TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
SWUTC/96/721932-1		

4. Title and Subtitle	5. Report Date
Americans with Disabilities Act: Considerations for Sensory and Mentally Impaired Individuals in Public Accommodations	August 1996
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Joseph J. Sifferman and Rodger J. Koppa	RF721932-1

9. Performing Organization Name and Address	10. Work Unit No.
Texas Transportation Institute Texas A&M University System College Station TX 77843-3135	11. Contract or Grant No. DOTS88-G-0006

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Southwest Region University Transportation Center Texas Transportation Institute The Texas A&M University System College Station, TX 77843-3135	Study Report (1 of 2)
	14. Sponsoring Agency Code

15. Supplementary Notes

Supported by a grant from the U.S. Department of Transportation
University Transportation Centers Program

16. Abstract

In this aspect of the study, "Incorporation of ADA Requirements into Transit Guidance Information," the more general question of access to information in public accommodations for those with sensory or mental disabilities was addressed. Regulations under the Americans with Disabilities Act (ADA) of 1990, together with standards and design considerations are summarized in this report. Elimination of structural barriers to communications for hearing impaired persons includes modifications such as visual alarms and signals. Visual impairment accommodation includes eliminating physical hazards such as protruding objects and uneven walking surfaces. Braille, raised lettering, environmental audio cues and assistive listening devices can also be employed. There is little specific guidance for assisting information transfer for cognitively impaired individuals. Even with federal standards as a guide, choosing the proper methods and tools to insure satisfactory communication is a challenging task. Designing accessible facilities for the physically and mentally impaired has many benefits beyond that of merely adhering to federal guidelines, including increased ease-of-use and safety effectiveness of facilities for the general public.

17. Key Words	18. Distribution Statement
Disabilities, ADA, Public, Accommodations, Facilities, Transit	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	57	

Form DOT F 1700.7 (8-69)

AMERICANS WITH DISABILITIES ACT: CONSIDERATIONS FOR SENSORY AND MENTALLY IMPAIRED INDIVIDUALS IN PUBLIC ACCOMMODATIONS

A Research Study by

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and

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August 1996

DISCLAIMER

ACKNOWLEDGEMENT

The authors would like to acknowledge the partial support provided by a grant from the U.S. Department of Transportation, University Transportation Centers Program, to the Southwest Region University Transportation Center, which made this research possible. The research that formed the basis for this report was part of a graduate research project pursuant to the degree of Master of Engineering (Industrial Engineering) for the senior author.

FOREWORD

It is an understatement to declare the Americans with Disabilities Act (ADA) a broad piece of legislation. The legislation affects a wide array of life including employment, government services, public accommodations, and telecommunications. Therefore, the scope of the report is limited to sensory and cognitive impairment considerations in regards to public accommodations.

The impetus for studying sensory and mental impairment accommodations stems the fact that many people only conceptualize accessibility in terms of physical modifications and physical barrier removal. When asking people what they picture when they think of ADA, one hears the same things mentioned repeatedly: wheelchair ramps, wide sliding doors, and physical modifications to human-machine interfaces. The notion that *accessibility* is strongly tied to the concept of physical accessibility is strengthened when noting the widely known and often present international symbol of accessibility is a symbolic representation (pictogram) of an individual in a wheelchair.

The purpose of this study was to study specific components of the Americans with Disabilities Act of 1990. Questions to be answered included:

- How explicit is the legislation?
- What is the source of federal guidelines?
- What assistance is available to facilitate interpretation of legislation?
- What is the impact of ADA on the Human Factors field?
- What provisions of the legislation and guidelines are specifically aimed at accommodating the sensory disabled and mentally impaired?

The document that follows is not meant to be a comprehensive review of the Americans with Disabilities Act. We have attempted to point out pertinent, interesting, and outstanding findings regarding the accommodation of mentally, visually, and hearing impaired individuals.

EXECUTIVE SUMMARY

The main goal of the study was to find sufficient information regarding public accommodations regulations, standards, and considerations for sensory and mentally impaired individuals within the context of the Americans with Disabilities Act of 1990.

Code of Federal Regulation (CFR) guidelines provide the most useful accessibility guidelines and standards source. Title III of ADA legislation (Public Law 101-336) is implemented through 28 CFR Part 36. The technical standards see forth by ADAAG are presented in the first appendix to CFR Part 36. Americans with Disabilities Act Accessibility Guidelines are mainly taken from 1986 ANSI A117.1 standards, but the revisions added by ADAAG reflect congressional intent that the guidelines place an increased emphasis on communications with individuals with vision and hearing impairments (DOJ, *Title III* 57).

Eliminating structural communication barriers for the hearing impaired includes modifications such as providing visual alarms and signals and eliminating physical partitions that hinder sound waves or providing adequate sound buffers. Visual impairment accommodation includes eliminating physical hazards such as protruding objects and unlevel walking surfaces. Providing effective communication is also paramount. This may be accomplished through the use of Braille and raised lettering, environmental auditory cues, and assistive listening devices. Regulation guidelines are somewhat ambiguous regarding specifications of communication devices, but the Access Board provides adequate technical assistance through various bulletins and publications regarding assistive listening devices, visual alarms, and text telephones.

More work should be done to accommodate of the individuals with cognitive deficiencies, as there are no specific provisions aimed solely at individuals with cognitive limitations. Mental impairment accommodation considerations are difficult to conceptualize, as the barriers are not obvious as physical accessibility concerns. Even with federal standards as a guide, choosing the proper methods and tools to insure satisfactory communication is a challenging task.

The implications of ADA research beyond the accommodation of disabled individuals. Designing accessible facilities for the physically and mentally impaired has many benefits beyond that of merely adhering to federal guidelines, including increased ease-of-use and safety effectiveness of facilities for the general public. The Americans with Disabilities Act of 1990 also holds major implications for the Human Factors and Ergonomics field. The understanding and implementation of these governmental regulations and standards represent a critical responsibility for the engineer.

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Introduction and Background

The Americans with Disabilities Act, signed into law by President George Bush on July 26, 1990, represents the first widespread effort of the United States Government to address discrimination against individuals with disabilities. The purpose of ADA is to extend to people with disabilities civil rights similar to those now available on the basis of race, color, national origin, sex, and religion through the Civil Rights Act of 1964. It prohibits discrimination on the basis of disability in employment (Title I), state and local government services (Title II), public accommodations (Title III), and telecommunication services (Title IV). The legislation's widespread impact is evident when noting over 43 million Americans have one or more physical or mental disabilities, and this number is increasing as the population as a whole is growing older (Congressional Hearings XVI).

The component of ADA most relevant to project, Title III, took effect January 26, 1992. Title III of ADA states: "No qualified individual with a disability shall, by reason of such disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any such entity" (ATBCB *Guidebook*)

Project Setup

Work method

The project consisted of two main parts:

- Library Research and literature review
- Field Research

Library research involved obtaining and studying standards, regulations, and similar materials. Much additional literature was obtained via mail service through various governmental agencies and non-profit organizations. The other component of the project involved field research. This included talking to individuals involved with ADA compliance and regulation and studying existing facilities and accommodations.

Resources utilized

Sources of information included:

- Sterling C. Evans Library at Texas A&M University
- Government agencies

- Non-profit organizations
- Field research
- Computer interface (Internet)

The library was the beginning point for our research; the United States Documents Department of the Documents Division of the Library proved to be valuable resource. The United States Documents Department collection includes Code of Federal Regulation (CFR) guidelines, technical assistance manuals, congressional hearings, and other information created and distributed by various government agencies.

Government agencies such as the United States Architectural and Transportation Barriers Compliance Board (USATCB) were particularly useful in providing technical assistance and guidelines. Non-profit organizations were helpful in obtaining information on specialized topics such as cognitive, visual, and hearing impairments. Field research involved contact with ADA compliance specialists and observation of public facilities. The Internet (World-Wide-Web) also contained useful information (especially available resources) in an easily accessible, well organized format.

Much of the information obtained was repetitive. The multiple sources (Internet, library, organizations) of information dictated some overlap of information would be present. This repetitiveness and abundance of information is a positive attribute of ADA literature; it provides multiple avenues to disperse information to individuals concerned with the application of ADA.

A great deal of literature (produced by both governmental and non-profit organizations) was organized into a "question-answer" or "possible scenarios" format (as evidenced with a quick glance of the Works Cited section). This portion of the literature is aimed at facilitating the compliance of ADA requirements by business and other organizations.

In government domain, most impressive was the information and services provided by The Access Board. The Access Board is part of the United States Architectural and Transportation Barriers Compliance Board (USATBCB). The agency produces publications concerning architectural access, communication access, and transportation access. The Access Board also provides technical assistance through bulletins (including titles such as "Detectable Warnings", "Visual Alarms", and "Text Telephones"). The Access Board may be researched for technical assistance by phone, fax, mail, or a computer bulletin board service.

A listing of useful government agencies and non-profit organizations (including addresses and phone numbers) has been provided in Appendix A: Resource guide.

Results/Findings

Regulations, standards, and guidelines

The Department of Justice has adopted the ADA Accessibility Guidelines (ADAAG), issued by the Architectural Barriers and Transportation Compliance Board as the standard to be applied in new construction (DOJ, Title III 46).

Code of Federal Regulation (CFR) guidelines provide "The Source" as far as the Human Factors and Ergonomics domain is concerned. This set of regulations includes the standards and guidelines for accessibility. Title III of ADA legislation (Public Law 101-36) is implemented through 28 CFR Part 36 of the Code of Federal Regulations. The technical standards set forth by ADAAG are present in the first appendix to 28 CFR Part 36. Guidelines relevant to sensory and mental limitations will be discussed in the succeeding sections.

The accessibility guidelines of ADA are not all "new". The Architectural Barriers Act of 1968 (amended 1981) set initial guidelines for accessibility for federally funded buildings. The guidelines include standards for alarms, tactile warnings, and signage. Current ADA guidelines have incorporated much of the requirements set forth by the Architectural Barriers Act (USATBCB *Guidebook*).

Americans with Disabilities Act Accessibility Guidelines mainly resemble 1986 ANSI A117.1 standards. The main differences between ADAAG and ANSI standards are the scope and intent of the standards. The ADAAG includes scoping requirements as to "how many" and "under what circumstances" accessibility standards must be incorporated. The ADAAG also reflects congressional intent that the guidelines place an increased emphasis on communications with individuals with vision and hearing impairments (in areas not covered by ANSI such as restaurants, mercantile establishment, and dressing rooms) (DOJ, *Title III* 57).

The Department of Justice, in conjunction with other agencies, provides technical assistance to assist covered entities and individuals with disabilities in understanding responsibilities, requirements, and rights under the ADA (DOJ, Title III 70). Both the Department of Justice (DOJ) and the Architectural and Transportation Barriers Compliance Board (ATBCB) issue guidelines and provide technical assistance regarding public accommodations accessibility. Various publications produced by the DOJ and the ATBCB are provided in Appendix D: Selected ADA publications.

Sensory impairment

With sensory impairment, the question of accessibility includes more than physical modifications; the situation is also one of communication barriers and hindrances. Title III of the ADA states public accommodations must provide appropriate auxiliary aids and services where necessary to afford effective communication for persons with vision, hearing, speech and language disabilities where doing so would not be a fundamental alteration or undue burden (DOJ, *Title III* 26).

Auxiliary aids include: a) qualified interpreters, note takers, transcription services, written materials, telephone amplifiers, assistive listening systems and devices, closed caption decoders, videotext displays, or other effective methods of making aurally delivered materials available to individuals with hearing impairments; b) qualified readers, taped texts, audio recordings, Braille materials, large print materials, or other effective methods of making visually delivered materials available to individuals with visual impairments; c) acquisition or modification of equipment or devices; and d) other similar services and actions (Congressional Hearings 8).

Although guidelines are ambiguous regarding specifications of communication devices, the Access Board distributes various technical assistance bulletins and publications regarding assistive listening devices, visual alarms, and text telephones (TDD).

Auxiliary aids like assistive listening systems may be provided to enhance sound for the hearing impaired. The auto loop system, the wireless FM system, and the wireless infrared system are examples of assistive listening devices. Other listening devices, such as headphones with recorded messages may be used by both visually and hearing individuals so that large quantities of information may be relayed in a clear, effective manner. Listening devices with translated messages and information may also be useful for use by non-English speaking individuals.

Possible options in eliminating structural communication barriers for the hearing impaired include (National Center 8):

- Installing permanent flashing fire alarm lights
- Repositioning telephones for TDD use
- Installing flashing doorbells and other security alerting systems
- Installing permanent directional signs
- Eliminating physical partitions that limit sound waves
- Providing adequate sound buffers

New symbols of accessibility identifying volume control telephones, text telephones, and assistive listening devices are required by ADAAG (DOJ, *Title III* 63). Visual alarm requirements such as color, intensity, and flash rate have also been outlined by ADAAG. Visual alarms, TDD use, and other pertinent standards are reviewed in Appendix B: Title III guidelines and standards.

Visual impairment considerations include:

- Eliminating protruding objects
- Providing detectable warnings and "fence off" danger areas
- Creating level walking surfaces
- Relaying information using a combination of Braille and raised lettering
- Equipping interfaces (such as elevators) with auditory cues
- Providing listening devices when relaying a large quantity of information

Requirements for signage, auditory cues, protruding objects, and detectable warnings are detailed in ADAAG (DOJ, *Title III* 62). These and other pertinent standards are discussed in Appendix B: Title III guidelines and standards.

