep bags on the belt require less physical effort and are more universally accessible.	Visual	X	X	X	X	ACRP Synthesis 51	
A-BC.09	Carousels have a designated area for persons with disabilities or others who need assistance in retrieving their bags.	Visual	X		X	X	Example, Barcelona-El Prat	
A-BC.10	Baggage handlers are available to provide assistance in retrieving and transporting checked luggage.	Verbal	X	X	X	X		
A-BC.11	Airline service company staff are available to help retrieve and provide assistance with checked baggage to a curbside/ground service connection (or other terminal for connecting flight).	Verbal	X	X	X	X	14 CFR Part 382.91	
A-BC.12	Luggage carts, free or fee-based, are available at central locations in the baggage claim area.	Visual	X	X	X	X		
A-BC.13	Seating areas are available near carousels for those waiting for checked luggage.	Visual	X	X	X	X		
A-BC.14	Accessible men's, women's, and companion restrooms are available in the baggage claim area and have appropriate directional and identification signage.	Visual	X	X	X	X		
A-BC.15	Accessible facilities for reporting lost or damaged luggage or assistive device, are available in the baggage claim area and have appropriate directional and identification signage.	Verbal	X	X	X	X		
A-BC.16	Lost or damaged luggage or assistive devices can be reported via mobile application, website, and phone as well as in person.	Virtual	X	X	X	X		
A-BC.17	A CRO is available in person or remotely (e.g., by phone, TTY, text) to resolve issues involving damage or loss of an assistive device.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153.	
A-BC.18	BIDSs are located at baggage claim entrance.	Visual Virtual	X	X	X	X		
Section 6.4: Lobby Area (LA)								
A-LA.01	Directional signage leads from baggage claim to information desk, ground transportation counters, and other points of interest and to ground transportation pick-up areas and SARAs outside terminal or on departures level.	Visual	X	X	X	X		
A-LA.02	An accessible information desk is available to assist passengers with ground transportation, hotels, etc.	Verbal Visual	X	X	X	X		
A-LA.03	The information desk has prominent identification signage with a pictogram.	Visual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-LA.04	Staff have disability awareness training and computer access to airport access database.	Verbal Virtual	X	X	X	X		
A-LA.05	Staff is fluent in English and other local languages and has access to interpreters for many languages through means such as the AT&T language line.	Verbal Virtual	X	X	X	X		
A-LA.06	The information desk has video remote interpreting service.	Virtual Verbal		X				
A-LA.07	A counter induction loop is in place for persons who have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.	Verbal		X				
A-LA.08	Correctly oriented “You Are Here” illuminated maps and directories for arrival-level facilities, ground transportation pick-up locations, and SARAs are located near the information desk and inside each terminal entrance.	Visual Virtual	X	X	X	X		
A-LA.09	Seating areas, with some seats designated as disability priority, are located near the information desk and terminal entrances.	Visual	X	X	X	X		
A-LA.10	The shuttle kiosk (for hotels, rental car companies, etc.) has a TTY as well as phone. Phone numbers for all free shuttles serving the airport are provided in the airport mobile application, if there is one.	Visual Virtual	X	X	X	X		
A-LA.11	Where public pay phones are provided, ADA requirements for wheelchair-accessible phones, volume control, and TTYs are also met.	Virtual	X	X	X	X	2010 ADAAS 217 and 704	
A-LA.12	ATMs meet ADA accessibility standards.	Virtual	X	X	X	X	2010 ADAAS 707	
A-LA.13	Ground transportation counters (e.g., rental cars, paid bus and van shuttle services) meet ADA accessibility standards.	Visual				X	2010 ADAAS 207	
A-LA.14	Directional signage indicates the specific terminal exit to use for each mode of ground transportation and for SARAs.	Visual	X	X	X	X		
A-LA.15	Directional signage is also in place for any modes of transportation that pick up from/connect to a different level of the terminal.	Visual	X	X	X	X		
A-LA.16	Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.	Visual	X	X	X	X	2010 ADAAS 206.3	
A-LA.17	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
A-LA.18	Primary exit doors have clear identification of terminal and level and have a unique door number.	Visual	X		X	X		
Section 6.5: Ground Transportation (GT)								
A-GT.01	Accessible pick-up points for people with disabilities have been designated by the airport; are included in the access database and on web, mobile and terminal maps; and are signed for easy viewing from roadways and by passengers waiting for pick-up.	Visual Virtual	X	X	X	X	Passenger loading zones scoping and design: 2010 ADAAS 209 and 503	
A-GT.02	There is a designated pick-up point for motor coaches to meet tour groups and deploy a lift as needed.	Visual	X	X	X	X		
A-GT.03	SARAs are located as close as possible to terminal exit doors and have appropriate directional and identification signage.	Visual	X	X	X	X		
A-GT.04	Walking surfaces are stable, firm, and slip-resistant and have no openings more than 1/2”.	Visual	X	X	X	X	2010 ADAAS 302.3	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-GT.05	Visual and auditory signals are in place at pedestrian crossings with traffic lights, with adequate crossing time for those who move more slowly.	**Visual Virtual**	X	X	X	X		
A-GT.06	Where there are no signals, pedestrian crossing signs are prominently displayed for drivers and pedestrians. Raised pedestrian crossings help to slow traffic while providing level access. Speed bump signage and road markings should be in place.	**Visual**	X	X	X	X		
A-GT.07	Pedestrian crossings have higher illumination levels and/or different colors.	**Visual**	X	X	X	X		
A-GT.08	Detectable warnings are in place at curb ramps and marked crosswalks.	**Visual**	X		X?		*DOT ADA Standards (2006) 406.8 NPRM Public Rights of Way*	
A-GT.09	If sidewalk is flush with roadway, detectable warnings are in place along the edge.	**Visual**	X		X?			
A-GT.10	At least one accessible route is provided from the terminal to accessible parking spaces and accessible passenger loading zones, sidewalks, and public transportation stops.	**Visual**	X	X	X	X	2010 ADAAS 206.2.1	
A-GT.11	Air carriers or their contracted service companies provide assistance to all curbside pick-up points.	**Verbal Virtual**	X	X	X	X	14 CFR Part 382.91. DOT FAQ 28 *http://www.dot.gov/airconsumer/frequently-asked-questions-may-13-2009*	
A-GT.12	Directional and identification signs have fonts that are easily read, have good contrast, are non-glare, and allow close approach wherever possible.	**Visual**	X	X	X	X	2010 ADAAS 703	
A-GT.13	Identification signs for each mode of transportation are prominently displayed for both drivers and pedestrians.	**Visual**	X	X	X	X		
A-GT.14	Where specific hotels, parking lots, or rental car companies are assigned a particular pick-up point (rather than all hotels at one point, all rental cars at another, etc.), a directory is provided inside the terminal and at each location (e.g., Marriott, Hilton – Stop A; Embassy Suites, Sheraton – Stop B).	**Visual Virtual**	X	X	X	X		
A-GT.15	Airport staff are available curbside to provide information and directions.	**Verbal**	X	X	X	X		
A-GT.16	Seating areas, with some seats designated as disability priority, are provided near transportation stops.	**Visual**	X	X	X	X		
