

EVALUATION OF AIRPORT IMPROVEMENTS FOR OLDER ADULTS

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SUMMARY

Some transport planners and architects and transportation service providers express the concern that the number of people who benefit from compliance with the Americans with Disabilities Act Guidelines (ADAAG) or similar accessibility regulations does not warrant the costs incurred. The purpose of this paper is to address issues surrounding this generalization, and to reframe the perspective of compliance in order to more clearly recognize its value.

The United Nations has projected that the number of people 65 and older worldwide will increase from 420 million in 2000 to 835 million by 2025 [United Nations, 2006]. As people age they experience certain mobility, agility, sensory and cognitive problems that have major implications for airport design. There are many airport improvements that can compensate for these impairments. However, cost is a major consideration for their implementation.

The challenges in costing these airport improvements include, determining the marginal cost of the proposed enhancement, retrofitting versus new construction, equivalent facilitation, selection of appropriate technology and associated costs, and the impact of competition as the market of seniors and persons with disabilities expands.

While a growing number of older adults could create a lucrative market niche for air service providers, it is less clear that the cost of pursuing these enhancements will be worth the benefits derived. Two commonly used methods for gauging the viability of airport investments are benefit-cost (B/C) analysis and return-on-investment (ROI). The applicability of these methods is discussed.

The main conclusion from this review is that improvements which are typically viewed as only catering to needs of persons with disabilities also help older adults with less severe impairments, and in most instances, facilitate all air travelers on their journey. It is recommended that detailed research be pursued on adequately quantifying the cost of airport improvements needed to comply with ADAAG and the potential revenues generated; and that B/C analysis and/or ROI be applied to sample projects to gauge their financial viability.

Key Words: airport accessibility; elder air travel; benefit-cost analysis; return-on-investment analysis; evaluation

PURPOSE OF THE PAPER

There is a widespread belief among transport planners and architects and transportation service providers that the number of people who benefit from compliance with the Americans with Disability Act Guidelines (ADAAG) [36 CFR Part 1191] and other accessibility requirements does not warrant the cost incurred. Consequently, it is often difficult to gain support for design standards or adaptations that are needed for older adults who have mobility, agility, sensory or cognitive impairments.

This paper aims at addressing the generalization that compliance with ADAAG or similar regulations may not be cost-effective, and to reframe the perspective of critics who do not support compliance with accessibility regulations to more clearly recognize its value. This will be done by reviewing the people who benefit from airport accessibility enhancements and its related costs. The types of financial analysis used to evaluate airport improvements will be discussed to identify more appropriate methods for gauging the viability of airport improvements in the future.

A review of the literature and regulations pertaining to construction and design of accessible features at airports was undertaken [Federal Aviation Administration, 1999]. The regulations include the Americans with Disabilities Act Accessibility Guidelines and the regulations that implement the Air Carrier Access Act of 1986.[49 U.S.C. §41705] It is also acknowledged that there are other relevant standards related to accessibility, including the Architectural Barriers Act,[42 U.S.C.§ 4151] the Rehabilitation Act of 1973 [29 U.S.C. §701] and the International Building Codes [International Code Council, 2003].

The authors proceeded to develop an evaluation framework. A table was prepared with rows that correspond to ADAAG compliant features and columns that correspond to ADAAG beneficiaries. By identifying the enhancements and their corresponding beneficiaries, a pattern will emerge denoting those enhancements that are impairment-specific and others that benefit all air travelers. Ideally cost and the amount of benefits could be quantified so that a B/C or a ROI analysis can be conducted to justify the proposed enhancements. It is hoped that this paper will provide a framework and new perspectives on the value of enhancing airports for older adults. It also points to the direction of future research required to charter the course of air travel for all.

REVIEW OF THE LITERATURE

This section reviews the literature in terms of the ageing of the population, the changes that accompany aging and laws and regulations relevant to airport accessibility.

The age threshold used to define older adults as well as the time horizon for projecting the number of older adults vary widely. The United Nations has projected that the number of people 65 and older worldwide will increase from 420 million in 2005 to 835 million by 2025 [United Nations, 2006]. The United Nations has also estimated that there were about 700 million people 60 years and older worldwide in

2006 with about 450 million of those in developing countries. By 2050 it is projected that there will be almost 2 billion people 60 years and older, or about 22 percent of the population [United Nations, 2006].

There is no specific age at which a person becomes old, especially in view of the fact that the ageing baby boomers are healthier than their previous cohorts. However, everyone experiences certain physiological, sensory and mental changes during the ageing process.