Mental impairment

Nearly 11 million Americans have a cognitive impairment (The Arc, *Q&A* 1). Mental impairment may include a cognitive deficiency in one or more of several areas including language, learning, memory, awareness, communication, and decision making. ADA regulations and standards "...provide limited information related to accessibility for individuals with cognitive disabilities" (Arc, *Guide* 1).

There are no specific provisions aimed solely at individuals with cognitive limitations. Most of the guidelines mentioned in the previous section (sensory impairment limitations and considerations) would assist in creating a barrier free environment for mentally challenged individuals by providing multiple sources of information (visual, auditory, tactile).

A large percentage of the literature regarding accommodations of mentally impaired individuals focuses more on employee training and sensitivity rather than physical modifications. For example, The Arc, a national foundation for mental retardation, has developed a training program for fixed route bus operators. The program was created to assist public transit systems in training bus operators to communicate effectively with passengers with disabilities affecting cognition.

Programs and modifications created for individuals with cognitive disabilities may also work well for situations involving foreign visitors and non-English speakers, people who are functionally illiterate, and older adults who may have difficulty with speed of transactions, reading, and mobility (the Arc). Modifications of this sort may include using:

- Pictures to illustrate a series of steps or to illustrate choices/alternatives
- Color coding similar sections and types of services or hazard areas
- International pictograms (such as the question mark to signify "help")
- Employee training programs focusing on sensitivity and how to interact and communicate in an effective and appropriate manner.
- Common sense (i.e. do not exclusively use unclear/uncommon wording such as "Guys" and "Gals" or "Does" and "Bucks" to denote gender differences on restroom doors)

Although useful in a variety of situations, one should note that pictograms and other symbolic representations may be abstract and difficult to understand for some individuals with cognitive difficulties.

More work could be done regarding the accommodation of individuals with cognitive deficiencies. Mental impairment accommodation considerations are difficult to conceptualize, as the barriers are not as obvious as physical accessibility concerns. Effective communication is the key to producing an adequate situation for mentally impaired individuals. This communication is multi-purposed and may include relaying directions, denoting services, marking safety hazards, or personal one-on-one interaction. Even with federal standards as a guide, choosing the proper methods and tools to insure satisfactory communication is a challenging task. Mental impairment accommodations will become increasingly important with America's aging population and the increase in Alzheimer's disease.

Field research

Field research activities are described in Appendix C: Field research.

Conclusion

Although not directly involved with the study and application of law, many fields in industry must adhere to and are directly involved with the ramifications of government legislation. For example, the Civil Rights Act of 1964 created an impact on the field of

Industrial and Organizational Psychology by forcing I/O practitioners to prove job selection and performance appraisal instruments were valid and non-discriminatory.

Similarly, the Americans with Disabilities Act of 1990 holds major legal implications for the Human Factors and Ergonomics field. Human Factors and Ergonomic experts will be call upon to aid in the modification of existing facilities and help in the design of new facilities. Human Factors and Ergonomic specialists may also be called upon to make expert witness appearances in court or may face charges themselves for improper planning and/or accommodation. Although perhaps not rewarding for the "pure" scientists and engineers, the understanding and implementation of governmental regulations and standards represents a necessary prerequisite for success.

Designing accessible facilities for the physically, sensory, and mentally impaired has many benefits beyond that of merely adhering to federal guidelines. For example, using effective communication tools and methods has application for international usage, while minimizing physical barriers such as protruding objects and unlevel walking surfaces have safety benefits for the general public.

We must keep in mind the federal guidelines represent a minimum standard to be followed. It would be hoped that an individual's integrity and code of ethics would implore him/her to set a higher standard of accommodation when financial and time constraints do not present an overwhelming burden. (Note: the cost of incorporating accessibility features in new construction is less than one percent of construction costs (EEOC 24)).

Works Cited

The Arc, *The Americans with Disabilities Act Title III: A Guide for Making Your Business Accessible to People with Mental Retardation.* Arlington, Texas: The Arc, 1994.

The Arc, *Q&A: The Americans with Disabilities Act of 1990.* Arlington, Texas: The Arc, 1994.

Architectural and Transportation Barriers Compliance Board (ATBCB), *Accessibility Guidelines Checklist for Buildings and Facilities.* Washington, ATBCB, 1992.

Architectural and Transportation Barriers Compliance Board (ATBCB), *A Guidebook To: The Minimum Federal Guidelines and Requirements for Accessible Design.* Washington: ATBCB, 1981.

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Department of Justice (DOJ), *Code of Federal Regulations (CFR), Part 36.* Washington: U.S. Government Printing Office, 1994.

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Equal Employment Opportunity Commission (EEOC) and Department of Justice (DOJ) Civil Rights Division, *The Americans with Disabilities Act: Questions and Answers.* Washington: EEOC and DOJ, 1992.

National Center for Law and Deafness, *The Americans with Disabilities Act -- Communication Accommodations Project: ADA Questions and Answers for Deaf and Hard of Hearing Individuals.* Washington: National Center for Law and Deafness.

Presidents Committee on Employment of People with Disabilities, *Americans with Disabilities Act: Focus on Transportation.* Washington: Presidents Committee on Employment of People with Disabilities, 1993.

APPENDIX A

Appendix A: Resource guide

This appendix lists the most useful organizations for the acquisition of pertinent information. Most publications (guidelines, brochures, pamphlets, bulletins, etc.) may be obtained at no cost.

Information on considerations for specific disabilities:

American Foundation for the Blind 15 West 16th Street
New York, NY 10011
(212) 620-2000
(212) 620-2158 (TDD)

The Arc 500 E. Border St., S-300
Arlington, TX 76010
A national organization on mental retardation
(817) 261-6003
(817) 277-0553 (TDD)

National Center for Law and Deafness
880 Florida Ave NE
Washington, DC 20002
(202) 651-5096

Sources of guidelines and technical assistance:

United States Architectural and
Transportation Barriers Compliance Board
(USATCB)
1111 18th Street NW
Suite 501
Washington DC 20036
(800) USA ABLE

United States Department of Justice
P.O. Box 66118
Washington DC 20035
(202) 514-0301
(202) 514-0383 (TDD)

A resource list of various organizations and agencies is available through two sources:

- Internet: Resource list downloaded from "handicap.afd.olivetti.com"
- The "Resource List" printed in the *Americans with Disabilities Handbook*, published by the Equal Employment Opportunity Commission and the Department of Justice.

APPENDIX B

Appendix B: Title III Guidelines and Standards

The Americans with Disabilities Act of 1990 (Public Law 101-336) represents an expansive piece of legislation passed by Congress. The actual legislation, though, provides no standards to guide the construction and modification of facilities.

Section 504 of the ADA states the United States Architectural and Transportation Barriers Compliance Board (ATBCB) shall issue minimum guidelines for the accessibility of public facilities. The Department of Justice, in turn, adopts the guidelines set forth by the ATBCB. These guidelines are continually reviewed and modified as necessary.

These guidelines and standards appear in 28 CFR (Code of Federal Regulations) Part 36 created by the Department of Justice. The purpose of this regulation is to implement Title III of the Americans with Disabilities Act of 1990 (U.S.C. 12181). Appendix A to Part 36 represents the Americans with Disabilities Act Accessibility Guidelines (ADAAG) set forth by ATBCB. These guidelines are mainly based on ANSI 117.1 1980 and 1986 standards and previous guidelines set forth by the Access Board through the Architectural Barriers Act (and the Uniform Federal Accessibility Guidelines).

Appendix A to 28 CFR Part 36 / Americans with Disabilities Act Accessibility Guidelines

Standards most applicable to accommodation of visually impaired individuals include:

- Accessible route (4.3)
- Protruding objects (4.4)
- Ground and Floor Surfaces (4.5)
- Elevators (4.10): includes requirements of visual, auditory, and tactile information
- Alarms (4.28): requirements of visual, audible, and auxiliary alarms
- Detectable warnings (4.29)
- Signage (4.30): character proportions/height, braille characters, and pictorial symbols

Standards most applicable to the accommodation of hearing impaired individuals include:

- Elevators (4.10): includes requirements of visual, auditory, and tactile information

- Alarms (4.28): requirements of visual, audible, and auxiliary alarms
- Telephones (4.31): requirements of text telephones
- Assembly Areas (4.33): includes requirements of listening systems

There are no standards specifically created for the accommodation of mentally impaired individuals. The guidelines also include specific sections for accommodation within Restaurants and Cafeterias, Medical Care Facilities, Business and Mercantile, Libraries, Transient Lodging, and Transportation Facilities.

Other CFR regulation related to accessibility

36 CFR Part 1190
Implementation of Rehabilitation Act of 1973 / Architectural Barriers Act of 1968.

36 CFR Part 1191, Americans with Disabilities Act Accessibility Guidelines (ADAAG)

36 CFR Part 1192, ADA Accessibility Guidelines for Transportation Vehicles

41 CFR, Part 101-19, Construction and Alteration of Public Facilities
Subpart 101-19.6 covers accommodations for the physically handicapped; includes the Uniform Federal Accessibility Standards (which are based on ANSI A117.1-1980 and were created in meeting the requirements of the Architectural Barriers Act).

49 CFR Parts 27, 37, and 38, Transportation services for individuals with disabilities
Created by the Department of Transportation (DOT); implementation of transportation and related provisions of Titles II and III of ADA; includes ADAAG.

49 CFR Part 609, Transportation for Elderly and Handicapped Persons
Establishes the requirements set forth by the Federal Transit Administration (FTA) regarding transportation for elderly and handicapped persons.

Technical Assistance Bulletins

The ATBCB has also produced technical assistance bulletins on several specific topics to guide the accommodation process required by ADA. Bulletins covering areas of interests pertinent to the scope of this report include:

- Detectable warnings (Bulletin #1)
- Visual alarms (Bulletin #2)
- Text telephones (Bulletin #3)
- Surfaces (Bulletin #4)

These bulletins include up-to-date information on the status of regulations and/or provide in-depth discussion and background information regarding the guidelines. Bulletins 1-4 may be found in Appendix D: Selected ADA publications.

Other Useful ADA Compliance Sources

The ADA Handbook, published by the Department of Justice (DOJ) and Equal Employment Opportunity Commission (EEOC), serves as a basic resource document on

the ADA. It provides analysis of Title I, II, and III regulation in a well organized manner. This document also includes the ADA Accessibility Guidelines (ADAAG), Public Law 101-336, resource lists, and a large amount of background information.

The ADA Title III Technical Assistance Manual covering public accommodations and commercial facilities also serves as a useful ADA compliance source. Although the manual does not contain specific standards, the document facilitates the interpretation of Title III requirements.

As mentioned previously, the ATBCB provides the single most useful source of information. The ATBCB provides publications on accessibility guidelines and standards, architectural access, communication access, transportation access, and technical assistance bulletins. The Access Board provides publications and technical assistance at no charge.

APPENDIX C

Appendix C: Field research

The purpose of the field research was to study the accommodations provided for sensory and mentally impaired individuals at various facilities. The other benefit of field research was obtaining first hand information from individuals directly responsible for providing accessible accommodations. Rather than performing an exhaustive check of facilities to insure ADA compliance, I was more interested in studying outstanding and interesting accommodation strategies and techniques.

Field research criteria was based on the American with Disabilities Act Accessibility Guidelines (ADAAG) and the Accessibility Guidelines Checklist obtained from the Architectural and Transportation Barriers Compliance Board. The guidelines and checklist are displayed in Appendix D: Selected ADA publications. Field research also involved contacting ADA compliance specialists and other representatives of various organizations.

The field research mainly focused on elevators, transportation facilities, and hotel establishments. Elevators are covered in section 4.10 of the Accessibility Guidelines. In addition to complying with the general provisions of ADAAG, transient lodging and transportation facilities must also observe the standards documented in sections 9 and 10 of ADAAG which are reserved for those specific facility types.

Since facilities existing before 1992 are not required to abide by all provisions of ADA regulation, I studied both existing and newly constructed facilities. In regards to facilities constructed before 1992, 28 CFR Part 36.402 (Alterations) states "...alterations to a place of public accommodation shall be made so as to ensure that, to the maximum extent feasible, altered portions of the facility are readily accessible to and usable by individuals with disabilities".

I visited several transient lodging (hotel) establishments in College Station (Super 8 and Hilton) and Dallas (Sleep Inn and Marriott Courtyard). Accessible transient lodging presents a unique public accommodation situation for the sensory and mentally impaired, because the many accommodations are not utilized or placed in a "public" setting. Within a guest room, no company representatives are present to assist individuals and adequte accessible features must be provided for a specific limited space. Hotel establishments must create individual, small, self-sufficient, accessible areas.

Besides physical accessibility, a majority of accessibility modifications within hotels exist for the hearing impaired. Limited auxiliary accommodations, such as braille and raised lettering on general signage and elevators controls, are required to accommodate visually impaired individuals, as adequate sound cues for elevators, phones, and general alarms are considered standard design features.