A-GT.17	Where bus shelters are provided, they meet ADA accessibility standards.	**Visual**	X	X	X	X	2010 ADAAS 810	
A-GT.18	Transportation systems/vehicles provided by or contracted by the airport meet ADA Standards.	**Visual**	X	X	X	X	49 CFR Part 37, Part 38	
A-GT.19	Fee-based private shuttles (bus and van) serving the airport meet ADA Standards. Where there is more than one route per stop, the destination of each vehicle is clearly announced.	**Visual**	X	X	X	X	49 CFR Part 37, Part 38	
A-GT.20	At taxi stands, people with disabilities can go to the head of the line, and a priority access sign with wheelchair symbol is in place at head of queue/dispatch stand.	**Visual Verbal**	X		X	X		
A-GT.21	Where accessible taxis are available, a system is in place and dispatchers are trained to give priority to those vehicles to persons who use wheelchairs or have large service animals.	**Verbal**	X	X	X	X		
A-GT.22	Remote ground transport pick-up locations are identified on airport maps and on website and mobile application.	**Virtual**	X	X	X	X		
A-GT.23	Wheelchair and escort assistance (including help with luggage) is available from airline or service company to remote pick-up points.	**Verbal**	X	X	X	X	14 CFR Part 382.91. DOT FAQ 28 *http://www.dot.gov/airconsumer/frequently-asked-questions-may-13-2009*	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-GT.24	Staff member is on hand to direct passengers, e.g., at AirTrain stations.	Verbal	X	X	X	X	Examples: JFK, EWR	
A-GT.25	There is at least one accessible route from airport terminals to remote pick-up points with each element (walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADAAS.	Visual	X			X	2010 ADAAS 206.2.1	
A-GT.26	There are no objects protruding more than 4" into the path of travel that are not cane detectable (lower edge 27" or less above finished floor), e.g. fire extinguishers, pay phones, drinking fountains.	Visual	X				ADAAS 307	
A-GT.27	Overhead clearance is 80" minimum, and unenclosed stairs or escalators have a rail or barrier underneath.	Visual	X	X	X	X	ADAAS 307.4	
A-GT.28	Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path.	Visual	X	X	X	X	No ADA standard. Building and Construction Authority. Code on Barrier-Free Accessibility In Buildings, Singapore, 2002, recommends seating areas no more than 30 m (328 ft) apart.	
A-GT.29	Directional signs to guide travelers to different modes of transportation/pick-up points are located at frequent intervals and at any decision points en route.	Visual	X	X	X	X		
A-GT.30	Directional signs have large, unadorned, illuminated fonts.	Visual	X	X	X	X		
A-GT.31	Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.	Visual			X			
A-GT.32	Identification signs are visual and tactile, i.e., have raised characters and Braille, and are correctly positioned.	Visual	X	X	X	X	2010 ADAAS 703	
A-GT.33	Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.	Visual	X	X	X	X		
A-GT.34	Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.	Visual	X	X	X	X	2010 ADAAS 206.3	
A-GT.35	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
A-GT.36	Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.	Visual	X	X	X	X	2010 ADAAS 407, 408, 409, 708	
A-GT.37	Audible indicators outside elevators are loud enough to be heard over ambient noise.	Visual	X	X	X	X		
A-GT.38	Accessible means of egress (e.g., evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) are available and have appropriate identification and directional signage.	Visual	X	X	X	X	International Building Code (IBC)-2000 (including 2001 Supplement to the International Codes) and IBC-2003	
A-GT.39	Detectable warnings are in place at curb ramps, marked crosswalks, and wherever the accessible route crosses vehicular roadways in parking structures.	Visual	X		X?		*DOT ADA Standards (2006) 406.8* *NPRM Public Rights of Way*	
A-GT.40	Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.	Visual	X	X	X	X		
A-GT.41	An audible signal alerts passengers to the end of moving walkways.	Visual	X	X	X	X		
A-GT.42	Emergency communications equipment is provided at strategic locations wherever potential security or safety threats may exist and is identified by visual and tactile signage. Locations are noted in the access database and mobile application, if any.	Virtual	X	X	X	X	Standard for two-way communications system 2010 ADAAS 708	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-GT.43	Seating areas, with some seats designated as disability priority, are provided at transportation stops.	Visual	X	X	X	X		
A-GT.44	Accessible men's, women's, and companion restrooms and drinking fountains are available near the remote pick-up location or en route and have appropriate directional and identification signs.	Visual						
A-GT.45	Where bus shelters are provided, they meet ADA accessibility standards.	Visual				X	2010 ADAAS 810	
A-GT.46	Airport or ground transportation staff are on hand at stations/stops to provide information or directions *or* a courtesy phone/kiosk is available.	Verbal Virtual	X	X	X	X		
A-GT.47	Fare machines meet ADA accessibility standards, or cash fares can be paid to the driver.	Virtual Verbal	X	X	X	X	2010 ADAAS 707	
Section 6.6: Rental Car (RC)—On-Site and Remote								
A-RC.01	There is at least one accessible route from the rental car facility to airport terminal.	Visual	X	X	X	X		
A-RC.02	Directional signs are in place from the rental car drop-off area to the closest terminal entrance.	Visual	X	X	X	X		
A-RC.03	Facility entrances, paths of travel, counters, and other features meet ADA Standards.	Visual	X	X	X	X		
A-RC.04	An accessible means of transport links the rental car facility with airport terminals, e.g., shuttle bus or automated people mover.	Visual	X	X	X	X		
Section 6.7: Parking (PK)								
A-PK.01	Accessible parking spaces in parking lots and parking garages adjacent to the terminal are connected by an accessible path of travel to terminal entrances with each element (e.g., walking surfaces, ramps, lifts, elevators, doors, etc.) meeting either 1991 or 2010 ADAAS.	Visual				X		
A-PK.02	Accessible parking spaces are located on the shortest possible route(s) to accessible terminal entrance(s) and dispersed if there is more than one accessible entrance.	Visual				X	2010 ADAAS 208.3.1	
A-PK.03	All accessible van spaces may be grouped on one level in a multi-car parking facility.	Visual				X	2010 ADAAS 208.3.1	
A-PK.04	All accessible parking locations are identified in the airport access database, on maps, and in the mobile application, if any.	Visual				X		
A-PK.05	The number of accessible van and car spaces meets minimum local, state, or federal scoping (whichever is highest) and standards for size and identification signage.	Visual				X	2010 ADAAS 208.2	
A-PK.06	Directional signs are in place from the terminal entrance to adjacent parking garage and parking lots.	Visual		X	X	X	2010 ADAAS 703	
A-PK.07	Parking fare machines meet ADA accessibility standards.	Virtual	X	X	X	X	2010 ADAAS 707	
A-PK.08	The signage system in parking garages and lots allows drivers to easily locate their vehicle or a car finder application is available.	Visual Virtual		X	X	X		
A-PK.09	Directional signs to parking exits are in easy view for drivers.	Visual						
A-PK.10	Drive-through fare machines are accessible to persons with limited use of arms/hands, or a staffed booth is available.	Visual Verbal				X	2010 ADAAS 707	