Physiological changes reduce mobility and agility. It becomes more difficult to walk, and assistive devices such as canes and walkers are commonly used to compensate for reduced endurance. Agility changes impact manual dexterity, balance, bending, head rotation and general range of motion. Reductions in manual dexterity make it more difficult to grasp objects and to operate certain mechanical and electrical devices.

Sensory changes impact vision and hearing. A person of 60 needs three times the light to see as a person of 20 [Mayo Clinic, 2002]. As we age, one becomes less tolerant to glare and sudden changes in lighting [Rensselaer Polytechnic Institute, Lighting Research Center, 2006]. In addition to visual changes, about 30 percent of persons over the age of 70 have serious hearing loss. [Mayo Clinic 2002] For those individuals it is difficult to hear normal conversations at high ambient noise levels.

Because of changes to the brain, older adults take more time to process information and are less able to manage stress. These changes, together with other changes brought about by ageing can have an impact on the propensity to use air travel. Many airport improvements, which are directed at people with mobility, agility or sensory impairments, will also help individuals with mental impairments.

The ADAAG has a section devoted to airports [36 C.F.R. Part 1191] but also has regulations that apply to buildings in general. ADAAG requirements address the impairments that accompany normal ageing.

While ADAAG has been the focus of this regulatory review, there are other accessibility requirements that apply to airports. For example, the grant assurances that an airport sponsor must sign to receive federal airport funding require compliance with the Rehabilitation Act of 1973 [29 U.S.C § 504. § 508] and the Architectural Barriers Act of 1968 [42 U.S.C. § 4151 et seq] . Sponsors that fail to comply with these assurances risk the loss of federal funding.

EVALUATION FRAMEWORK

Changes brought about by the ageing process impose challenges that older adults experience in airport terminals such as inconvenient modes of access and egress, long walking distances, prolonged waiting, difficulties in wayfinding and navigating through the terminal and boarding the aircraft.

Airport improvements to address these challenges have been identified by reviewing the requirements included in the ADAAG and applying those requirements to

determine features that are needed if an airport is to be “accessible”. Based on this analysis, Table 1 has been prepared.

Table 1 arranges the ADAAG compliant features in rows and divides them into three categories: access to the airport, terminal accessibility, accessibility in the gate area and boarding the aircraft. These categories correspond to the various links in the air trip chain from the passenger’s origin to the point of boarding the aircraft.

The columns in the Table 1 identify the beneficiaries of the ADAAG enhancements. The first four columns categorize the beneficiaries by type of impairment: mobility, agility, sensory, and mental. The last column identifies where everyone benefits from the ADAAG enhancements.

Mobility and agility impairments are interrelated, but have been separated to distinguish between those individuals who are unable to walk without some assistance, and those who can walk but have range of motion limitations not directly related to walking. There are also wide variations in the degree to which a person experiences impairment or one individual may have multiple impairments. Therefore caution needs to be exercised in defining the number of persons by disability type.

Table 1 illustrates three types of enhancements. The first category, the **mandatory** requirements, is highlighted in red. These are directed exclusively at individuals formally classified as persons with a disability because they use a wheel chair or are blind or deaf. These include lower counter-height, grab bars and railings accessible parking spaces, the use of Braille, emergency evacuation strobe lights and space and dimensional standards. While these features are undertaken for a small but increasing segment of the overall travel market, they are non-negotiable and are required by law.

The second type of ADAAG features in Table 1 is beneficial to all travelers and should be undertaken and is **recommended**. These include low floor buses, curb cuts, automatic doors, better lighting, clear signage, and slip-resistant surfaces. Such features and/or equipment should be pursued either by incorporation into design standards for new or retrofitting existing facilities and equipment. These features are coded in the table in orange.

The third category, coded in yellow, denotes projects that may be **desirable**, but need to be investigated further to ensure that they are effective and can be implemented. These include, but are not limited to, additional seating in people movers, standardized and simplified kiosks, and induction loops on counters for person with hearing impairments.

Many of the improvements identified below that help persons with mobility, agility and sensory impairments, will also help individuals with mental impairments by facilitating airport use and thereby reducing anxiety.