Every hotel I visited utilized a portable hearing impairment accommodation setup. By not permanently installing these assistive devices, hotels are able to utilize the equipment in any room.

Devices provided in a typical hearing impairment accommodation kit include:

- Text Telephone (TDD)
- Telephone Amplifier
- Telephone Alert Unit
- Door Knock Alert Unit
- Telecaption Decoder
- Bed Vibrator (to be used in conjunction with clock alarm)
- Visual Smoke Detector/Fire Alarm

Pictures and explanations of these devices are provided on the following pages. Representatives at several hotels were unfamiliar with the equipment while others stated they had training (and had accommodation manuals on-site) regarding the accommodation of individuals with disabilities.

In many cases, I believe existing hotel establishments have not modified facilities to accommodate to "the maximum extent feasible". In addition, although newly constructed hotels had no outstanding violations of ADA requirements, I feel some facilities could be designed with more forethought. For example, only a few hotels I have visited displayed information in a raised lettering and braille format. Displaying information in this manner would be relatively inexpensive and simple to install.

I studied elevators on the campus of Texas A&M University in addition to examining elevators in hotel establishments. Elevators require a great deal of design thought for a relatively small amount of physical space. Information must be presented in auditory, visual, and tactile form. The standards for elevators are clearly stated in section 4.10 of the ADA Accessibility Guidelines.

As expected, the elevators in the older facilities (Hilton Hotel and Rudder Tower) did not meet criteria of current ADA standards for new construction. All new facilities had well designed elevator systems. Many of the new facilities (Student Services Building at Texas A&M and several hotels) actually had identical elevator systems. Perhaps speed requirements/limitations of elevator systems should be addressed in future editions of ADAAG. Elevators that accelerate too fast (like Rudder Tower elevators) may cause problems for individuals who are not physically stable.

I also visited Dallas-Fort Worth (DFW) International Airport and Dallas Area Rapid Transit (DART) light rail transportation facilities during my field research. Dallas Fort Worth Airport is a very large and old facility while the DART light rail and bus stop I visited is a small and newly constructed facility.

Although lacking in several areas (such as braille signage and visual fire alarms), DFW airport has put forth great effort to accommodate disabled individuals. In accommodating hearing impaired individuals, DFW airport has outfitted all courtesy phones with volume control receivers. Since the courtesy phones are not TDD compatible, signs have been posted at every courtesy phone stating all courtesy phone services may be accessed free of charge from any TDD pay phone. Other basic considerations such as detectable warnings and protruding objects have adequately been accounted for. Areas of potential danger (baggage claim and tram areas) were outfitted with both visual and auditory alarms.

At DFW Airport, the accommodation process is mainly the responsibility of the airlines. Most airlines utilize a one-to-one strategy. They provide a company representative to guide and/or assist a single individual. American Airlines actually subcontracts to obtain accommodation assistance for their customers. When talking with representatives of airlines and DFW airport, they all stated a major problem was "getting the word out" that services were available for disabled individuals. In addition to complying with ADA requirements, airplanes and airport facilities must also comply with the Air Carrier Access Act (ACAA).

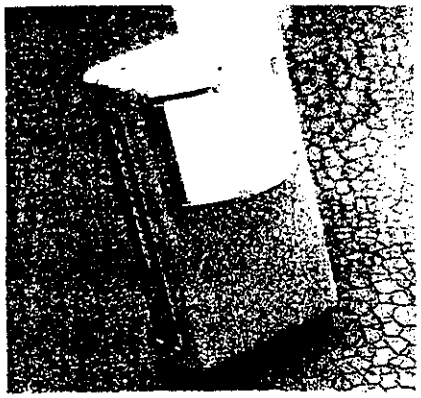
The DART light rail and bus stop facility I visited had limited accessibility problems to consider. The small size of the facility allows a great deal of the accommodation process to be handled on a individual basis with one-to-one service. Once again, simple accommodation considerations such as detectable warnings at danger areas and loading zones proved to be adequate. Although I did not notice any outstanding accessibility provisions, no glaring deficiencies of the facility were apparent.

Both DFW airport and DART employ ADA compliance specialists to insure ADA guidelines are followed. Both compliance specialists I spoke to were very helpful and enthusiastic about their work. Curtis Inglis, the ADA Coordinator for Services and Facilities at DFW airport, helped me understand the impact of ADA and the concern for disabled individuals. He stated DFW airport alone has 270 text telephones (TDD's) while their are only 80 public TDD's in all of the United Kingdom.

Field research provided an excellent opportunity to study accommodation considerations and devices in the public domain. Speaking with numerous individuals involved with the implementation of ADA guidelines provided an excellent opportunity to view how the regulations and guidelines are interpreted. Because of my interest and concern with the accommodation of sensory and mentally impaired individuals, I consider the field research portion of the project to be a continual project which will continue well beyond the submission of this document.

HITEC GROUP INT'L, INC.
"Providing People with Disabilities Access to Independence"
Info: 708/963-5588
Fax: 708/963-6088

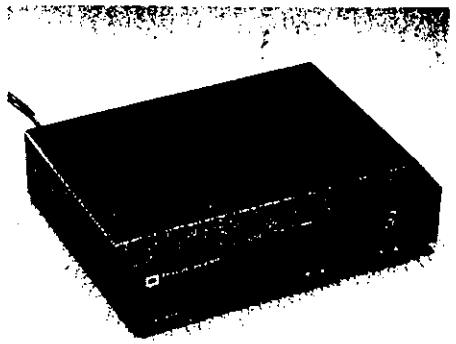
Assistive Devices Installation Guid



KNOCKALERT: *Flashes a light with a knock on the door.*

1. Make sure a 9V Duracell battery is installed in the battery compartment.
2. Pull one velcro strip from the back of the unit. Remove the protective paper and place on the center of the door just below eye level.
3. Line up the velcro strip on the unit to the strip on the door and press firmly.
4. Turn the switch to the on position. The unit will flash for a few seconds and stop.
5. Test the unit by knocking on the outside of the door. The knock alert will flash for several seconds and then stop.

(Be sure the switch is in the OFF position when the unit is in storage. The battery will need to be replaced after approximately 120 minutes of flashing time. If the switch is left on when not being used, the battery will drain much faster. Replace battery with a 9 volt Duracell battery for best operation.)



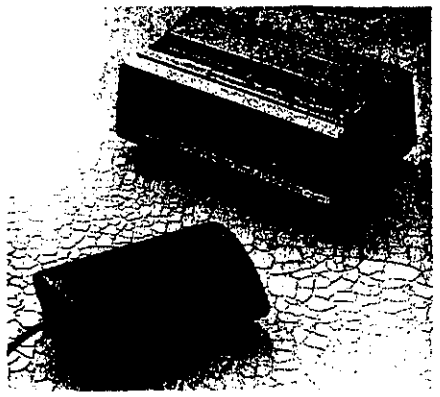
TELECAPTION DECODER: *Decodes the dialogue of television shows that are close captioned and displays it on the television screen.*

You will be using one of two models the NC4000 or the VR100.

NC4000: This unit can be used with most all television systems. It has a tuner and is necessary for use with televisions where there is no cable tuner or where your incoming signal from the movie box is on Channel 2.

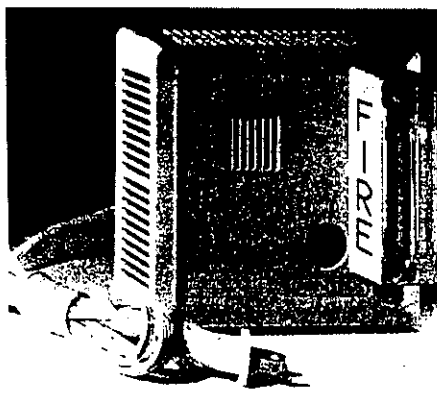
VR100: This unit does not have a built in tuner and is for use with existing tuners such as those with Spectravision.

1. If you have Movie Service, cable the decoder between the movie channel box and the TV set. Make sure the decoder is set to channel 3 or 4.
2. If you do not have any movie channel system, cable the NC4000 between the incoming signal and the TV set.



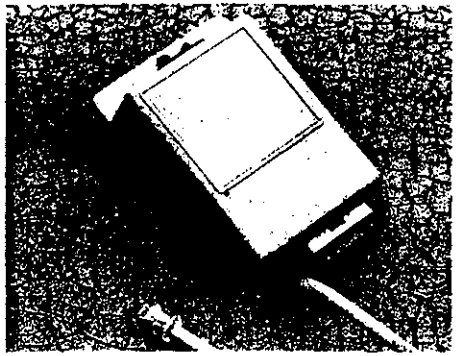
TIMER CLOCK AND BED VIBRATOR: *Used as a wake up system.*

1. Plug the timer clock into the wall and set the time by holding the time button down while you push the hour and then the minute buttons to reach the correct time.
2. Plug the bed vibrator into the back of the clock.
3. If the guest requests that you set the wake up time, then hold the alarm button down while you push the hour and then the minute buttons to reach the requested time.
4. The vibrating unit should be placed between the mattresses under the head area.
5. Make sure the alarm switch is on. The vibrator will activate when the preset time is reached.



VISUAL SMOKE DETECTOR: *Has a powerful strobe which will flash when the smoke detector is activated.*

1. Select a location on the wall facing the bed. Place a hook high on the wall so that the smoke detector will hang between 6-9 inches below the ceiling.
2. Plug the unit into an electrical outle
3. Test the unit by holding down the test button. (If using the Whelen smoke detector you will need a pointed object to hold down the te button. If using the Gentex smoke detector, simply turn the test knob the test position.)
4. When testing, the alarm will sounc first and then the strobe will begin flash. Make sure that the strobe does flash.



TELEPHONE ALERT UNIT: *Used to flash a room light when the telephone rings.*

This may require the use of a strip plug which should be placed on the table or desk near the telephone. A "T-jack" (double phone jack) may also be needed.

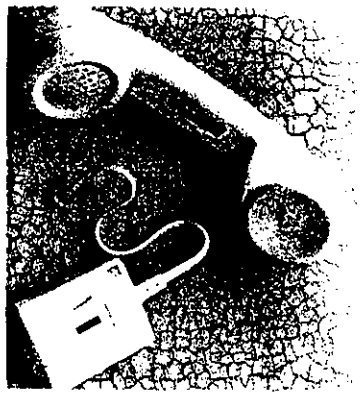
1. Plug the telephone signaler into an AC outlet.
2. Plug the table lamp into the signaler. Make sure the lamp is on before you plug it into the signaler. The lamp can now be turned on and off by the switch on the signaler unit. Test the switch by turning the lamp on or off. The lamp will flash when the signaler switch is in either the on or off position.
3. Remove the phone wire from the jack in the wall and install a T-jack.
4. Put the phone wire in one side of the jack and the wire from the signaler into the other side.

The unit is now ready and will cause the lamp to flash when the phone rings.

DISPLAY MODEL TDD/TT *(Text Telephone) : This is used by hearing or speech impaired who cannot use the usual telephone.*

1. Place the unit on the desk or table near the telephone.
2. Plug the AC adapter into the wall or strip plug and plug adapter wire into the back of the TDD.
3. Turn the unit on with the switch on the right side of the display screen. Push a few keys to make sure the letters show up on the screen. Each time you push a key you should also hear a beeping sound. If you do not see letters when you type them, or if you do not hear any beeping sound, then the unit may not be working properly and you should install a back up unit.

These are very reliable units, but if dropped, the display screen can break.



TELEPHONE AMPLIFIER: *In-Line amplifier or amplified handset.*

IN-LINE AMPLIFIER: *A device which plugs between the handset and the base of the telephone and will amplify the sound when the dial is turned. Unit is powered by an AA battery.*

1. Make sure the AA Battery is properly installed.
2. Disconnect the handset wire from the base of the phone.
3. Plug the handset wire into one end of the in-line amplifier.
4. Plug the other end into the base of the phone.
5. Volume will be controlled by the dial on the in-line amplifier.
6. Test the unit by picking up the handset and listening to the tone. Turn the dial on the amplifier and make sure the sound becomes louder.

AMPLIFIED HANDSET: *This is a hands that replaces the room telephone handset. The volume control is in the handset. This control may be either a dial or a touch bar control.*

1. Disconnect the handset wire from t existing telephone handset.
2. Replace it with the amplified hands
3. Test the unit by calling another exte sion and make sure you can hear th person you are calling and they can hear you.
4. Test the volume by turning the dial pressing the touch bar. If you have trouble hearing or if the volume is not increasing you may need to us the in-line amplifier rather than the amplified handset.

Additional Products are available

If you have selected a brand of product diffe from those described here, you may call customer service for assistance.

HITEC GROUP (708) 963-5588

APPENDIX D

On April 12, 1994, the Access Board published a joint final rule with the Departments of Justice (DOJ) and Transportation (DOT) to suspend temporarily--until July 26, 1996--requirements for detectable warnings at curb ramps, hazardous vehicular areas, and reflecting pools. This action does not affect the ADAAG requirement for detectable warnings at transit platforms, which remains in effect.