A-PK.11	Accessible parking spaces are on the shortest possible accessible route to shuttle bus stops, automated people mover station, or other accessible means of transportation linking parking lots to airport terminals.	Visual				X	2010 ADAAS 208.3.1	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-PK.12	The number of accessible van and car spaces in remote lots meets minimum local, state, or federal scoping (whichever is highest) and ADA Standards for size and identification signage.	**Visual**				X	2010 ADAAS 208.2	
A-PK.13	Accessible parking spaces do not have to be provided in each parking facility on the site but must have equivalence in terms of distance, parking fees, and user convenience.	**Visual**				X	2010 ADAAS 208.3.2	
A-PK.14	Transportation systems/vehicles provided by or contracted by the airport meet ADA Standards.	**Visual**	X	X	X	X	49 CFR Part 37, Part 38	
A-PK.15	Shuttle stops and shelters meet ADA accessibility standards.	**Visual**				X	2010 ADAAS 810	
A-PK.16	Directional signs to parking exits are in easy view for drivers.	**Visual**		X	X	X		
A-PK.17	Drive-through fare machines are accessible to persons with limited use of arms/hands, or a manned booth is available.	**Visual** **Verbal**				X	2010 ADAAS 707	
Section 6.8 International Flights (IN) / 6.8.1 Immigration								
A-IN.01	Single route leads from arrival gate to Immigration.	**Visual**	X	X	X	X		
A-IN.02	Airline service provider meets plane and provides wheelchair assistance or escort from seat or door of plane, as needed, to immigration.	**Verbal**	X	X	X	X	14 CFR Part 382.91	
A-IN.03	In case of ad hoc request(s), airline or service agent calls for additional personnel to provide assistance.	**Verbal**	X	X	X	X		
A-IN.04	Passenger's wheelchair, if any, is returned at door of plane. For mobility equipment stowed as cargo, elevator or lift near jet bridge allows prompt delivery from tarmac.	**Visual** **Verbal**				X	14 CFR Part 382.125(c)	
A-IN.05	A CRO is available in person or remotely (e.g., by phone, TTY, text) to resolve issues involving damage or loss of an assistive device, assistance in the terminal, etc.	**Verbal**	X	X	X	X	14 CFR Part 382.151, 382.153. CROs must be made available at any point in the traveler's trip when a disability-related problem arises as well as during the reservation and booking process.	
A-IN.06	Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path, unless not permitted by the TSA.	**Visual**	X	X	X	X	No ADA standard. Building and Construction Authority. *Code on Barrier-Free Accessibility In Buildings*, Singapore, 2002, recommends seating areas no more than 30 meters (328 feet) apart.	
A-IN.07	Corridors and hallways are evenly Illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.	**Visual**	X	X	X	X		
A-IN.08	Accessible routes coincide with or are located in the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.	**Visual**	X	X	X	X	2010 ADAAS 206.3	
A-IN.09	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	**Visual**	X	X	X	X		
A-IN.10	Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floor is preferable to beeping sound.	**Visual**	X	X	X	X	2010 ADAAS 407, 408, 409, 708	
A-IN.11	Audible indicators outside elevators are loud enough to be heard over ambient noise.	**Visual**	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-IN.12	There are no objects protruding more than 4” into the path of travel that are not cane detectable (lower edge 27” or less above finished floor), e.g., fire extinguishers, pay phones, drinking fountains.	**Visual**	X				2010 ADAAS 307	
A-IN.13	No overhead clearance is less than 80” and there are no unenclosed stairs or escalators without a rail or barrier underneath.	**Visual**	X	X	X	X	2010 ADAAS 307.4	
A-IN.14	Accessible men’s and women’s restrooms and companion restroom, appropriately signed, and drinking fountains are available in or before immigration area.	**Visual**	X	X	X	X		
A-IN.15	There are dedicated lanes for employees and people with disabilities or staff direct people with disabilities and those who self-identify as such to front of line.	**Visual Verbal**	X	X	X	X		
A-IN.16	Where available, signs indicate lanes for employees and people with disabilities. This benefits those not being escorted, especially those with hidden disabilities.	**Visual**	X	X	X	X		
A-IN.17	Accessible passport kiosks enable U.S. passengers to scan passport and customs forms and print a receipt to show officers.	**Virtual**	X	X	X	X		
A-IN.18	Staff are on hand to assist people with disabilities and others unfamiliar with the passport kiosks.	**Verbal**	X	X	X	X		
A-IN.19	Mobile Passport Application enables U.S. passengers to submit passport information and customs declaration forms electronically and receive an electronic receipt to show officers.	**Virtual**	X?	X	X?	X	Application not yet accessible for passengers who are blind at time of report publication. Not tested by passengers with cognitive disabilities	
Section 6.8 International Flights (IN) / 6.8.2 Baggage Claim								
A-IN.20	The route leads directly from immigration to baggage claim.	**Visual**	X	X	X	X		
A-IN.21	An accessible directory (large font, high contrast, and hung at eye level for close approach) lists arriving flights and carousel assignments.	**Virtual**	X	X	X	X		
A-IN.22	Baggage claim information is sent by text message *or* passenger can check carousel location via mobile application after arrival.	**Virtual**	X	X	X	X		
A-IN.23	Airport or airline staff are available to give information/directions.	**Verbal**	X	X	X	X		
A-IN.24	Dynamic signage at each carousel lists the flight(s) assigned to it.	**Virtual**	X	X	X	X		
A-IN.25	If carousel signage does not allow for close approach by passenger, e.g., is placed in the center of carousels, font size and contrast allow easy viewing from a distance.	**Virtual**	X	X	X	X		
A-IN.26	Flat carousels without a raised edge to keep bags on the belt require less physical effort and are more universally accessible.	**Visual**	X	X	X	X	ACRP Synthesis 51	
A-IN.27	Carousels have a designated area for persons with disabilities or others who need assistance in retrieving their bags.	**Visual**	X		X	X	Example, Barcelona-El Prat	
A-IN.28	Baggage handlers are available to provide assistance in retrieving and transporting checked luggage.	**Verbal**	X	X	X	X		
A-IN.29	Airline service company staff help retrieve and provide assistance with checked baggage to a curbside/ground service connection (or other terminal for a connecting flight).	**Verbal**	X	X	X	X	14 CFR Part 382.91	
A-IN.30	Luggage carts, free or fee-based, are available at central locations in the baggage claim area.	**Visual**	X	X	X	X		
A-IN.31	Seating areas are available near carousels for those waiting for checked luggage.	**Visual**	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
A-IN.32	Accessible men's, women's, and companion restrooms are available in the baggage claim area and have appropriate directional and identification signage.	Visual	X	X	X	X		
A-IN.33	Accessible facilities for reporting lost or damaged luggage or assistive devices are available in the baggage claim area or after exiting customs and have appropriate directional and identification signage.	Verbal	X	X	X	X		
A-IN.34	Lost or damaged luggage or assistive devices can be reported via mobile application, website, or phone as well as in person.	Virtual	X	X	X	X		
A-IN.35	A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve issues involving damage or loss of an assistive device.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153.	
A-IN.36	Directional signage to the customs and baggage claim exit is prominently displayed (in view from all carousels).	Visual	X	X	X	X		