	Type of Beneficiaries				
	Mobility	Agility	Sensory	Mental*	Everyone
ADAAG Compliant Features					
Access to Airport					
Low floor buses	X				X
Curb cuts	X				X
Accessible parking spaces	X				
Automatic doors	X		X		X
People movers with additional seating	X	X			
Accessible paths	X			X	
Terminal Accessibility					
Terminal lighting properties			X	X	X
Signage –size, color, font, contrast, position			X	X	X
Flight information display systems			X	X	X
Even slip-resistant floor surfaces	X		X		X
Standardized kiosks		X		X	
Hi-low drinking fountains		X			X
Lower counter height:	X				Short people and children
Braille symbols	X				
Strobe light alarm			X		
Space and dimensional standards	X				
Accessibility in the Gate Area and Boarding the Aircraft					
Boarding bridges with minimal grade and even surfaces	X				
Visual Paging			X		
Induction Loop on counters			X		
Grab bars and railings	X		X		
Additional Gate area seating	X				X

Table 1 – ADAAG Compliant Airport Features by Type of Beneficiary



Mandatory



Recommended



Desirable

FINANCIAL ANALYSIS/EVALUATION METHODS

Two methods that are often used to evaluate the financial viability of airport investments are Benefit –Cost (B/C) Analysis and Return on Investment (ROI). While there are differences between the methods both is the need to define a project cost.

The issue of the cost of projects associated with ADAAG compliance is not always clear-cut. While it may be costly to retrofit a terminal building to comply with the space and dimensional requirements of accessibility regulations, the incorporation of accessible design standards into new construction specifications can reduce the cost attributable to ADA compliance.

For new construction, it may be difficult to isolate the marginal cost of the accessibility requirements above and beyond the normal specifications for the project. For example, a new 10-gate terminal at San Diego International Airport is being designed to be fully accessible. The cost of this terminal is estimated at \$600 to \$700 million dollars, but there is no estimate of the cost attributable to ADAAG compliance and enhanced accessibility. [San Diego Airport Master Plan, 2005]

There is also a problem in estimating the cost of equipment because of varying technology and standards. For example, there is a wide array of visual paging systems and hence variation in their associated costs.

Another cost related issue is whether the equivalent facilitation section of ADAAG can provide less expensive ways for achieving comparable or greater levels of accessibility. Equivalent facilitation is defined in the ADAAG noted below:

“Equivalent Facilitation. Departures from particular technical and scoping requirements of this guideline by the use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the facility.” [ADAAG, Article 2.2]

A final consideration is the impact of an expanding market of older adults on costs. As the market expands, competition to satisfy the needs of the ageing population may exert a downward influence on costs.

The principal difference between B/C analysis and ROI is the manner in which they calculate the benefits that result from an investment.

The term (ROI) “means that decision-makers compare the magnitude and timing of expected gains to the investment costs.” [Solution Matrix Ltd. 2004]. ROI analysis seeks to demonstrate that the revenue generated as a result of an investment decision will create a profit that is at least equal to or greater than an alternative use of the funds.

Quantifying the additional revenue that will result from the investment in an airport enhancement for older adults requires that assumptions be made about the increase in the number of older adults and their propensity to use air travel.

Forecasting the number of older adults nationwide involves the application of a commonly used age cohort survival model. If the current propensity to use air travel by older adults is examined, assumptions can be made about the increase in that propensity resulting from enhanced accessibility. Using these assumptions, the number of additional air trips by older adults could be determined nationwide.

Once the additional number of air trips is calculated, the amount of additional revenue generated needs to be quantified. Because federal funds are allocated to airports based upon air passengers enplaned, each additional passenger enplanement represents revenue that is easily quantified. Added to this would be the revenue generated to airport service providers, a percentage of which is allocated to the airport through use fees.

When assessing the financial impacts of enhancements on the number of air trips at a given airport, the benefits could be understated if other competitive airports are not accessible. One method to overcome this would be to determine the cost of improvements nationwide and the number of additional travelers that could potentially be generated. Another procedure would be to examine the number of passengers between a market pair, or a defined set of airports, and then to evaluate the additional passengers that could be generated in the market as a result of the improvements to those airports.

Future revenue streams need to be discounted to present value to allow for a legitimate comparison between revenues and costs. This involves making assumptions regarding inflation rates and using it to convert future revenue streams to an equivalent value in today's dollars. Project costs also need to be expressed in current dollars.

While ROI analysis can be used by government agencies, B/C analysis may be a more appropriate tool for analysis. These agencies are typically not motivated by profit and tend to invest in projects to enhance the public welfare. For them, B/C analysis provides a "systematic method for comparing the value of outcomes with the resources needed to achieve those outcomes." [URENIO, 2001]. This, in turn, involves not only quantifying the direct benefits that result from revenue generated by the additional passengers accommodated, but also indirect and intangible benefits.

An example of an indirect benefit is the increase in employment that results from companies that locate in the area because of the enhanced airport facility. An airport improvement, which engenders better air service, makes the facility more attractive to businesses. B/C analysis then attempts to quantify the estimated dollar value of both the additional employment and the tax benefits to the local governments. Intangible benefits include time savings accrued to air travelers as a result of airport improvements that enhance accessibility. This requires estimating the time saved and placing a dollar value on the passengers' time.