The landmark Americans with Disabilities Act (ADA), enacted on July 26, 1990, provides comprehensive civil rights protections to individuals with disabilities in the areas of employment (title I), State and local government services (title II), public accommodation and commercial facilities (title III), and telecommunications (title IV). Both the Department of Justice and the Department of Transportation, in adopting standards for new construction and alterations of places of public accommodation and commercial facilities covered by title III and public transportation facilities covered by title II of the ADA, have issued implementing rules that incorporate the ***Americans with Disabilities Act Accessibility Guidelines (ADAAG)****, developed by the Access Board.*

U.S. Architectural and Transportation Barriers Compliance Board

BULLETIN #1: DETECTABLE WARNINGS

Why were detectable warnings developed?

A detectable warning is a standardized surface that incorporates small truncated domes at closely-spaced intervals (see Plan and Section illustrations). The use of distinctively-textured paving patterns as signaling and wayfinding devices for the foot or cane of pedestrians who have vision impairments was pioneered in Japan in the mid-1960s. Today, curb ramps and grade-level crossings at intersections in many Japanese cities are marked by installations of bright yellow tiles with an alternating pattern of raised truncated domes. Similar wayfinding tiles with raised ridges mark routes and stopping points along sidewalks and in transit stations to assist travellers who are blind or who have low vision.

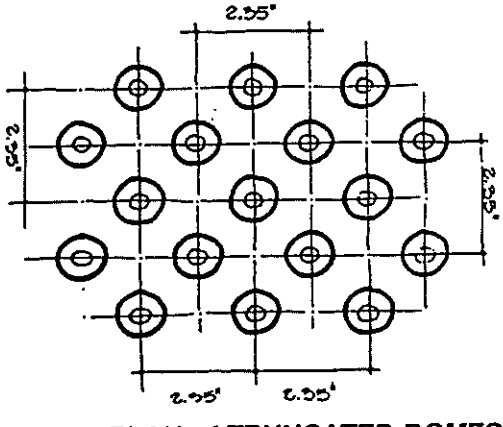
Persons with little or no usable vision depend upon environmental cues--ambient sounds, edges and other physical elements that can be sensed by a cane, and texture changes underfoot--for safe and independent travel. People with low vision can also use color contrast as a navigation aid.

When raised curbs do not mark and separate the pedestrian route on a sidewalk from the vehicular way, as at curb ramps, vehicle drop-offs, or depressed corners at intersections, it is difficult for some pedestrians to discern the boundary between pedestrian safety and hazard.

Several research projects tested textured walking surfaces in the United States in the 1980s. One study compared the detectability of the truncated dome pattern with other textured surfaces. Several pilot installations of raised-pattern tiles in a strip along the edge of a transit platform tested their utility, maneuverability, and safety on level surfaces at drop-offs.

ADAAG 3.3 Definitions.
Detectable Warning.
A standardized surface feature built in or applied to walking surfaces or other elements to warn visually impaired people of hazards on a circulation path.

4.1.3 (15) New Construction. Detectable warnings shall be provided at locations as specified in 4.29.



PLAN of TRUNCATED DOMES
(not to scale)

ADAAG 4.7.7 Detectable Warnings. *A curb ramp shall have a detectable warning complying with 4.29.2. The detectable warning shall extend the full width and depth of the curb ramp.*

TEMPORARILY SUSPENDED

ADAAG 4.29.2 Detectable Warnings on Walking Surfaces. ***Detectable warnings shall consist of truncated domes with a diameter of nominal 0.9 in (23 mm), a height of nominal 0.2 in (5 mm) and a center-to-center spacing of nominal 2.35 in (60 mm) and shall contrast visually with adjoining surfaces, either light-on-dark, or dark-on-light.***

The material used to provide contrast shall be an integral part of the walking surface. Detectable warnings used on interior surfaces shall differ from adjoining walking surfaces in resiliency or sound-on-cane contact.

ADAAG 4.29.5 Detectable Warnings at Hazardous Vehicular Areas. *If a walk crosses or adjoins a vehicular way, and the walking surfaces are not separated by curbs, railings, or other elements between the pedestrian areas and vehicular areas, the boundary between the areas shall be defined by a continuous detectable warning which is 36 in (915 mm) wide, complying with 4.29.2.*

TEMPORARILY SUSPENDED

ADAAG 4.29.6 Detectable Warnings at Reflecting Pools. *The edges of reflecting pools shall be protected by railings, walls, curbs or detectable warnings complying with 4.29.2.*

TEMPORARILY SUSPENDED

Findings of the studies conducted prior to the publication of scoping requirements and technical specifications for detectable warnings in the *ADA Accessibility Guidelines* indicated that maximum effect was achieved:

- when the warning texture was unique, so that it would not be confused with other commonly-encountered surfaces in the environment;
- when its location adjoined or abutted the hazard, where it could signal an impending change, and
- when it extended beyond the average stride in length, so that it allowed the pedestrian to sense it physically, understand its meaning, and react appropriately before the hazard was encountered.

Additionally, a high visual contrast at pedestrian and vehicular hazards was recommended by these and other research studies. *ADAAG* scoping for detectable warnings and the technical specifications for the truncated domes they require were developed to alert pedestrians of an imminent hazard and were not intended for use as wayfinding devices.

Why have some applications of detectable warnings been temporarily suspended?

The Access Board, in response to business and user concerns about the need for and safety of truncated domes on curb ramps and at hazardous vehicular areas, has determined that additional research is needed to determine whether changes to *ADAAG* requirements for detectable warnings may be necessary. A research project involving a large number of test subjects has been initiated under Board sponsorship. It is anticipated that findings from this and other research will assist the Access Board in determining both the need for and usability of current technical specifications for detectable warnings, particularly those applied to sloping surfaces at curb ramps, and to complete rulemaking in this area prior to the July 26, 1996 expiration date of the temporary suspension.

What scoping requirements have been suspended?

ADAAG scoping at *4.1.3(15)* requires that detectable warnings be provided *"at locations specified in 4.29."* The temporary suspension includes these locations:

- on curb ramps (*ADAAG 4.7.7*);
- at hazardous vehicular areas (*ADAAG 4.29.5*), and
- at reflecting pools (*ADAAG 4.29.6*).

Where must detectable warnings still be applied?

The technical provisions of *ADAAG 4.29.2* remain in effect as the standard for detectable warnings at platform edges in transit stations, as required in *ADAAG 10.3.1(8).* Since much of the early research into detectable warnings was conducted where they were installed in rapid rail systems, abundant data exist on these applications.

ADAAG 10.3 Fixed Facilities and Stations.

10.3.1 New Construction.

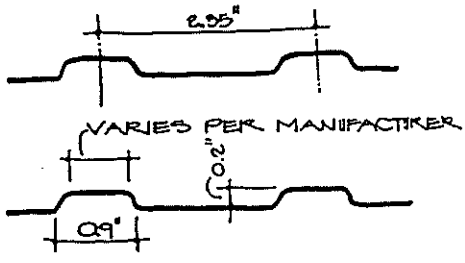
[...]

(8) Platform edges bordering a drop-off and not protected by platform screens or guard rails shall have a detectable warning. Such detectable warnings shall comply with 4.29.2 and shall be 24 inches wide running the full length of the platform drop-off.

Platform edges in new and altered rapid, light, commuter, and intercity rail stations must have detectable warnings. Additionally, key rapid, light, and commuter rail stations and all intercity rail stations must install detectable warnings where platform edges are not otherwise protected by screens or guardrails.

The detectable warning must be placed at the platform edge and must extend the full length of the platform in a 24-inch width. The 24-inch requirement is an absolute dimension, not a minimum. Where a breakaway material is installed at the platform edge, the width of the detectable warning surface may begin at the edge of the breakaway material rather than at the edge of the platform. Since the sway--the "dynamic envelope"--of some commuter rail cars may overlap a platform edge, the area of the detectable warning installation should not be considered a safety zone but rather an indication of an adjacent drop-off or platform edge.

Interior applications require that the warning feature provide contrast in resilience or in sound when sensed by a cane. The domes and their matrix must also offer a strong visual contrast to adjacent pedestrian surfaces. Although *ADAAG* does not specify values for light-on-dark or dark-on-light contrast, a 70% figure is recommended in the Appendix.



SECTION thru TRUNCATED DOMES
(not to scale)

What is the new deadline for key station retrofits requiring detectable warnings under the DOT rule?

On November 30, 1993, the Department of Transportation amended its ADA regulation to extend the compliance date for retrofitting key rail stations with detectable warnings. The new deadline is July 26, 1994. For further information on this rulemaking, which also affects procedures for requesting equivalent facilitation under the DOT rule, contact DOT at (202)366-1656 (V) or (202)755-7687 (TTY).

Who makes detectable warnings?

The Access Board has been advised by the following manufacturers that their products meet the technical specifications for detectable warnings. All proposed materials should be carefully evaluated against ADA guidelines for application, design and installation. The Access Board does not review plans, products or materials for ADA compliance and thus cannot certify the suitability of such products or systems for the purposes intended.

The Department of Transportation regulations governing public transportation services and facilities establish a procedure through which an agency--or manufacturer--may apply for a determination of equivalent facilitation for a design or technology that represents a departure from *ADAAG* technical or scoping provisions. DOT has granted equivalent facilitation for some surface treatment specifications whose geometry, spacing, or profile differ from detectable warning provisions in *ADAAG*; products meeting these specifications have been listed in this Bulletin as well. For more information, contact DOT at (202)366-1656 (V) or (202)755-7687 (TTY).

This listing is provided by the Access Board in the interests of information dissemination. The Access Board does not evaluate or certify products as complying with the requirements of any accessibility standard. Neither the Access Board nor the U.S. Government assumes liability for the contents of this list or its use, nor do they endorse manufacturers or their products. Trade or manufacturer's names appear herein solely because they are considered essential to the object of this Bulletin. This listing should not be construed as exhaustive or comprehensive, nor does inclusion on the list attest to the suitability of a specific product for a particular use. Readers are advised to obtain and review manufacturer's specifications, recommended applications, and installation instructions in order to evaluate each product for its intended use.

Applied Surfaces

Applied Surfaces, Incorporated
18 Overlook Avenue
Rochelle Park, NJ 07662
TEL: (201)836-5552 / FAX: (201)836-5552

Advantage Metal Systems
685 Oak Street, Suite 13-1
Brockton, MA 02401
TEL: (508)580-5177 / FAX: (508)587-9510

Bridgeco Products Division
Brio Industries Incorporated
302 Maro Road
Pasadena, MD 21122
TEL: (800)466-4884; (301)261-2166

COTE-L Enterprises, Incorporated
1542 Jefferson Street
Teaneck, NJ 07666
TEL: (201)836-9448 / FAX: (201)836-2290

COTE-L Midwest
211 East Ohio, Suite 513
Chicago, IL 60611
TEL: (312)321-9068

Gene Falco Tool Supply
88 Toledo Street
Famingdale, NY 11735
TEL: (516)752-7550 / FAX: (516)752-7515

Increte Systems
8509 Sunstate Street
Tampa, FL 33634
TEL: (800)752-4626 / FAX: (813)886-0188

Nation Wide Products Company
P.O. Box 9031
Fort Worth, TX 76147-2031
TEL: (817)332-7217 / FAX: (817)335-1240

Rapidcrete Incorporated
P.O. Box 16
Syracuse, NY 13205
TEL: (800)446-5338; (315)457-5338 / FAX: (315)451-2290

Strongwall Industries, Inc.
P.O. Box 201
Ridgewood, NJ 07451
TEL: (201)445-4633 / FAX: (201)447-2317

Masonry Unit Pavers/Bricks

Hanover Architectural Products, Incorporated
240 Bender Road
Hanover, PA 17331
TEL: (717)637-0500 / FAX: (717)637-7145

Hastings Pavement Company, Incorporated
30 Commercial Street
Freeport, NY 11520
TEL: (516)379-3500 / FAX: (516)379-0570

Oldcastle, Inc.
5600 Glenridge Drive, Suite 260W
Atlanta, GA 30342
TEL: (404)851-9484 / FAX: (404)851-9390

Superock Block Company
3301 27th Avenue North
P.O. Box 5326
Birmingham, AL 35207
TEL: (205)324-8624 / FAX: (205)324-8671

Whitacre-Greer Fireproofing Company
P.O. Box 460
Waynesburg, OH 44688-0460
TEL: (216)866-9331 / FAX: (216)866-4208

Metal Plate

Advantage Metal Systems
685 Oak Street, Suite 13-1
Brockton, MA 02401
TEL: (508)580-5177 / FAX: (508)587-9510

High Quality Manufacturing
P.O. Box 208
Woburn, MA 01801
TEL: (617)935-8450 / FAX: (617)935-4958

Precast Curb Ramps

Steps Plus, Incorporated (NY sales only)
Kravec Drive
Syracuse, NY 13214
TEL: (315)446-8050 / (315)449-0271

Resilient Mats

ADA Consultants, Incorporated
P.O. Box 41029
Raleigh, NC 27629-1029
TEL: (919)872-4994 / FAX: (919)954-1015

Detectable Warnings/MSi
17150 Newhope Street, Unit 106
Fountain Valley, CA 92708-4200
TEL: (800)897-9276; (714)966-0779 / FAX: (714)966-1226

MCW Industries
East 12411 Empire Avenue
Spokane, WA 99216
TEL: (509)891-6342 / FAX: (509)927-1368

REHAU Incorporated
P.O. Box 1706
1501 Edwards Ferry Road
Leesburg, VA 22075
TEL: (703)777-5255 / FAX: (703)777-3053