Chapter 7

Wayfinding Accessibility
Audit Checklist

CONNECTING PASSENGER (C)

Section 7.1: Airline Support (AS)

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
C-AS.01	Gate numbers are provided onboard the aircraft by flight attendants or by agents in the gate area after arrival, verbally or visually as needed.	Verbal	X	X	X	X	14 CFR Part 382.69, 382.119	
C-AS.02	Gate numbers are sent by text message, or passengers can check flight information via mobile phone after arrival.	Virtual	X	X	X	X		
C-AS.03	Passengers consult the nearest FIDS after exiting the arriving gate.	Virtual	X	X	X	X		
C-AS.04	Agents give directions to the connecting gate.	Verbal	X	X	X	X		
C-AS.05	Passengers use a mobile application, if there is one, for directions/route to the connecting gate.	Virtual	X	X	X	X		
C-AS.06	Airline service employees provide wheelchair assistance or escort from the seat or the door of the plane, as needed, to the connecting gate. Service by electric cart replaces wheelchair service for ambulatory passengers in some airports.	Verbal	X	X	X	X	14 CFR Part 382.91	
C-AS.07	In case of ad hoc request(s), an airline or service agent calls for additional personnel to provide assistance.	Verbal	X	X	X	X		
C-AS.08	Passenger wheelchairs are returned at the door of the plane. For those stowed as cargo, an elevator or lift near the jet bridge allows prompt delivery from the tarmac.	Verbal				X	14 CFR Part 382.125(c)	
C-AS.09	In case of flight cancellation, the rebooking center is accessible with either a ticket agent or phone instead of/in addition to an inaccessible touch-screen kiosk. Alternatively, passengers can rebook by airline mobile application.	Virtual Verbal	X	X	X	X		
C-AS.10	Where possible, passengers with disabilities are given priority in rebooking.	Verbal	X	X	X	X	In Europe, priority is mandated under EC 261/2004.	
C-AS.11	A counter induction loop is installed at one rebooking counter, with priority access for persons who are hard of hearing and have hearing aids or cochlear implants with T-coils. A hearing loop graphic sign is displayed on the counter.	Verbal		X				
C-AS.12	Rebooking centers have appropriate directional and identification signage and appear on maps/directories.	Visual Virtual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
C-AS.13	Staff from the airline service company are recalled by gate agents to provide an escort to the rebooking center and the new gate.	Verbal	X	X	X	X		
C-AS.14	Gate agents direct passengers to rebooking centers.	Verbal						
C-AS.15	A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153.	
Section 7.2: Gate Area (GA)								
C-GA.01	At major decision points, multisensory destination/directional information is provided via a map, kiosk, or information booth.	Visual Virtual Verbal	X	X	X	X		
C-GA.02	Directional and identification signs have fonts that are easily read, good contrast, non-glare, and allow close approach wherever possible.	Visual	X	X	X	X	2010 ADAS 703	
C-GA.03	Directional and identification signs include pictograms to aid comprehension by persons with intellectual disabilities and international travelers.	Visual			X			
C-GA.04	Identification signs are visual and tactile, i.e., have raised characters and Braille, and are correctly positioned.	Visual	X	X	X	X	2010 ADAS 703	
C-GA.05	Directional signs have large, unadorned, illuminated fonts.	Visual	X	X	X	X		
C-GA.06	FIDSs are located at frequent intervals along concourses.	Virtual	X	X	X	X		
C-GA.07	FIDSs are hung at eye level for close approach, with larger fonts, good contrast, and a slower refresh rate.	Virtual	X	X	X	X		
C-GA.08	FIDS information is available via a mobile application or verbally via a dedicated telephone number.	Virtual	X	X	X	X		
C-GA.09	Visual paging is available at frequent intervals along concourses, e.g., built into FIDSs. Pages may also be provided on the airport website or via a mobile application.	Virtual		X			Example: MSP posts all pages on its website.	
C-GA.10	The paging system allows passengers to request audible or visual page by phone, text, or email.	Virtual Verbal	X	X	X	X		
C-GA.11	Courtesy phones are located at regular intervals along the concourse, including at major decision points, and identified by visual and tactile signage.	Verbal	X	X	X	X		
C-GA.12	Directional signage for gate numbers is located at regular intervals, at all entrances onto the concourse from security, and at all decision points/nodes.	Visual	X	X	X	X		
C-GA.13	Signs indicating the direction to baggage claim/terminal exit are located at frequent intervals and outside restrooms.	Visual	X	X	X	X		
C-GA.14	Good lines of sight allow travelers to see a series of gate numbers along the concourse, i.e., gate numbers are not blocked by other signage or architectural elements.	Visual	X	X	X	X		
C-GA.15	Gate numbers follow a regular pattern, e.g., even on left, odd on right.	Visual	X	X	X	X		
C-GA.16	Seating areas for resting, with some seats signed for disability priority, are provided at frequent intervals and located out of the circulation path, e.g., where there are long corridors not adjoining holding areas.	Visual	X	X	X	X	No ADA standard. Building and Construction Authority. *Code on Barrier-Free Accessibility In Buildings,* Singapore, 2002, recommends seating areas no more than 30 m (328 ft) apart.	
C-GA.17	Differences in floor texture and color help provide an edge for wayfinding and distinguish the concourse walkway from holding areas.	Visual	X		X?			
C-GA.18	Detectable floor surface changes (color, texture) are in place at approaches to escalators, moving walkways, and stairs.	Visual	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
C-GA.19	Corridors and hallways are evenly illuminated with gradual transitions from dark to bright spaces, especially those that have high levels of natural light.	Visual	X	X	X	X		
C-GA.20	Accessible routes coincide with, or are located in, the same area as general circulation paths. Elevators and lifts must be in the same area as stairs and escalators.	Visual	X	X	X	X	2010 ADAAG 206.3	
C-GA.21	Where elevators are not near or in sight of stairs and escalators, directional signage is provided.	Visual	X	X	X	X		
C-GA.22	Elevators meet ADA Standards for signage, controls, visible and audible indicators, two-way communication systems, etc. Announcement of floors is preferable to a beeping sound.	Visual	X	X	X	X	2010 ADAS 407, 408, 409, 708	
C-GA.23	There are no objects protruding more than 4" into the path of travel that are not cane detectable (lower edge 27" or less above finished floor), e.g. fire extinguishers, pay phones, drinking fountains.	Visual	X				2010 ADAS 307	
C-GA.24	Overhead clearance is 80" minimum, and there are no unenclosed stairs or escalators without a rail or barrier underneath.	Visual	X	X	X	X	2010 ADAS 307.4	
C-GA.25	An audible signal alerts passengers to the end of moving walkways.	Visual	X	X	X	X		
C-GA.26	Accessible means of egress (evacuation elevators, areas of safe refuge, exit stairways, horizontal exits, etc.) have appropriate identification and directional signage in view from concourse walkways and/or holding rooms.	Visual	X	X	X	X	*International Building Code* (IBC)-2000 (including 2001 *Supplement to the International Codes*) and IBC 2003	
C-GA.27	Signs at exit doors and areas of safe rescue are tactile as well as visual. Instructions for summoning assistance in areas of safe rescue are also tactile with an accessible two-way communication system in place.	Visual Virtual Verbal	X	X	X	X	2010 ADAS 216.4, 703.1, 703.2, 703.5, 708	
C-GA.28	Airport, airline, and concessions staff have training on the Airport Evacuation Plan (AEP) and how to assist passengers with disabilities in case of emergency.	Verbal	X	X	X	X	ACRP Reports 112, 73, 95	
C-GA.29	Visual and audible signaling systems are under central control to help direct people along best route. Push notification sends emergency information and directions to mobile phones.	Visual Virtual	X	X	X	X		
C-GA.30	Correctly oriented "You Are Here" illuminated map with large font designed for close approach shows connecting gate information and facilities and services on the airside.	Visual	X	X	X	X		
C-GA.31	Where people movers to or along the concourse are optional, dynamic signage indicates flights or gates for which the tram or monorail ride is recommended. Walking times/distances are provided.	Virtual	X	X	X	X	Example: FIDSs at DTW display a tram icon for flights from distant gates.	
C-GA.32	Station and other announcements on the automated people mover are both visual and virtual.	Virtual	X	X	X	X	Example, MCO	
C-GA.33	A designated seating area and wheelchair area with grab bar are provided in the cars.	Visual	X	X	X	X		
C-GA.34	Effective directional signage is in place, especially where a level change is involved.	Visual	X	X	X	X		
C-GA.35	On long concourses, maps with point-of-interest directories are placed at regular intervals.	Virtual	X	X	X	X		
C-GA.36	SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.	Visual	X	X	X	X	FAA standards for SARAs in the secure zone and that specify a maximum walking distance are under development.	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
C-GA.37	An airport information desk or international Traveler's Aid counter offers video remote interpretingservice.	Virtual Verbal		X			Example, SFO	
C-GA.38	Restrooms, companion restrooms, and drinking fountains are grouped at frequent intervals along concourses, with men's and women's facilities in a standard relation to each other, e.g., men's to left of women's.	Visual	X	X	X	X		
C-GA.39	Restaurants, food kiosks, and convenience stores are distributed along concourses to provide close access from all gates.	Visual	X	X	X	X		
C-GA.40	Restaurant menus are in large print, Braille, or posted in an accessible format online.	Visual Virtual	X				28 CFR Part 36.303	
C-GA.41	For electronic menus, e.g., on an iPad, accessibility features such as VoiceOver are enabled and the device allows close approach for easyviewing.	Virtual	X					
C-GA.42	Restaurants that have wall menus also have a large print copy available on request.	Visual	X					
C-GA.43	Restaurant staff will read the menu.	Verbal						
C-GA.44	Restaurant staff willingly accommodate service animals.	Verbal	X	X	X	X	28 CFR Part 36.302	
C-GA.45	Aisles in stores and spaces between tables in restaurants have a clear width of 36".	Visual	X			X	2010 ADAS 403.5.1	
C-GA.46	Restaurant and retail staff have disability awareness training including how to guide people who are blind.	Verbal	X	X	X	X		
C-GA.47	VIP lounges are fully accessible, have appropriate directional and identification signage, and are identified on the airport access database, maps, and directories.	Visual	X	X	X	X		
C-GA.48	SARAs available airside are centrally located to minimize walking times, have appropriate directional and identification signage, and appear on maps/directories.	Visual	X	X	X	X	49 CFR Part 27.71. Also see FAA Draft Advisory Circular AC-150/5360-14A, Appendix A for proposed standards for SARAs.	
C-GA.49	Where SARAs are only available landside, service companies provide escort or wheelchair assistance out and then back through security.	Verbal	X	X	X	X	14 CFR Part 382.91	
C-GA.50	A TSA policy is in place to allow people traveling with service/emotional support animals to bypass the line on return.	Verbal	X	X	X	X		
C-GA.51	Gate agents provide confirmation that the passenger is at the correct gate as well as expected boarding and departure time.	Verbal	X	X	X	X		
C-GA.52	The quality of the PA system and terminal acoustics allow announcements in the gate area to be easily understood.	Visual	X	X	X	X		
C-GA.53	Gate areas have induction loops to allow PA announcements to be transmitted directly to persons using hearing aids with T-coils or cochlear implants. Graphic signage alerting passengers to the presence of the hearing loop is displayed on the podium.	Verbal		X				
C-GA.54	There is a general pre-boarding announcement for people with disabilities or personal notification by gate agents for those who self-identify as needing to pre-board.	Verbal	X	X	X	X	14 CFR Part 382.93	
C-GA.55	GIDSs have real-time information, including which rows are boarding.	Virtual		X	X	X		
C-GA.56	Passengers with sensory disabilities who self-identify must be provided prompt access to information provided other passengers, personally by the gate agent if no other means is employed, e.g., GIDS, text message, PA system, etc.	Verbal Virtual	X	X			14 CFR Part 382.53	