Problems associated with the application of B/C analysis in providing an objective assessment of the financial viability of a project include: Firstly, the relationship between the airport improvement and the attraction of businesses and jobs may be tenuous. The airport is only one of a variety of factors that influences a business

location decision. If the necessary labor force, educational facilities and public infrastructure are not available, then the firm will not relocate regardless of the airport's improved accessibility. Quantifying intangible benefits is subjective, requires a substantial amount of analysis and assumptions, and is difficult to consistently apply across a series of enhancements.

Secondly, when the airport investment undertaken offers a benefit to the local government that operates the airport, it may be achieved at the expense of neighboring airports. For example, an investment that attracts an industry and/or jobs from a nearby airport results in a redistribution of jobs rather than a net increase in the overall number of jobs in the region.

The application of B/C analysis needs to account for the issues note above to ensure that it provides a realistic picture of the viability of an airport investment.

CONCLUSIONS AND RECOMMENDATIONS

Improvements which are typically viewed as only helping persons with disabilities help older adults with less severe impairments and in some instances help all air travelers by facilitating their journey.

Determining whether these improvements are worth the resources invested depends upon: accurately calculating the cost of the project, estimating the size of the expanding market and the potential revenues generated, and applying the appropriate method of financial analysis. While this paper has raised a number issues related to these factors, more research needs to be conducted, as follows:

1. Identify specific airport projects for older adults at facilities of varying sizes in different parts of the country to provide a representative cross-section. This could be accomplished by reviewing proposed capital improvement programs for airports and collaborating with airport sponsors to identify project costs.
2. Estimate the additional air passenger trips that would be undertaken as a result of the improvement. This could involve isolating a specific airport or airports, conducting a survey of the facilities to estimate the current number of older adult air trips, quantifying their propensity to use air travel, and then developing assumptions about the increase in the propensity to use air travel resulting from enhanced accessibility.
3. Estimate the revenue that is generated by each passenger trip by examining the allocation of federal airport funds based upon passenger levels, and typical passenger expenditures at airports. This could result in an estimation of additional revenue per air trip.
4. To the extent possible, apply both B/C analysis and ROI to a series of airport improvements to gauge the relative merits of each.
5. Obtain time-series data by conducting a before-after study on the actual results.

Armed with these research results, transport planners and architects can justify the economic merits of investing on airport enhancement to meet the needs of an ageing air traveler market. Policy- makers can be provided with a tool for making rational decisions about the allocation of public resources for these airport investments.

REFERENCES

36 C.F.R. Part 1191 Americans With Disabilities Act (ADA) Accessibility Guidelines For Buildings And Facilities. 2006.

49 C.F.R. Part 27, Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting From Federal Assistance, October 2006.

29 U.S.C § 504. § 508 § 701 Rehabilitation Act of 1973, Sections 504, 508.

42 U.S.C. § 4151 et seq. Architectural Barriers Act of 1968 as amended,

49 U.S.C. §41705 Air Carrier Access Act of 1986

Federal Aviation Administration, 1999 *Advisory Circular, 150/5360-14, Access to Airports by Persons with Disabilities.*

HNTB Consultants, 2005 San Diego Regional Airport Authority, Airport Master Plan, Cost estimate from Steve Correll, San Diego Regional Airport Authority.

Mayo Clinic, Rochester Minnesota 2002 *Geriatric Medicine: Practical Functional Assessment of Older Persons* [Internet] Available from: <http://www.mayo.edu/geriatrics-rst/RFA.html>, January 2, 2007

Rensselaer Polytechnic Institute, Lighting Research Center 2006, [Internet] Available from <http://www.lrc.rpi.edu>, January 2, 2007

Solution Matrix Ltd., 2004-2007 *What is Return on Investment Analysis?* Available from: <http://www.solutionmatrix.com/return-on-investment.html> January 20, 2007

United Nations, 2006 *Population Age Composition, World Population Prospects, 2004 Revision, Table II-1 page 24.* [Internet] Available from: http://www.un.org/esa/population/publications/WPP2004/WPP2004_Vol3_Final/Chapter2.pdf January 20, 2007

United Nations, Department of Economic and Social Affairs, Population Division 2006, Population Aging , Table [Internet] Available from: <http://www.un.org/esa/population/publications/ageing/ageing2006table.xls>, January 15, 2007.

Urenio Inc., 2001 Research Unit, Technology Evaluation, Cost Benefit Analysis, 2001. <http://www.newventuretools.net/cba/index.html> January 12, 2007