Stamping/Imprinting Systems

Cobblecrete
205 West 2000 South
Madera, CA 93637
TEL: (800)798-5791; (801)224-6662 / FAX: (801)225-1690

CT Concrete Company
394 Whitehall Street
Allentown, PA 18104
TEL: (215)433-2757 / FAX: (215)433-3402

Increte Systems
8509 Sunstate Street
Tampa, FL 33634
TEL: (800)752-4626 / FAX: (813)886-0188

Specialty Concrete Products
P.O. Box 2922
West Columbia, SC 29171
TEL: (803)955-0707 / FAX: (803)955-0011

Stampcrete Decorative Concrete, Incorporated
127 Ball Circle
Syracuse, NY 13210
TEL: (315)451-2837 / FAX: (315)451-2290

Stamprite
1462 SW 12th Avenue
Pompano Beach, FL 33069
TEL: (305)946-6155 / FAX: (305)946-8049

Tiles

American Olean Tile Company
Lansdale, PA 19446-0271
TEL: (215)855-1111 / FAX: (215)362-6050

Bridgeco Products Division
Brio Industries Incorporated
302 Maro Road
Pasadena, MD 21122
TEL: (800)466-4884; (301)261-2166

Carsonite International
1301 Hot Springs Road
Carson City, NV 89701
TEL: (800)648-7974 / FAX: (702)883-0525

Castek, Incorporated
20 Jones Street
New Rochelle, NY 10801
TEL: (800)321-7870; (914)636-1000 / FAX: (914)636-1282

Crossville Ceramics
Cumberland County Industrial Park
Crossville, TN 38555
TEL: (615)484-2110 / FAX: (615)484-8418

Dal-Tile Corporation
6760 Gravel Avenue
Alexandria, VA 22310
TEL: (703)971-8485 / FAX: (703)971-8604

Engineered Plastics, Incorporated
300 Pearl Street, #200
Buffalo, NY 14202
TEL: (800)682-2525; (716)842-6039 / FAX: (716)842-6049

Project Design USA, Incorporated
1950 Old Covington Road
Conyers, GA 30208
TEL: (404)388-0552 / FAX: (404)388-0527

Safety Services, Incorporated
1543 Del Plaza No. 3
Baton Rouge, LA 70815
TEL: (504)924-0010 / FAX: (504)928-3447

Summitville Tiles, Incorporated
Summitville, OH 43962
TEL: (216)223-1511 / FAX: (216)223-1414

Terra Clay Products, Incorporated
926 26th Street
West Palm Beach, FL 33407
TEL: (407)655-3988 / FAX: (407)833-4629

The landmark Americans with Disabilities Act (ADA), enacted on July 26, 1990, provides comprehensive civil rights protections to individuals with disabilities in the areas of employment (title I), State and local government services (title II), public accommodations and commercial facilities (title III), and telecommunications (title IV). Both the Department of Justice and the Department of Transportation, in adopting standards for new construction and alterations of places of public accommodation and commercial facilities covered by title III and public transportation facilities covered by title II of the ADA, have issued implementing rules that incorporate the ***Americans with Disabilities Act Accessibility Guidelines (ADAAG)****, developed by the Access Board.*

U. S. Architectural and Transportation Barriers Compliance Board

"The severity of hearing problems was strongly associated with age. Persons 65 and older constituted 69 percent of the population with the most severe hearing trouble...but only 8.7 percent of the population without hearing trouble."

Digest of Data on Persons with Disabilities (1984)

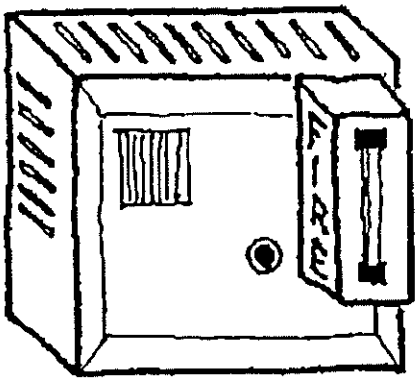
BULLETIN #2: VISUAL ALARMS

Why are visual alarms required?

One American in a hundred has a severe hearing loss; nearly one in ten has a significant loss. Those who are deaf or hard-of-hearing--a growing percentage of our population, due largely to the growth in the numbers of older persons--depend upon visual cues to alert them to emergencies. A visual alarm provides persons with hearing loss the same warning delivered to hearing persons by an audible alarm.

Audible fire alarms have been a standard feature of building construction since the life safety codes of the early 1900s. However, visible signals did not appear even in accessibility codes until 1980. Early standards required relatively dim flashing lights at exit signs--an alarm system that was effective only along an exit route. As accessibility, life safety, and building codes were revised, however, they began to incorporate alarm technology that was developed for use in schools for persons who are deaf and in factories where ambient noise levels made audible alarms ineffective.

In passing the Americans with Disabilities Act in 1990, Congress specifically directed the Access Board to provide greater guidance regarding communications accessibility. Thus the *ADA Accessibility Guidelines (ADAAG)* require that where emergency warning systems are provided in new or altered construction, they must include both audible and visible alarms that meet certain technical specifications.



What are visual alarms?

Visual alarms are flashing lights used as fire alarm signals. The terms visual alarm signal, visible signal device, and visible signaling appliance are used relatively interchangeably within the fire protection community; the National Fire Protection Association (NFPA) calls them *visual notification appliances*. There is no practical distinction between a *visual* signal and a *visible* signal. Although visual signals may be used for other purposes, the type described in this Bulletin is appropriate only for use as an emergency alarm signal.

There are two major categories of fire alarms:

- *self-contained units*, as exemplified by the single-station residential smoke detector unit--battery-operated or hard-wired to building electrical power--which produces an alarm signal at the fixture itself when activated by an integral sensing device, and

- *building-wide systems*, integrated--often zoned--alarms whose local signals are remotely initiated, either automatically from detectors or manually from pull-stations spread throughout a facility.

ADAAG requires that when either type is installed, it must have a visual alarm component.

4.1.3 (14) New Construction.
If emergency warning systems are provided, then they shall include both audible and visual alarms complying with 4.28. Emergency warning systems in medical care facilities may be modified to suit standard health care alarm design practice.

4.28 Alarms.
4.28.1 General.
Alarm systems required to be accessible by 4.1 shall comply with 4.28. At a minimum, visual signal appliances shall be provided in buildings and facilities in each of the following areas: restrooms and any other general usage areas (e.g., meeting rooms), hallways, lobbies, and any other area for common use.

3.5 Definitions.
Common Use.
Refers to those interior and exterior rooms, spaces, or elements that are made available for the use of a restricted group of people (for example, occupants of a homeless shelter, the occupants of an office building, or the guests of such occupants).

Where are visual alarms required?

Facility design is subject to state and local ordinances that may both require and specify standards for emergency alarm systems. These regulations--building codes, life safety codes, accessibility codes, technical standards--are typically based upon national model codes and standards. The requirement for an emergency alarm system in new construction will be established by the applicable State or local building, life safety, or fire protection regulation. *ADAAG* does not mandate an emergency alarm system; its scoping provision at *4.1.3(14)* simply requires that when emergency warning systems are provided, they shall include both audible and visual alarms that comply with *4.28.*

Thus the requirement for an alarm system in a facility will trigger the *ADAAG* technical specifications for alarms. *ADAAG 4.1.3(14) Accessible Buildings: New Construction* requires that visual alarms be installed if emergency warning systems are provided in a new facility. In existing buildings, the upgrading or replacement of a fire alarm system also requires compliance--*see ADAAG 4.1.6(1)(b)*--with *ADAAG* technical provisions for alarms.

Because it is not always possible to fix the occupancy of a room or space or anticipate its use by a person with a hearing impairment, visual alarms are required in every common use room or space in facilities equipped with an emergency alarm system. This is particularly important in those common use spaces where a person may be alone. *ADAAG 4.28.1 General* stipulates that alarm systems required to be accessible shall provide visible signals in restrooms, in other general and common use areas, and in hallways and lobbies. Common use

areas also include meeting and conference rooms, classrooms, cafeterias, filing and photocopy rooms, employee break rooms, dressing, examination, and treatment rooms, and similar spaces that are not used solely as employee work areas.

System designers and specifiers must be particularly attentive to signal coverage issues. Where audible alarms are installed in corridors and lobbies to serve adjacent common use rooms, individual visual alarm signal appliances must be installed in those rooms, since the warning provided by a visual signal, unlike that of a bell or other annunciation system, can only be observed within the space in which it is installed. Dressing and fitting rooms, for example, can be easily protected by an audible alarm outside the room or space. However, the customer or patient who has a hearing impairment will not be alerted unless the dressing room he/she is using is protected with a visual alarm in (or above, if partitions do not extend to full height) the space. In general, it is not sufficient to install visual signals only at audible alarm locations.

4.1.1 Application.
(3) Areas Used Only by Employees as Work Areas. Areas that are used only as work areas shall be designed and constructed so that individuals with disabilities can approach, enter, and exit the areas. These guidelines do not require that any areas used only as work areas be constructed to permit maneuvering within the work area or be constructed or equipped (i.e., with racks or shelves) to be accessible.*

******
For information on employee accommodation under title I of the ADA, contact the Equal Employment Opportunity Commission (EEOC) ADA information line at (800) 669-3362 (voice) (800) 800-3302 (TTY)

Where are visual alarms <u>not</u> required?

ADAAG does not require that areas used only by employees as work areas be fully accessible. Thus, visual alarms are not required in individual employee offices and work stations. However, providing a visual alarm in the work area of an employee who is deaf or hard-of-hearing may be--like other elements of workplace accessibility-- a reasonable accommodation under title I** of the ADA, which addresses employment issues. The potential for such future employee accommodations should be considered when facility wiring is planned to facilitate a later connection to the building alarm system. Mechanical, electrical and telephone closets, janitor's closets, and similar non-occupiable spaces that are not common use areas nor assigned work areas are not required to have visual alarms.

What technical provisions apply to visual alarms?

The technical provisions of *ADAAG 4.28 Alarms* include minimum standards for the design and installation of single-station and building-wide visual alarm systems. They are based upon research sponsored by the Access Board and other groups, principally Underwriters Laboratories (UL).

To be effective, a visual signal--or its reflection from adjacent walls and ceiling--must be of an intensity that will raise the overall light level sharply, but not so intense as to be unsafe for direct viewing at a specified mounting height. Technical criteria for visual alarm signal appliances are established in *ADAAG 4.28.3 Visual Alarms* (see sidebars).

In research sponsored by the Access Board, a high-intensity xenon strobe lamp was found to be the most effective in alerting persons with hearing impairments. White light was judged to be the most discernible; colored lamps (particularly red) were not effective even at extreme intensities.

4.28.3 Visual Alarms.
Visual alarm signal appliances shall be integrated into the building or facility alarm system. If single station audible alarms are provided then single station visual alarm signals shall also be provided. Visual alarm signals shall have the following minimum photometric and location features:
(1)
The lamp shall be a xenon strobe type or equivalent.
(2)
The color shall be clear or nominal white (i.e., unfiltered or clear filtered white light).
(3)
The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time between initial and final points of 10 percent of maximum signal.
(4)
The intensity shall be a minimum of 75 candela.
(5)
The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
(6)
The appliance shall be placed 80 in (2030 mm) above the highest floor level within the space or 6 in (152 mm) below the ceiling, whichever is lower.
(7)
In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft (30 m) across, without obstructions 6 ft (2 m) above the floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft (30 m) apart, in lieu of suspending appliances from the ceiling.
(8)
No place in common corridors or hallways in which visual alarm signalling appliances are required shall be more than 50 ft (15 m) from the signal.

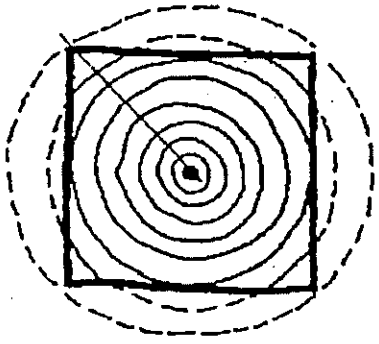
Ninety percent of the research subjects were alerted by a 75 candela (cd) signal mounted fifty feet away on the wall directly behind them, where the horizontal output of a strobe lamp is measured at 100% of its nominal rating. For this reason, 75 cd is a minimum performance criterion--not a lamp sizing or specifying standard--for all locations within the 50-foot radius of the covered area. Because most strobes are not point sources, light output falls off sharply to the sides; a lamp with a maximum output of 75 cd when measured at 0 degrees will not necessarily provide this required minimum illumination at a 45 degree angle. Lamp intensity is given in effective candela, measured in use at the source.

Like a camera flash, the strobe produces a short burst of high-intensity light. The repetition of this pulse at a regular interval is the flash rate. Pulse duration--the interval of the flash between signal build-up and decay--is limited so that the signal is not temporarily blinding. Testing indicated that flash rate cycles between one and three Hertz (flashes per second) successfully alerted subjects with hearing impairments; a 3 Hz rate appeared to be somewhat more effective. Lamps tested at 1/3 Hz were adjudged ineffective. *ADAAG* thus requires flash rates within the 1 to 3 Hz range.