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
C-GA.57	Accessible recharging stations are available in the gate area for mobile devices and assistive equipment.	Visual	X	X	X	X		
C-GA.58	TV monitors have high-contrast closed captioning enabled.	Virtual		X			14 CFR Part 382.51	
C-GA.59	Visual paging is built into TV monitors.	Virtual		X				
C-GA.60	A designated seating area for people with disabilities is located near the podium or boarding gate.	Visual	X	X	X	X		
C-GA.61	Airline or service company personnel assist passengers with disabilities to the door of the plane or seat, as needed.	Verbal	X	X	X	X		
C-GA.62	Boarding bridge slopes should be as gentle as possible, with handrails at transitions and minimal gap/step into plane.	Visual	X	X	X	X	FAA Advisory Circular 150/5220-21C Aircraft Boarding Equipment	
C-GA.63	Passenger wheelchairs may be used until the door of plane, then gate-checked for stowage as cargo or if a manual chair or walker, may be stowed in the cabin on a first-come, first-serve basis. An elevator or lift near the jet bridge allows timely transfer of wheelchairs to the tarmac for stowage.	Verbal				X	14 CFR Part 382 Subpart I – Stowage of Wheelchairs, Other Mobility Aids, and Other Assistive Devices	
C-GA.64	A CRO is available in person or remotely (by phone, TTY, text, etc.) to resolve disability-related issues involving requested accommodations, assistive devices, carry-on baggage, denied boarding, etc.	Verbal	X	X	X	X	14 CFR Part 382.151, 382.153.	
Section 7.3: Terminal Transportation (TT)								
C-TT.01	Shuttle vans operating between concourses for customer convenience are accessible, have appropriate directional and identification signage, and are identified in the access database and on airport maps.	Verbal Visual	X	X	X	X		
Section 7.4: Airline Support (AS)—Same Terminal, Different Airline								
C-AS.16	Gate numbers are sent by text message from the departing carrier, or passengers check flight information via mobile phone after arrival.	Virtual	X	X	X	X		
C-AS.17	Passengers can consult nearest FIDS for connecting flight information after exiting the arriving gate.	Virtual						
C-AS.18	Agents give directions to the connecting gate.	Verbal	X	X	X	X		
C-AS.19	Passengers use a mobile application, if any, for directions/route to the connecting gate.	Virtual						
C-AS.20	Airline service employees provide wheelchair assistance or escort from the seat or door of the plane, as needed, to the connecting gate. Service by electric cart replaces wheelchair service for ambulatory passengers in some airports.	Verbal	X	X	X	X	14 CFR Part 382.91. Connecting assistance by arriving carrier is still required if the departing flight is on a different carrier. See also DOT FAQ 27: *http://www.dot.gov/airconsumer/frequently-asked-questions-may-13-2009.*	
C-AS.21	In case of ad hoc request(s), an airline or service agent calls for additional personnel to provide assistance.	Verbal	X	X	X	X		
C-AS.22	The passenger's wheelchair, if any, is returned at door of plane. For mobility equipment stowed as cargo, elevator or lift near jet bridge allows prompt delivery from tarmac.	Verbal				X	14 CFR Part 382.125(c)	
C-AS.23	In case of a missed or cancelled connection, the rebooking center for the departing carrier is accessible with either a ticket agent or phone instead of/in addition to an inaccessible touch-screen kiosk, or the traveler can rebook by mobile application.	Virtual Verbal	X	X	X	X		

REF #	Recommendations & Requirements	3Vs	Vision	Hearing	Cognition	Mobility	Standards Reference / Guidance	Completed
C-AS.24	Rebooking centers have appropriate directional and identification signage and appear on maps/directories.	**Visual Virtual**	X	X	X	X		
C-AS.25	Staff from the arriving carrier's service company will provide wheelchair service or escort to the departing carrier's rebooking center and new gate.	**Verbal**	X	X	X	X	14 CFR Part 382.91	
C-AS.26	Passengers locate rebooking center for departing carrier and route to it on a mobile application.	**Virtual**						
Remainder of passenger journey follows segment order listed above, beginning with ***Gate Area - Concourse***								

Connecting – Different Terminal:** If the passenger's departing flight is from another terminal, the arriving carrier must still provide connecting assistance to the passenger with a disability, either to the check-in counter or the gate, depending on the circumstance. For this scenario, see both the ***Arriving Passenger and ***Departing Passenger*** checklists. Means of transportation between terminals, if any, must meet ADA accessibility standards. To enable quicker and easier transfer of the passenger with both their carry-on and checked luggage, it may be advisable to have a dedicated shuttle van service between terminals, especially at large international airports where numerous passengers with disabilities are being assisted between domestic and international flights. Example: JFK.

APPENDIX B

Application Review Criteria

Requirement:		Good	Fair	Poor	Absent
A.	***Equitable Use***				
a.	*Utility:*				
i.	Useful for all travelers, rather than specified for certain age groups or differing abilities.				
b.	*Usability:*				
i.	Includes basic usability options (i.e. text to speech as default) to avoid stigmatizing users.				
ii.	Provides alternative means of inputting and outputting information (e.g., non-verbal) to ensure privacy.				
iii.	Appeals to the widest possible audience by providing preference options based on a wide range within each specific ability.				
iv.	Allows users to "hyper-personalize" the application via a user profile that accounts not just for their specific abilities but also preferences (e.g., family restrooms vs. wheelchair stall). This also requires that the level of facility detail built into the application data includes specifics such as family restroom vs. restroom.				
v.	The ability to plan in advance is very important to both persons with disabilities and older travelers. Wayfinding applications should allow users to map their routes before arriving at the airport and know both distances and approximate times needed to/from the gate. This both reduces anxiety and allows users to make an informed decision on whether, for example, wheelchair assistance is necessary.				
B.	***Flexibility in Use***				
a.	*Utility:*				
i.	Provide a choice in the way directions are given by using the device's accelerometer/magnetometer/gyroscope to deliver instructions using compass heading (e.g., "walk north 100 feet") or orientation ("walk straight 100 feet").				
ii.	For those who prefer cardinal directions, an easily accessed compass button is quite valuable.				
iii.	Provide alternative information systems (e.g., text, vibration, flashing light) for receiving airport announcements, particularly for travelers who cannot hear the public address system.				
iv.	Having a Bluetooth-controllable audio menu allowing for little hand use is helpful for travelers who are blind and those with limited manual dexterity.				
v.	Convey wayfinding information using as many multisensory cues as possible including tactile (floor or wall) information, colors, sounds, temperature, volume, and smell.				
vi.	Provide accessibility both with features provided by the operating system as well as interfaces with other wayfinding applications and other physical technologies such as Braille displays.				

Requirement:		Good	Fair	Poor	Absent
vii.	Allow users to move seamlessly from outdoor GPS navigation to the indoor navigation system provided by the airport application.				
b.	*Usability:*				
i.	Provide multimodal input methods such as touch screen (tap, lifting finger off screen), speech recognition, and gestures, including 3D touch gestures with use of fingers such as pinching and scrolling for magnification and navigation or hard-pressing to reveal more information about an item and 3D air gestures such as swipe, circle, or zoom that involve free movement in space.				
ii.	Provide choice in moving forward and back between screens including scrolling as well as touch buttons such as "forward/next" or arrows. Minimize required user interaction accuracy and precision by using buttons that are as large as possible.				
iii.	The application should be adaptable to a user's pace, such as letting the user control progress within the application so that they have adequate time to read the text for popups that appear. In other words, popups should not automatically disappear based on a timer or user physical progress—the dismissal of the popup should be controlled by the user.				
C.	***Simple and Intuitive Use***				
a.	*Utility:*				
i.	Terminology should be clear to users who are unfamiliar with map and navigation applications and should be consistent with standards of practice for similar applications.				
ii.	Naming conventions for airport destinations and terminology should be consistent with the context (e.g., should replicate, to the extent possible, terminology used in a specific airport). However, where an airport uses unfamiliar terms, in the case of ABIA "hydration station" instead of "water fountain," it may be necessary to also provide a more familiar term or description. Those who travel infrequently may also not be familiar with terms in common use in airports such as "concourse," "hammerhead," or "boarding area," or they might be confused about the meaning of "departures" and "arrivals"; so, simple explanations or pictograms may be needed.				
iii.	Applications should display information about alternative destinations (e.g., what's nearby) on a map and/or list, with descriptions of points of interest.				
iv.	Limit the information provided going through security as users typically put the mobile device away.				
v.	Allow for random access to destination directions to enable users to locate destinations in any order (e.g., restroom) rather than assuming that the departure gate is always the primary destination.				
vi.	To accommodate a wide range of wayfinding skills and information needs, routes and cues should be provided in a variety of ways, including turn-by-turn directions and overall route directions and alternative cues such as landmarks, points of interest, shorelines, and textures.				
vii.	A "look around" feature allows the traveler who is blind to self-orient and to learn locations as they travel. Pointing the phone in a particular direction elicits a list of points of interest located there and the distance to each. This could also be generated via a "what's around me" button, again providing specific directions to reach each nearby location.				
viii.	Another preferred feature for users who are blind allows "bread crumb" recording of routes so that one can ask for assistance in walking a specific, often repeated, route and then have it recorded for step-by-step use in future. Most of these routes are also reversible.				

Requirement:		**Good**	**Fair**	**Poor**	**Absent**
ix.	Provide information that will accommodate a wide range of abilities, such as highly detailed descriptions for users who are blind, a visual/map-based system for people who have hearing loss, and information on where to locate a wheelchair for people with ambulatory limitations.				
b.	*Usability:*				
i.	To eliminate unnecessary complexity, instructions should be direct, such as: "turn left in 10 feet at the concourse walkway and walk for 100 feet."				
ii.	Provide a menu button on each screen to allow random access to previous screens and application features (e.g. changing preferences) to avoid going back screen-by-screen in a linear manner or starting the application over from the beginning.				
iii.	The default for "usability" options such as text to speech should be basic preferences that are turned on, rather than hidden accessibility features that are turned off.				
iv.	Each screen should clearly specify its purpose and indicate what is on the next screen and what was on the previous screen, providing full context of where the user is within the application.				
v.	Icons should be familiar and consistent with user expectations and consistent with the design guidelines for the particular mobile phone platform.				
vi.	The function of all buttons should be clear and consistent with user expectations.				
vii.	To ensure that all users have access to all inputs and outputs, the default mode is to have all modalities turned on rather than forcing users to select those that they need and then limiting the types of modalities.				
viii.	To accommodate a wide range of literacy and language skills, directions and destinations should avoid unfamiliar terminology (e.g., points of interest to identify restrooms) or define context-specific terms (e.g., hydration station to identify water fountains) that are not commonly used.				
ix.	All features should be located in order of importance and consistent with the expectations, such as a menu at the top of the screen and "next" buttons at the bottom right of the screen.				
x.	Provide multimodal prompts and outputs, including visual, speech, audio (e.g., non-speech cues sounds), and tactile cues to provide feedback that confirms user inputs (e.g., preference selection) and actions during and after task completion. These prompts and outputs should be consistent with the accessibility design guidelines and implementation for each mobile phone platform.				
D.	***Perceptible Information***				
a.	*Utility:*				
i.	Provide multimodal prompts and feedback to provide orientation to the layout and one's location in the airport (i.e., a route map that identifies where the traveler is in the wayfinding process).				
ii.	Integrate an interactive map of the airport with spatial structure that is appropriate for conveying wayfinding-relevant information, including orientation, progress, and error correction in both visual and non-visual formats.				
iii.	When possible, incorporate live picture tagging (identification of what the device is pointing at) to describe location and differentiate elements in the environment.				
b.	*Usability:*				
i.	Provide simultaneous visual (e.g., icons, text, and color), audio, and tactile outputs for redundant cueing.				
ii.	Maximize contrast between foreground essential information (icons, text, etc.) and background (e.g., white or yellow on black, dark gray or blue).				

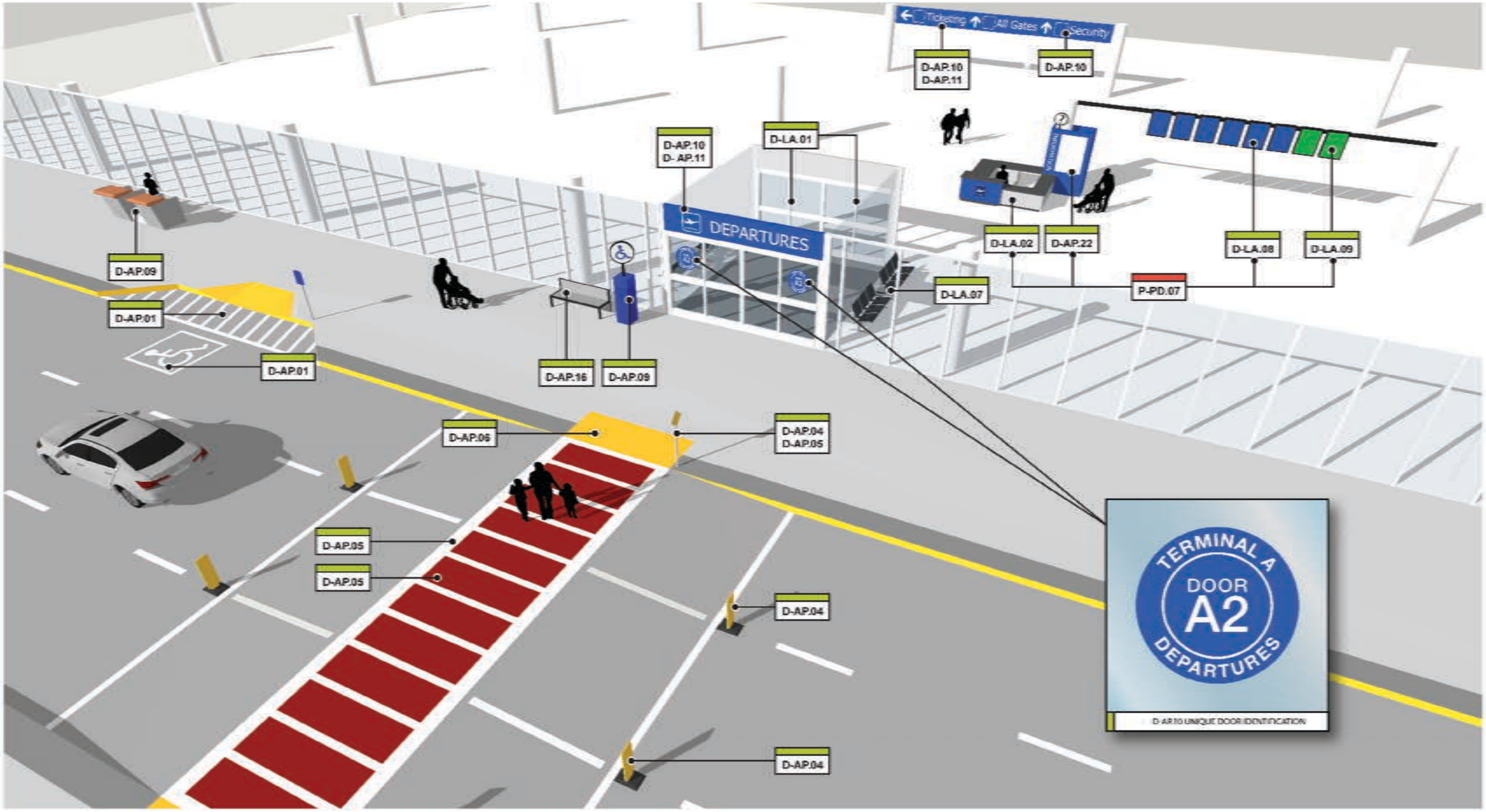
Requirement:		Good	Fair	Poor	Absent
iii.	Maximize legibility of essential information by making digital buttons and text as large as possible.				
iv.	Information should be obvious; when possible, and taking the device's zoom feature into consideration, all relevant information should fit on each screen to avoid scrolling down. When not possible it should be clear both visually and through text to speech that there is more information.				
v.	Provide alternate text color and size options to meet individual preferences and abilities.				
vi.	Use different vocal tones for different types of information, such as directions and landmarks.				
vii.	Provide compatibility with a variety of techniques or devices used by people with sensory limitations, such as ASL, voice recognition, or speech output.				
viii.	Geofencing is a technique that can be used such that when a user enters a particular space or passes by a particular landmark, they can be given a notification to validate the wayfinding route as they navigate the airport.				
E.	***Tolerance for Error***				
a.	*Utility:*				
i.	Provide visual, tactile, and/or audio warnings to identify errors during wayfinding. Also see note on geofencing above.				
ii.	Provide sensing capability to identify a traveler's current location and orientation on an interactive plan of the airport.				
iii.	Incorporate user tips to facilitate different phases of getting around the airport, such as preparing to go through security (have your ID out, wheelchair may cause delay, etc.), parking, accessing assistance, etc.				
iv.	Include map/interactive directional map to see progress and correct mistakes.				
v.	Add an auto timer for the user's flight departure to avoid missing one's flight.				
vi.	Alert travelers of arrival at their destination.				
vii.	Identify each gate that is passed along the route to discourage unconscious actions.				
viii.	Incorporate real-time data about closed facilities and services (like a security checkpoint) and include vertical transitions like escalators and elevators. The application should adjust wayfinding routes in real time to avoid routing a user to a closed facility.				
b.	*Usability:*				
i.	Provide fail-safe directions by ensuring that photographs and descriptions of destinations line up with the angle that the user will be facing.				
ii.	Provide visual, tactile, and/or audio verification outputs to affirm or confirm a selection (e.g., "Are you sure you want to choose 'find restroom?'").				
iii.	Provide sufficient and redundant detail in the directions such as number of feet and use of landmarks/signs/geofences to avoid errors.				
iv.	Provide redundant route details, including the provision of landmarks (e.g., "walk past the drinking fountain"), distance (e.g., "walk 20 feet until you reach the drinking fountain"), and compass directions.				
v.	Automatically select the units for distance based on the locale that the user has selected on the mobile device (e.g., use "imperial" for U.S. English locale), but also offer a manual option to choose metric or imperial.				
vi.	Provide redundant multimodal feedback to alert the user of their arrival at a destination.				
vii.	Understand and anticipate that the user may be interrupted during navigation and need to close and re-open the application (e.g., when going through security checkpoints or switching to another application to scan a ticket).				