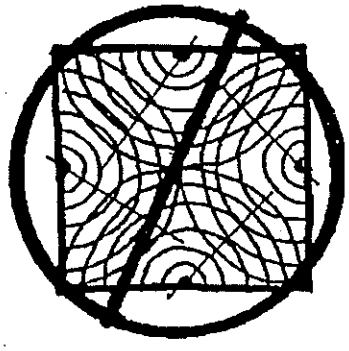
Rates that exceed 5 flashes per second may be disturbing to persons with photosensitivity, particularly those with certain forms of epilepsy. Information received during the development of these guidelines suggests that multiple unsynchronized visual signals within a single space may produce a composite flash rate that could trigger a photoconvulsive response in such persons (for example, two strobes set at 3 Hz in a room could generate a combined flash rate of 6 Hz). Installations that may produce a composite rate in excess of 5 Hz should therefore be avoided by decreasing the number of fixtures and raising the intensity of the lamps they contain, by decreasing the flash rate of multiple lamps, or by synchronizing the flash rates of multiple fixtures. This is particularly important in schools, since children are more frequently affected by photosensitivity than are adults.

Mounting provisions were developed from NFPA signal criteria and UL smoke test findings. Strobes--whether projected from a wall or suspended from the ceiling--must be a minimum of 6 inches below the ceiling plane to minimize smoke obscuration in the event of a fire. To comply with provisions covering protruding objects, alarm devices must be at least 80 inches above the finished floor. To preclude installations that might be outside the field of view in high-ceilinged spaces such as atriums and warehouses, the guidelines require a strobe to be mounted at the lower of the two heights. However, photometric calculations of lamp intensity for mounting heights of 80 inches and of 96 inches show only nominal differences and can be practically considered to be equivalent. A single visual signal meeting ADAAG specifications could be expected to serve a large room or length of corridor if optimally located on perimeter walls or suspended below the ceiling so that the signal can spread throughout the space, unobstructed by furnishings, equipment, or room geometry.

Illustration 2
Strobe lamp coverage



Recommended



Not recommended

In multipurpose facilities where bleacher seating, athletic equipment, backdrops, and other movable elements may at times be deployed or in warehouses, libraries, convention centers and other building types where devices would not be visible when installed at specified heights, optimal signal placement may require considerable study and the development of alternative intensity and placement calculations as an equivalent facilitation.

Provisions governing the spacing of visual alarms in hallways and corridors will generally require one fixture every 100 feet. In lengthy corridors, such as in shopping malls and large buildings, it is recommended that appliance spacing be maximized within the limits of the technical provision to minimize the effect of a composite flash rate on persons with photosensitivity. It is further recommended that the placement of visual signals along a corridor alternate between opposing walls to minimize the number of signals in a field of view.

What criteria affect the design of visual alarm systems?

Illustrations 2 through 4 describe general fixture placement and lamp coverage in schematic form. In general, it is recommended that visual alarm lamp intensity be maximized so as to require the minimum number of fixtures. Large, high-ceilinged spaces may best be served by suspended flash tubes of very high intensity (lamps up to 1000 candela are available for such applications). Smaller rooms, with an area that can be circumscribed by a circle 50 feet in radius, can be covered by a single, centrally located visual alarm meeting ADAAG intensity specifications. For very small rooms, such as examination, toilet, and dressing rooms, a single strobe of lesser intensity may well be sufficient as an equivalent facilitation.

When should equivalent facilitation be considered?

ADAAG technical provisions apply to normative conditions. Signal intensity and placement in very small and very large rooms and in spaces with high ceilings, irregular geometry, dark or non-reflective walls, or very high ambient lighting levels may best be determined by specialized consultants employing photometric calculation for system design rather than by a literal application of *ADAAG* specifications. For these reasons, *ADAAG 2.2 Equivalent Facilitation* permits alternative designs that achieve substantially equivalent or greater accessibility.

Lamp intensity (like sound) decreases in inverse relation to the square of its distance from the viewer. Thus, by varying lamp intensity and spacing, system designers can tailor an installation to the physical conditions of the space being served. It is impossible to provide specific guidance for the design of non-standard installations based upon the photometric calculations necessary to demonstrate equivalent facilitation. Such applications should generally be designed by experienced electrical engineers or fire alarm consultants under performance specifications for coverage and illumination levels derived from the technical provisions of *ADAAG 4.28* and ambient conditions in

2.2 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.*

Illustration 3
Recommended spacing in corridors

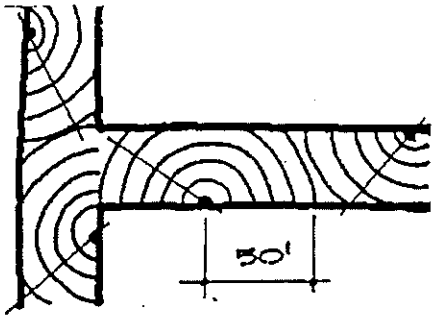
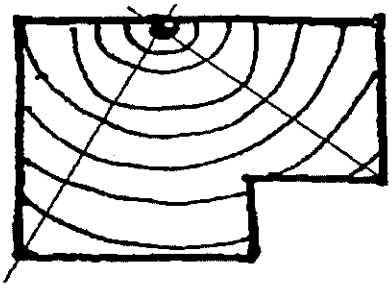


Illustration 4
Recommended placement in irregularly-configured room



4.28.4 Auxiliary Alarms. Units and sleeping accommodations shall have a visual alarm connected to the building emergency alarm system or shall have a standard 110-volt electrical receptacle into which such an alarm can be connected and a means by which a signal from the building emergency alarm system can trigger such an auxiliary alarm. When visual alarms are in place the signal shall be visible in all areas of the unit or room. Instructions for use of the auxiliary alarm or receptacle shall be provided.

the space. For example, a 75 cd strobe at 50 feet raises the ambient light by 0.03 lumens/square foot at 0 degrees in the horizontal plane. Equivalent design configurations should, therefore, result in approximately the same increase at all positions within the covered space.

As there is no process for certifying alternative methods (except in transportation facilities under DOT enforcement), the responsibility for demonstrating equivalent facilitation in the event of a challenge rests with the covered entity.

The *American National Standard for Accessible and Usable Buildings and Facilities (CABO/ANSI A117.1-1992)*, reflecting current NFPA 72 performance recommendations for visual alarms, stipulates lamp, installation, and spacing criteria at some variance with *ADAAG* technical specifications for visual alarms and with this Bulletin. *ANSI Table 4.26.3.2(a), Room Spacing Allocation*, suggests that an alarm installation of several low-intensity lamps within a room is the practical equivalent of a single high-intensity lamp serving that space.

Given concerns for economy (lower-candela lamps are less expensive to purchase and connect) and lamp standardization within a building (lower-candela lamps are more available and simplify inventorying), specifiers may be motivated to standardize on a minimum-candela fixture, achieving coverage in large rooms by close spacing of low-intensity lamps. The Access Board strongly discourages this practice. Where a single lamp can provide the necessary intensity and coverage, multiple lamps should not be installed because of their potential effect on persons with photosensitivity.

What types of visual alarms are available?

Most major suppliers to the fire protection industry manufacture visual appliances, which are readily available to electrical contractors and others responsible for the installation of building alarm systems. Visual alarms incorporating smoke detectors and lamp-only signal appliances are supplied through standard sources, although some lamp intensities and visual alarm fixtures may not be commonly stocked. Strobe lamps are commercially available in varying intensities up to 200 candela. Higher intensities can be provided by specialized manufacture.

Although an integrated audible and visual signal is available at about the same cost as an audible or visual signal alone, more visual signals than audible signals will be necessary for most applications. Careful attention to reflection from surfaces can increase light dispersion and coverage in both new and renovated structures.

What visual alarm requirements apply to sleeping rooms in transient lodging facilities?

ADAAG 9.3.1 requires that sleeping units covered by *Section 9 Accessible Transient Lodging* have a visual alarm connected to the building alarm system or provide a power outlet for a portable device that can be triggered by the building emergency alarm system (such

9.3 Visual Alarms, Notification Devices and Telephones.
9.3.1 General.
In sleeping rooms required to comply with this section, auxiliary visual alarms shall be provided and shall comply with 4.28.4. Visual notification devices shall also be provided in units, sleeping rooms and suites to alert room occupants of incoming telephone calls and a door knock or bell. Notification devices shall not be connected to auxiliary visual alarm signal appliances [...].

9.3.2 Equivalent Facilitation.
For purposes of this section, equivalent facilitation shall include the installation of electrical outlets (including outlets connected to a facility's central alarm system) and telephone wiring in sleeping rooms and suites to enable persons with hearing impairments to utilize portable visual alarms and communication devices provided by the operator of the facility.

units can be activated by a signal from the central alarm control system, transmitted through the standard 110V building wiring to a receiver plugged into a power outlet at a remote location). Portable units with a standard 110 volt electrical cord are available from specialized retailers of products for persons who are deaf and hard-of-hearing. Because guest room sizes are not large in such occupancies, the technical specification of *4.28.4 Auxiliary Alarms* requires only that the signal--intended to alert persons who are awake--be visible in all areas of the room or unit.

Visual alarms are not the technology of choice for awakening sleeping persons, however. A UL study concluded that a flashing light more than seven times brighter than that needed to alert office workers would be required to arouse a person who was asleep (110 cd vs. 15 cd at 20 feet, if mounted 24 inches or more from the ceiling; 177 cd if mounted less than 24 inches from the ceiling, where smoke obscuration might be a significant factor). Alarm system designers are advised to consider the UL findings if visual alarms are to be employed to warn sleeping persons of emergencies.

Although *ADAAG* does not establish standards for portable items or auxiliary aids, assistive devices may be required by §36.303 of the title III final rule. However, technologies other than visual signalling may offer equivalent or superior warning for sleeping guests who have hearing impairments. For example, a signal-activated vibrator was found to be much more effective in alerting sleepers than were the visual signals tested in the UL research. Such devices are commonly available and may be connected to or activated by a building alarm system. Care must be taken that notification devices intended to signal a door knock or bell are separately wired.

Why is there an exception in the scoping requirements of *4.1.3(14)* for "standard health care alarm design practice"?
In medical care settings where a supervised emergency evacuation plan is in place, it is usually not desirable to install alarms in patient rooms or wards. In such occupancies, personnel responsible for ensuring the safe egress of patients will respond to an intercom message or other signal that is not intended to alert or alarm patients incapable of independent evacuation. Additionally, visual alarms may not be appropriate for use in some specialized medical facilities, such as operating rooms, where lighting levels are high and the sudden discharge of a strobe flash might adversely affect a surgical procedure. For such facilities, the requirements for visual and audible alarms may be modified to suit industry-accepted practices.

U.S. Architectural and Transportation Barriers Compliance Board
The Access Board / 1331 F St. NW, #1000 / Washington, DC 20004
TECHNICAL ASSISTANCE TEL: (800)USA-ABLE TTY: (800)993-2822
TEL: (202)272-5434 TTY: (202)272-5449 FAX: (202)272-5447

The landmark Americans with Disabilities Act (ADA), enacted on July 26, 1990, provides comprehensive civil rights protections to individuals with disabilities in the areas of employment (title I), State and local government facilities (title II), public accommodations and commercial facilities (title III), and telecommunications (title IV). Both the Department of Justice and the Department of Transportation, in adopting standards for new construction and alterations of places of public accommodation and commercial facilities covered by title III and public transportation facilities covered by title II of the ADA, have issued implementing rules that incorporate the ***Americans with Disabilities Act Accessibility Guidelines*** *(ADAAG), developed by the Access Board.*

U.S. Architectural and Transportation Barriers Compliance Board

BULLETIN #3: TEXT TELEPHONES

Why are text telephones required?

In drafting the Americans with Disabilities Act, Congress cited the discriminatory effects of communications barriers in particular and directed the Access Board to include requirements for communications for persons with sensory impairments in its *ADA Accessibility Guidelines (ADAAG).*

Scoping and technical criteria were developed for assistive listening devices, emergency communications systems, visual alarms and auxiliary notification devices, volume controls at public telephones, and public text telephones for persons with speech or hearing impairments.

What is a text telephone? ... a TDD? ... a TTY?

Text telephone is a generic term for devices that provide access to real-time telephone communications for persons with hearing or speech impairments. Like computers with modems, text telephones provide some form of keyboard input and visual display output to callers and receiving parties connected over standard telephone lines and networks. A call from one text telephone can only be received by another--and compatible--text telephone. The devices, however, can be used by and between both hearing and non-hearing persons.

Text telephones enable non-voice communication with other users of such devices through the public telephone network. Two-way communications between individuals who use text telephones and those who do not is accomplished through 24-hour operator-assisted relay services mandated by title IV**** of the ADA.

Early models were known as TTYs (from their origin in teletype technology); current versions, both portable and fixed, are more frequently called TDDs (telecommunications devices for deaf persons), particularly on the signage required in public places to identify or direct users to them. The term ***text telephone*** is used throughout the *ADA Accessibility Guidelines* to include all such devices, including computers connected over telephone lines.

"The explosion in modern telecommunications technology has proved to be both a blessing and a curse for the deaf. Since the beginning of the century, telephone and radio have created greater isolation [...] as society shifted to audio communications for more of its [...] transactions."
--A Nationwide Communication System for the Hearing Impaired: Strategies toward Commercial Implementation (1981)

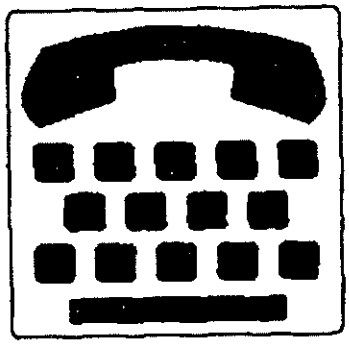


Figure 1
International TDD Symbol

3.3 Definitions.
Text Telephone.
Machinery or equipment that employs interactive graphic (i.e., typed) communications through the transmission of coded signals across the standard telephone network. Text telephones can include, for example, devices known as TDDs (telecommunication display devices or telecommunications devices for deaf persons) or computers.

"Users were most concerned about being able to request assistance, relay information, and respond to emergencies away from home."
--TDD Final Report
The Access Board (1984)

Text telephone capability may be integral with or accessory to a telephone. Many of the newer public pay telephones--both coin- and card-operated--incorporate TDD technology. One model provides a vandal-proof metal drawer for attachment beneath a public pay telephone housing. The outgoing call is made conventionally, using the telephone keypad, with the handset placed in an adjacent cradle. The drawer, which contains the keyboard and screen, automatically opens for use when the call is answered by another text telephone. If the call is not answered by a text telephone, the drawer will not operate. Another model has a handset cradle, small display screen, and keyboard within an enclosure that can be installed next to a wall-mounted public pay telephone. A portable device may also be permanently secured within or adjacent to a telephone enclosure. Other installations may provide only a shelf and power outlet for a portable TDD. Weatherproof text telephones were not available when *ADAAG* was under development and thus exterior installations are not currently required. However, several manufacturers now produce units for outdoor use. It is likely that scoping for exterior text telephones will be addressed in the guidelines for state and local government (title II) facilities now being developed by the Access Board.

Portable units can service office- and residential-type telephones as well. Devices typically comprise an acoustic coupler for the telephone handset, a simplified keyboard, and an LED message display. When connected to a standard power outlet, the TDD converts typed messages into audible tones that can be transmitted through the direct-dial network to a receiving TDD. Top-of-the-line equipment incorporates print-out and recording capability in many models; lightweight portable versions are useful for travelers.

Businesses that wish to provide text telephone service may acquire a portable TDD that can be used to answer calls on any voice number or line. An incoming text telephone call can usually be identified by a high-pitched, electronic or beeping sound that precedes it. Some TDDs are equipped with announcers whose recorded message signals a text telephone call. For instructions on handling text telephone calls and a lexicon of commonly-used TDD phrases and abbreviations, request the Access Board's free brochure on TDD communications.

Where are text telephones required?

Because telephone communications are so essential to the conduct of business and personal affairs today, text telephone requirements appear in each of the substantive titles of the ADA: TDDs may be a reasonable accommodation for an employee under title I*; a component of program accessibility or effective communications under title II**; an instance of readily-achievable barrier removal or an auxiliary aid in an existing place of public accommodation under title III***; or a link in the telecommunications relay system specified by title IV****.

Additionally, the installation of text telephones is required under certain conditions in new construction and alterations of buildings and facilities covered by titles II and III of the Act. *ADAAG* contains scoping and technical provisions that specify these conditions and installations. This bulletin deals largely with those requirements.

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For information on title I regulations for reasonable accommodations for employees, contact the Equal Employment Opportunity Commission (EEOC) ADA information line at (800)800-3302 (TDD) or (800)669-3362 (voice).

******
For information on title II regulations for program accessibility in existing State and local government buildings and effective communications by public entities, contact the Department of Justice ADA information line at (202)514-0381 (TDD) or (202)514-0301 (voice).

****
For information on title III regulations for barrier removal in existing buildings or auxiliary aids and services for public accommodations, contact the Department of Justice ADA information line at (202)514-0381 (TDD) or (202)514-0301 (voice).

****
For information on title IV regulations on telephone relay services, contact the Federal Communications Commission (FCC) at (202)632-6999 (TDD) or (202)632-7260 (voice).

4.1.3 Accessible Buildings: New Construction.
4.1.3 (17)(c)
[Public Telephones]
(i)
If a total number of four or more public pay telephones (including both interior and exterior phones) is provided at a site, and at least one is in an interior location, then at least one interior public text telephone shall be provided.
(ii)
If an interior public pay telephone is provided in a stadium or arena, in a convention center, in a hotel with a convention center, or in a covered mall, at least one interior public text telephone shall be provided in the facility.
(iii)
If a public pay telephone is located in or adjacent to a hospital emergency room, hospital recovery room, or hospital waiting room, one public text telephone shall be provided at each such location.

4.1.3(17)(d)
Where a bank of telephones in the interior of a building consists of three or more public pay telephones, at least one public pay telephone in each such bank shall be equipped with a shelf and outlet in compliance with 4.31.9(2).

4.1.6 Accessible Buildings: Alterations.
4.1.6(1)(e)
At least one interior public text telephone complying with 4.31.9 shall be provided if:
(i)
alterations to existing buildings or facilities with less than four exterior or interior public pay telephones would increase the total number to four or more telephones with at least one in an interior location; or
(ii)
alterations to one or more exterior or interior public pay telephones occur in an existing building or facility with four or more public telephones with at least one in an interior location.

In new construction, at least one public pay text telephone is required:

- in buildings *with four or more* public pay telephones on-site, if one is interior, and at rail station entrances and airport terminals, concourses, and baggage claim areas ***if four or more*** public pay telephones are provided in those locations:
- in transit stations, airports, stadiums, arenas, convention centers, hotels with convention centers, and covered malls ***if any*** interior public pay telephones are provided, and
- in or adjacent to hospital emergency rooms, recovery rooms, and waiting rooms ***if a single*** public pay telephone is provided.

Additionally, in new buildings with banks of three or more interior public pay telephones, one telephone at each bank must be equipped with a shelf and power outlet for a portable TDD.

In alterations, a text telephone would be required:

- in facilities that add public pay telephones ***for a total of four or more*** telephones on-site, if one is interior, or
- in facilities that alter public pay telephones, ***if four or more*** are provided and one is interior.

Alterations include the replacement of existing public pay telephones with units of a different type, relocating existing telephones, or installing new telephones where none had previously been located. Path-of-travel obligations under *ADAAG 4.1.6(2)* also include telephone scoping that may require the installation of a text telephone.

Reinstalling an existing unit at an accessible height to comply with title III requirements for barrier removal in a place of public accommodation or replacing an existing non-functioning telephone with a new unit of the same type would not trigger alterations provisions. However, routine maintenance of this sort may offer cost-effective opportunities to expand access for persons with hearing or speech impairments.

Why are there provisions for both fixed and portable text telephones?

Many persons with hearing or speech impairments travel with portable TDDs to ensure convenient and timely access to telephone communications. Since permanently-fixed public text telephones are only required in limited circumstances where use rates are--or are expected to be--high, *ADAAG* also includes provisions for accommodating portable units at other locations. Thus, a shelf and power outlet must be installed at one pay telephone in every bank of three or more public pay telephones provided in new construction. Travelers who carry laptop computers will also find a shelf and outlet useful.

10.3.1(12) [Fixed Facilities and Stations.]
The following shall be provided in accordance with 4.31.9:
(a)
If an interior public pay telephone is provided in a transit facility (as defined by the Department of Transportation) at least one interior public text telephone shall be provided in the station.
(b)
Where four or more public pay telephones serve a particular entrance to a rail station and at least one is in an interior location, at least one interior public text telephone shall be provided to serve that entrance.

Compliance with this section constitutes compliance with section 4.1.3(17)(c).

10.3.2(2)
[Key Stations]
[as in 10.3.1 above]

10.4.1(4) [Airports.]
Where public pay telephones are provided, and at least one is at an interior location, a public text telephone shall be provided in compliance with 4.31.9. Additionally, if four or more public pay telephones are located in any of the following locations, at least one public text telephone shall also be provided in that location.
(a)
a main terminal outside the security areas;
(b)
a concourse within the security areas;
or ***(c)***
a baggage claim area in a terminal.

Compliance with this section constitutes compliance with section 4.1.3(17)(c).

Where must the shelf and outlet be located?

ADAAG establishes a performance standard for the location of the shelf and outlet required to serve a portable text telephone. The shelf must provide a minimum vertical clearance of 6 inches to allow different types of portable text telephones to be connected (a shelf 10 inches square will accommodate most models). Specifiers must ensure that the handset is compatible with a portable TDD and that its cord is long enough for the receiver of the public pay telephone to fit into the acoustic coupling when the portable unit is placed on the shelf. The power outlet must be in or adjacent to the telephone enclosure so that portable TDDs that operate on electric current can be used (the cord on most portable units is about 3 feet long).

What is meant by equivalent facilitation?

ADAAG allows flexibility to design for unique and special circumstances and to facilitate the application of new technologies. Providing a portable text telephone at a hotel registration desk instead of a fixed text telephone at a nearby public pay telephone is an example of equivalent facilitation. The public pay telephone must be equipped with the requisite shelf and outlet to support the portable TDD; the portable device must be as available to users as are the facility's other public pay telephones, and directional signage must indicate where a portable unit can be obtained for use.

Are TDD directories required at public pay text telephones?

Where telephone books are provided at other public pay telephones, it is recommended that a text telephone directory also be provided at the text telephone. However, this is not required by *ADAAG*. An international TDD directory is available from:

Telecommunications for the Deaf, Inc.
8719 Colesville Road, Suite 300
Silver Spring, MD 20910
301-589-3006 (TDD) / 301-589-3786 (Voice)

TDI also offers a list of manufacturers and suppliers of portable TDDs, public pay text telephones, and other communications devices that do not require voice operation. A training video on using a TTY/TDD is also available.

How do users know that--and where--text telephones are available in a facility?

The international TDD symbol (see Figure 1) must be displayed where required text telephones are provided. At banks of telephones where no text telephone is installed, directional signage must indicate the location of the nearest public text telephone (if one is located in the facility). Where there are no banks of telephones, the directional signage should be located at the building entrance (for example, in the building directory).

4.31.9 Text Telephones Required by 4.1.
(1)
Text telephones used with a pay telephone shall be permanently affixed within, or adjacent to, the telephone enclosure. If an acoustic coupler is used, the telephone cord shall be sufficiently long to allow connection of the text telephone and the telephone receiver.
(2)
Pay telephones designed to accommodate a portable text telephone shall be equipped with a shelf and an electrical outlet within or adjacent to the telephone enclosure. The telephone handset shall be capable of being placed flush on the surface of the shelf. The shelf shall be capable of accommodating a text telephone and shall have 6 in (152 mm) minimum vertical clearance in the area where the text telephone is to be placed.
(3)
Equivalent facilitation may be provided. For example, a portable text telephone may be made available in a hotel at the registration desk if it is available on a 24-hour basis for use with nearby public pay telephones. In this instance, at least one pay telephone shall comply with paragraph 2 of this section. In addition, if an acoustic coupler is used, the telephone handset cord shall be sufficiently long so as to allow connection of the text telephone and the telephone receiver. Directional signage shall be provided and shall comply with 4.30.7.

4.30.7 Symbols of Accessibility.
(3) Text Telephones.
Text telephones required by 4.1.3(17)(c) shall be identified by the international TDD symbol (Fig. 43(C)). In addition, if a facility has a public text telephone, directional signage indicating the location of the nearest text telephone shall be placed adjacent to all banks of telephones which do not contain a text telephone. Such directional signage shall include the international TDD symbol. If a facility has no banks of telephones, the directional signage shall be provided at the entrance (e.g., in a building directory).

Should a required text telephone--or TDD capability--be provided at a wheelchair accessible telephone?

With careful design and placement of a standard TDD/text telephone adjacent to an accessible payphone, it is possible to serve all users with a single station. However, text telephone units that are affixed below a standard pay telephone mounted at a height accessible to people in wheelchairs will be too low for standing persons to use the keyboard comfortably or to see the display screen. They may also obstruct the required knee space. *ADAAG* distinguishes--in both scoping and technical provisions--between access to telephones for persons who use wheelchairs, persons who are hard of hearing, and persons who do not communicate by voice.

Where can public pay text telephones be obtained?

TDD capability is typically added to a standard telephone housing and does not affect use of the payphone by the hearing public. Units are commercially available from the same sources as are standard public pay telephones and enclosures. The following firms have advised the Access Board that they manufacture public pay text telephones:

- **Ultratec**
  450 Science Drive
  Madison, WI 53711
  (608)238-5400 (TTY/Voice)
  (800)482-2424 (TTY/Voice)
  (608)238-3008 (FAX)

- **Krown Research, Inc.**
  129 Sheldon Street
  El Segundo, CA 90245
  (800)833-4968 (TDD/Voice)
  in CA: (213)322-3202

- **AT&T** also offers a card-operated telephone that can incorporate a TDD option. However, it does not permit coin operation and should only be used as a supplemental unit.