Requirement:		**Good**	**Fair**	**Poor**	**Absent**
F.	***Low Physical Effort***				
a.	*Utility:*				
i.	Wayfinding information should be appropriate for a user's abilities.				
b.	*Usability:*				
i.	The interface should be appropriate for a user's abilities.				
ii.	Locate buttons along the top, bottom, and sides of the interface where they can be easily found and operated.				
iii.	Where possible, use one column of information to facilitate screen reading.				
iv.	The order defined for screen reading elements should match the logical order in which the information should be presented to the user.				
v.	When re-opening the application after an accidental shutdown, the start-up should bring the user back to where he/she left off.				
vi.	Minimize scrolling and other repetitive actions such as double tap and hitting "next" after every direction.				
vii.	Large touch-screen targets (e.g. buttons or check boxes) are easier to activate to turn features on/off than slide controls that require both accuracy and hand movement.				
viii.	Having a Bluetooth-controllable audio menu allowing for little hand use is helpful for both travelers who are blind and those with limited manual dexterity.				
G.	***Size and Space for Approach and Use***				
a.	*Utility:*				
i.	Photographs should provide a clear line of sight to important wayfinding elements.				
b.	*Usability:*				
i.	Applications should be compatible with all desktop and mobile devices to accommodate needs for screens and interfaces of different sizes.				
ii.	All buttons should be large enough size for users with a range of dexterity ability and variations in hand sizes to target them.				
iii.	Include as little information on a screen as possible to enable active areas of the screen to be as large as possible, enabling users to apply reasonable operating forces.				
iv.	All the buttons should be placed in the corners or the edges of the screen, allowing easier navigation for users who have difficulty seeing the screen.				
v.	Provide adequate sizes of objects and space on the screen for use of assistive technologies (e.g., mouthstick and pointer) as input device.				

APPENDIX C

Virtual Airport Models

The following virtual models render the customer journey segments and key areas of a theoretical, or “virtual,” airport. The numbered tags correspond with the Wayfinding Accessibility Audit Checklist (see Appendix A). The content of both the checklist and the models are also used throughout the guidebook to emphasize key points.



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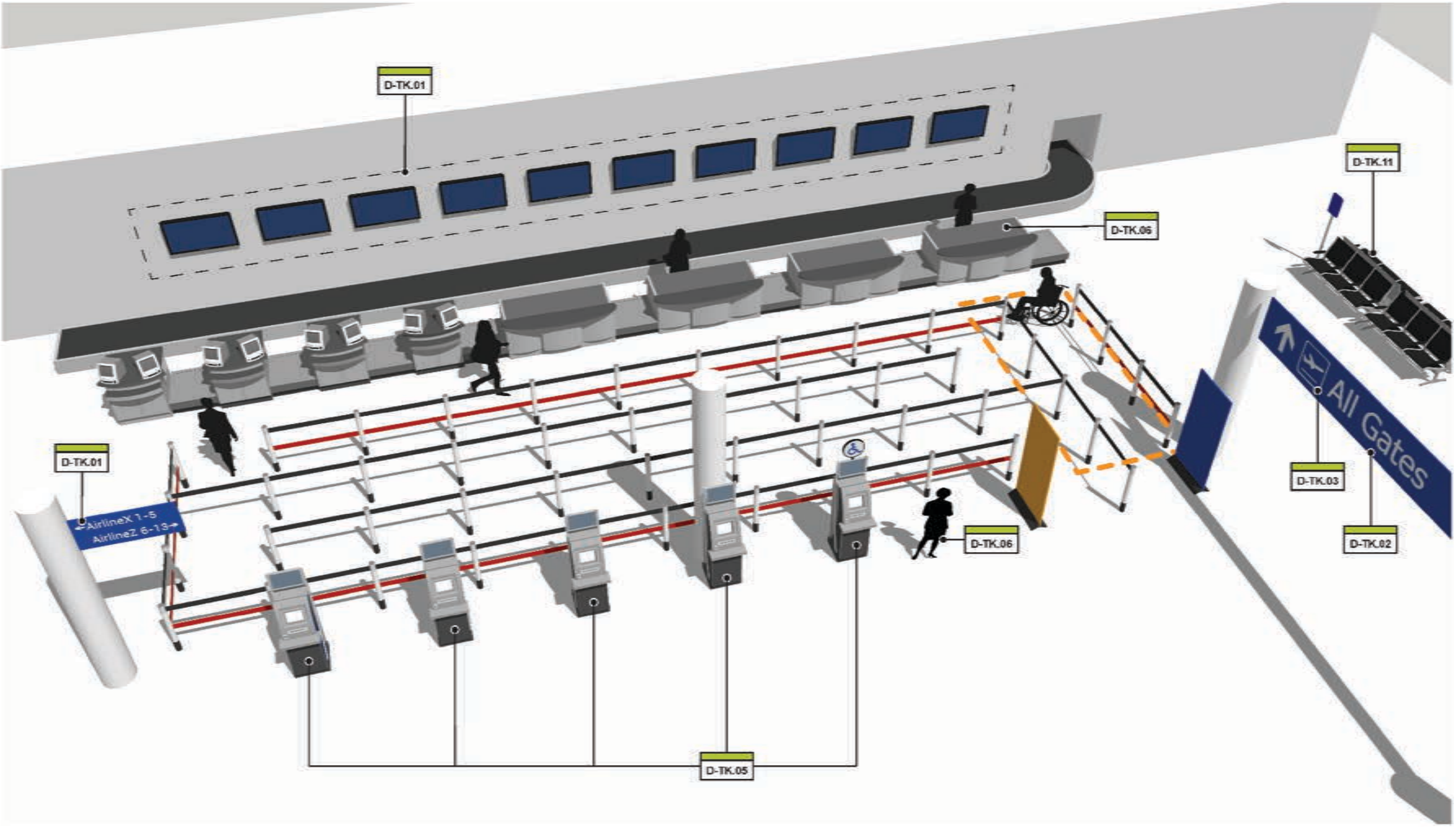
February 17, 2017

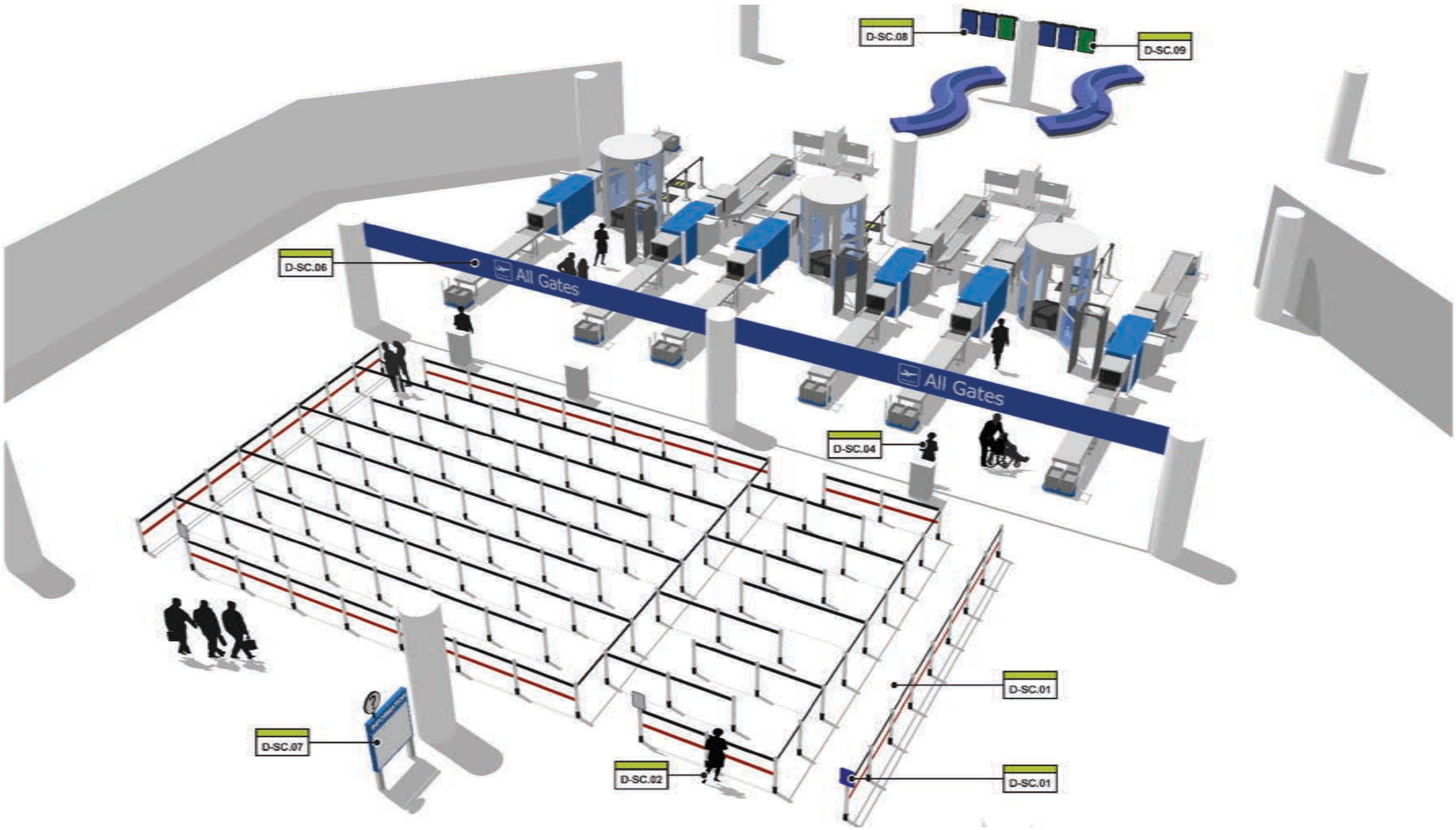
❶ AIRPORT ARRIVAL

Virtual Conceptual Airport



❷ **TICKETING**

Virtual Conceptual Airport



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❸ SECURITY CHECKPOINT

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4 VERTICAL TRANSITION

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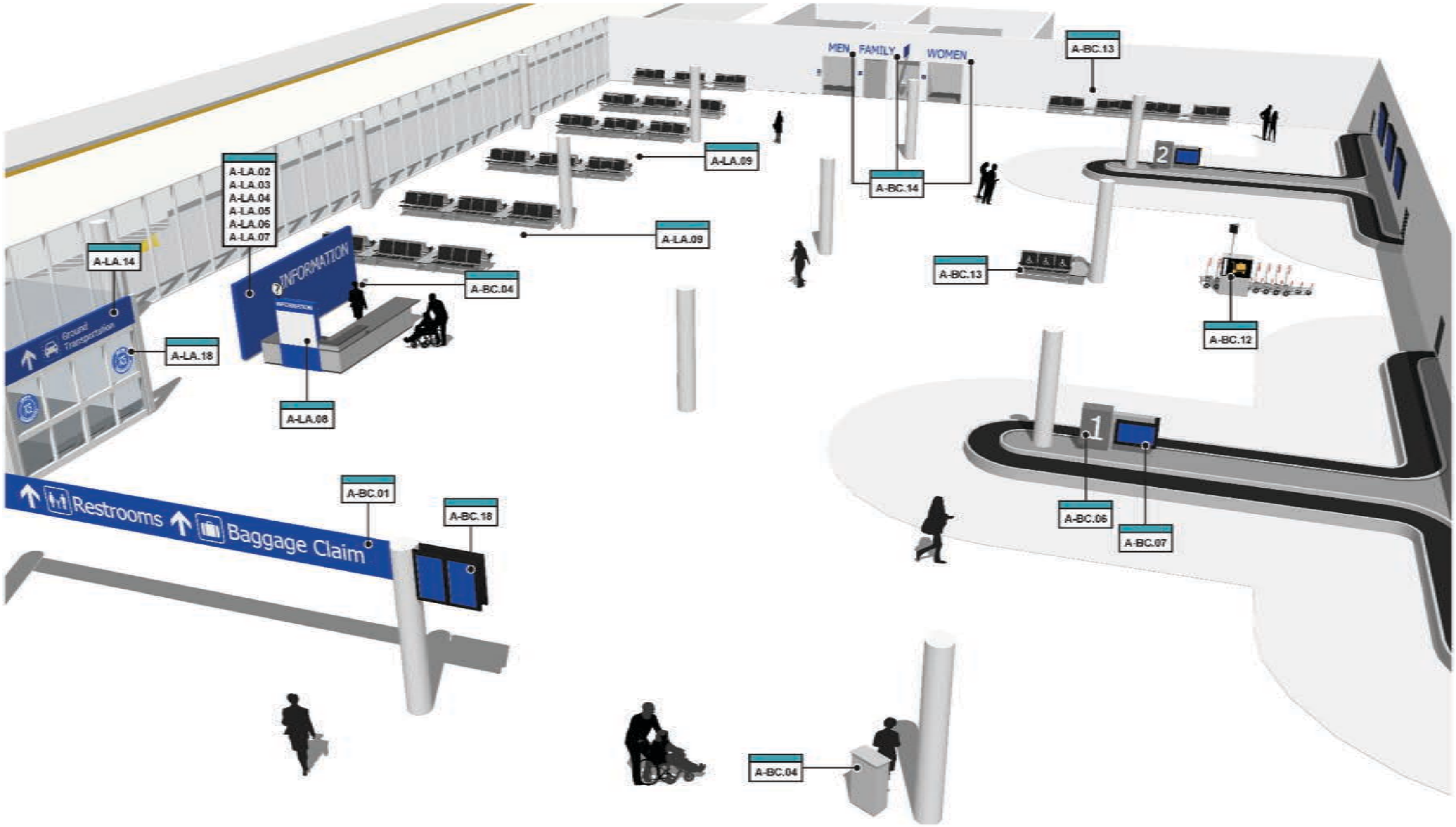

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6 BAGGAGE CLAIM & ARRIVAL LOBBY

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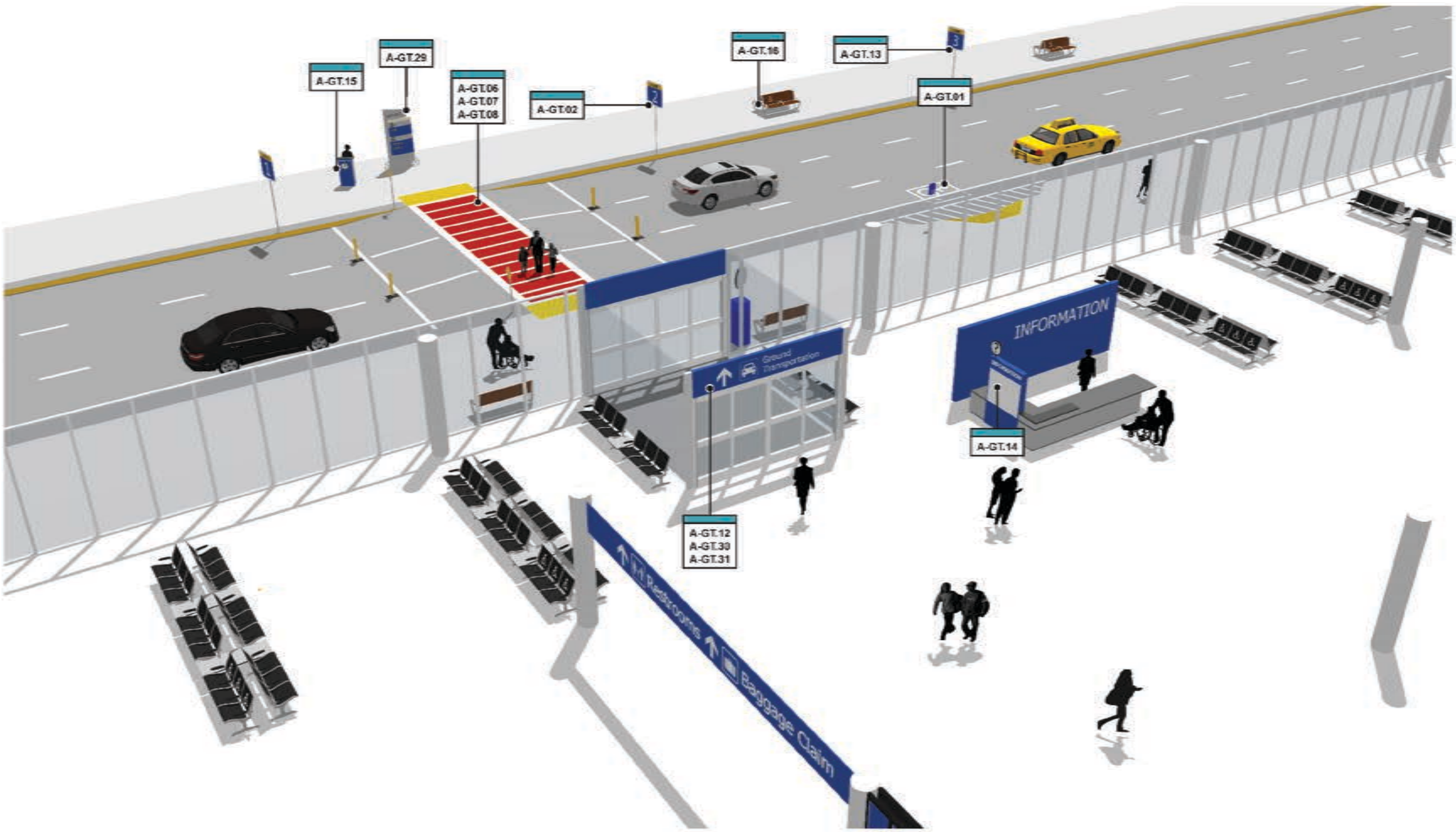

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7 TERMINAL EXIT

Virtual Conceptual Airport

Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAST	Fixing America's Surface Transportation Act (2015)
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TDC	Transit Development Corporation
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

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