The listing of these manufacturers is for informational purposes only and does not constitute an endorsement or compliance with ADA requirements. The Access Board does not review or certify plans or products as meeting *ADAAG* standards. All devices should be carefully evaluated against ADA regulations and *ADAAG* provisions for design, operation, and installation.

In new construction, TDD equipment can be provided as part of the public pay telephone contract with a telephone company, independent payphone provider, or route subcontractor. For existing installations, contact the pay telephone service provider to add a TDD to an existing bank or to modify an existing payphone enclosure with a shelf and power outlet to accommodate a portable device. Adding a shelf or outlet or--where vandalism will not be a concern--attaching a portable TDD adjacent to an existing public telephone can also be done by a carpenter or construction contractor.

TDD specifiers and purchasers should be aware of interface requirements when acquiring new equipment. TTY technology was standardized on Baudot (5-bit) communications codes in the 1960s; computer applications require an ASCII (8-bit) format. While current TTY/TDD devices continue to use Baudot technology, most newer units have an ASCII option available, and many are compatible with both systems. Computer-based text telephones use ASCII, but can be programmed to receive and send Baudot. Telephone emergency services (911 and similar fast-dial lines) provided by public entities

must be compatible with Baudot format. Although it is likely that the more flexible and accommodating ASCII format will soon dominate the market, Baudot models will certainly continue in use for many years.

Other issues affecting the specification of text telephones include acoustic vs. electric coupling of the public telephone receiver; maintenance and vandalism; convenience of use; purchase and installation cost, and coin vs. credit-card operation.

Appendix
A4.31.9 Text Telephones.
A public text telephone may be an integrated text telephone pay phone unit or a conventional portable text telephone that is permanently affixed within, or adjacent to, the telephone enclosure. In order to be usable with a pay phone, a text telephone which is not a single integrated text telephone pay phone unit will require a shelf large enough (10 in (255 mm) wide by 10 in (255 mm) deep with a 6 in (150 mm) vertical clearance minimum) to accommodate the device, an electrical outlet, and a power cord. Movable or portable text telephones may be used to provide equivalent facilitation. A text telephone should be readily available so that a person using it may access the text telephone easily and conveniently. As currently designed, pocket-type text telephones for personal use do not accommodate a wide range of users. Such devices would not be considered substantially equivalent to conventional text telephones. However, in the future as technology develops, this could change.

What other regulations may require the provision of a text telephone?

Under the Department of Justices title III regulations, a public accommodation must provide a TDD when customers, clients, patients, or participants are permitted to make outgoing calls on more than an incidental convenience basis. For example, TDDs must be made available on request to hospital patients or hotel guests if in-room phone service is provided.

Stores and shops, doctor's offices, restaurants, and similar establishments are not required to offer TDD service for persons with hearing or speech impairments making inquiries, appointments, or reservations since this can be accomplished through the relay system established under title IV of the ADA.

However, emergency telephone services (911 and similar fast-dial lines) offered by public entities covered by title II must offer direct access to non-voice callers. Other state or local government communications with applicants and beneficiaries require the use of TDDs or equally-effective telecommunications systems, which may include relay services.

What other situations might benefit from the provision of a text telephone?

A hospital or hotel front desk may be equipped with a TDD so that patients or guests using TDDs in their rooms can access and be notified of in-house services. A text telephone can also be used to provide effective non-voice communications where closed-circuit security, emergency, and house telephones and similar devices requiring voice communication are installed.

This technical assistance is intended solely as informal guidance; it is not a determination of the legal rights or responsibilities of entities subject to the ADA.

U. S. Architectural and Transportation Barriers Compliance Board
The Access Board / 1331 F St NW #1000 / Washington, DC 20004
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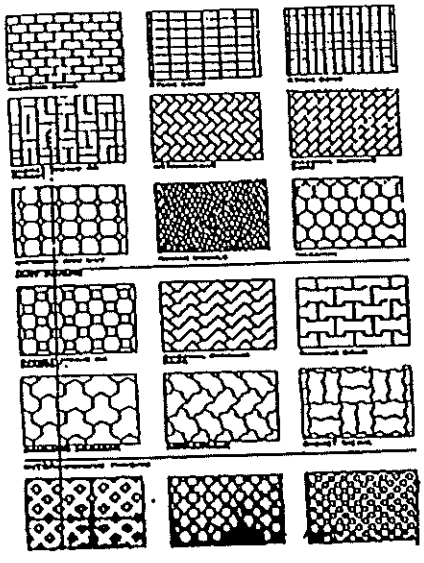
"Walking is nothing more than the successive loss and recovery of balance."
--The Magic of Walking
Aaron Sussman and Ruth Goode



Appendix to 28 CFR Part 36 - Standards for Accessible Design Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities.
3.5 Definitions.
Accessible Route.
A continuous unobstructed path connecting all accessible elements and spaces of a building or facility. Interior accessible routes may include corridors, floors, ramps, elevators, lifts, and clear floor space at fixtures. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps, and lifts.

The landmark Americans with Disabilities Act (ADA), enacted on July 26, 1990, provides comprehensive civil rights protections to individuals with disabilities in the areas of employment (title I), State and local government services (title II), public accommodations and commercial facilities (title III), and telecommunications (title IV). Both the Department of Justice and the Department of Transportation in adopting standards for new construction and alterations of places of public accommodation and commercial facilities covered by title III and public transportation facilities covered by title II of the ADA, have issued implementing rules that incorporate the Americans with Disabilities Act Accessibility Guidelines (ADAAG), developed by the Access Board.

For ease in reference, the ADAAG text and figures discussed in this Bulletin are reproduced in the sidebars, along with other illustrative material.

U.S. Architectural and Transportation Barriers Compliance Board

BULLETIN #4: SURFACES

Why are surface characteristics specified?

Over twenty-seven million Americans report some difficulty in walking. Of these, eight million have a severe limitation; one-fifth of this population is elderly. Ambulatory persons with mobility impairments--especially those who use walking aids--are particularly at risk of slipping and falling even on level surfaces. Preliminary research conducted for the Access Board in 1990 through the Pennsylvania Transportation Institute at The Pennsylvania State University compared the slip-resistance needs of persons with mobility impairments and those without disabilities walking on level and ramped surfaces both indoors and out. Findings from this limited human-subject testing confirmed that individuals who have gait and mobility disabilities make greater demands on the walking surfaces of floors, ramps, and walkways. The information in this Bulletin was derived from this and other research in order to provide designers with an understanding of the variables that affect the measurement and performance of materials specified for use on walking surfaces.

What surface characteristics are required of an accessible route?

The Americans with Disabilities Act Accessibility Guidelines *(ADAAG)* requires only that newly-constructed or altered ground and floor

surfaces of accessible routes on sites and in buildings and facilities be *stable, firm, and slip-resistant.* No standards or methods of measurement are specified in scoping or technical provisions, although the Appendix to *ADAAG* contains advisory recommendations for slip resistance values derived from Board-sponsored research. Because the sample size was small, the testing method unique, and the findings not yet corroborated by other research, the suggested values have not been included in the body of *ADAAG* and should not be construed as part of the regulatory requirements for entities covered by titles II and III of the ADA.

However, other regulations, such as those imposed by OSHA in the interests of worker safety, or design and testing standards applied by state, local, or industry mandate, such as certain ASTM (American Society of Testing and Materials) procedures, may require specific values or ranges of slip resistance.

A *stable* surface is one that remains unchanged by contaminants or applied force, so that when the contaminant or force is removed, the surface returns to its original condition. A *firm* surface resists deformation by either indentations or particles moving on its surface. A *slip-resistant* surface provides sufficient frictional counterforce to the forces exerted in walking to permit safe ambulation.

Because of the great number of variables that affect the performance of a given walking surface--its slope and cross-slope, its material, texture and finish, the presence of moisture or contaminants, the material that contacts it and the method of ambulation--no single set of technical specifications or measurement standards can encompass all criteria that contribute to the safety of a walking surface.

Only slip resistance has a commonly applied unit of measurement--the coefficient of friction, which may be measured as static (at rest) or dynamic (in motion). Its calculation is complex and the methods and equipment of its measurement vary. Affected industries--floor finishes, ceramic tile, plumbing fixtures--each employ a different testing methodology in designating the slip resistance of their products. The static coefficients of friction measured according to the four major ASTM-standard testing procedures have never been correlated by research, although a considerable body of data exists.

What is slip resistance?

In its simplest sense, a slip resistant surface is one that will permit an individual to walk across it without slipping. Contrary to popular belief, however, some slippage is in fact necessary for walking, especially for persons with restricted gaits who may drag their feet slightly. While increasing the slip-resistance of a surface is desirable within certain limits, a very high coefficient of friction may actually hinder safe and comfortable ambulation by persons with disabilities. In fact, a truly non-slip surface could not be negotiated.

While visual inspection can provide some information about a surface such as its degree of cleanliness, whether it is wet or dry, and even the type or texture it exhibits, it cannot provide sufficiently accurate information about a surface to be used in design.

4. ACCESSIBLE ELEMENTS AND SPACES: SCOPE AND TECHNICAL REQUIREMENTS.
4.1 Minimum Requirements.
4.1.1 Application.
(1) General. All areas of newly designed or newly constructed buildings and facilities required to be accessible by 4.1.2 and 4.1.3 and altered portions of existing buildings and facilities required to be accessible by 4.1.6 shall comply with these guidelines, 4.1 through 4.35, unless otherwise provided in this section or as modified in a special application section.

4.1.2 Accessible Sites and Exterior Facilities: New Construction.
An accessible site shall meet the following minimum requirements:
(1) At least one accessible route complying with 4.3 shall be provided within the boundary of the site from public transportation stops, accessible parking spaces, passenger loading zones if provided, and public streets or sidewalks, to an accessible building entrance.
(2) At least one accessible route complying with 4.3 shall connect accessible buildings, accessible facilities, accessible elements, and accessible spaces that are on the same site.
(3)...
(4) Ground surfaces along accessible routes and in accessible spaces shall comply with 4.5.

4:1.3 Accessible Buildings: New Construction.
Accessible buildings and facilities shall meet the following minimum requirements:
(1) At least one accessible route complying with 4.3 shall connect accessible building or facility entrances with all accessible spaces and elements within the building or facility.
(3) Ground and floor surfaces along accessible routes and in accessible rooms and spaces shall comply with 4.5.

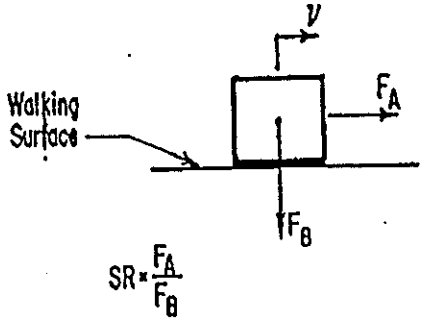


Illustration 1

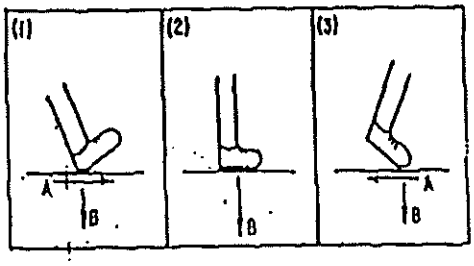


Illustration 2

Even clean, dry surfaces with readily-apparent texture will not always be slip resistant. Materials which might be suitable for level surfaces may be inappropriate for sloping surfaces; materials specified for dry conditions may be unsafe when it rains; a leather shoe may perform poorly on smooth dry surfaces yet provide adequate traction when wet. The presence of moisture or other contaminants, the characteristics of the shoe sole or crutch tip making contact, the direction (uphill and downhill effects differ) and slope of travel all will affect the slip resistance of installed surfaces. It is this interaction of material characteristics and human responses which fully characterizes slip resistance.

How is slip resistance measured?

The basic components of slip resistance are illustrated in the sidebar. In illustration 1, F_A represents the minimum tangential force necessary to initiate sliding of a body over the surface; F_B is the body gravity force. The coefficient of friction between the two surfaces is the ratio of the horizontal and vertical forces required to move one surface over another to the total force pressing the two surfaces together.

Illustration 2 demonstrates the three critical stages in an individual's gait: 1) touchdown, 2) full load, and 3) push-off. The small arrows represent the magnitude and direction of the contact forces. In order to avoid slippage while walking, the horizontal and vertical forces applied by the individual must be resisted by forces acting against the foot as it contacts the walking surface. The definitive component of this resisting force--and the variable most subject to manipulation--is the coefficient of friction of the surface material. Consider, for example, an icy surface with a negligible coefficient of friction. A runner whose forward motion applies a substantial horizontal force will slip--and probably fall--on such a surface. A more careful pedestrian may be able to limit his horizontal force contribution so that it balances the available frictional resistance of the ice and thus cross it safely. Adding sand to the icy surface will increase its coefficient of friction and allow for a more standard gait. Once the ice has melted, the higher coefficient of friction of the newly-exposed surface will offer sufficient resisting force to permit the runner to speed across it without incident.

The *dynamic* coefficient of friction varies in a complex and non-uniform way. Although it can be calculated and modeled in the laboratory using sophisticated computer programs, the more straighforward measurement of the *static* coefficient of friction provides a reasonable approximation of the slip resistance of most surfaces and is the method most appropriate for evaluating surface materials and finishes.

A variety of devices are available for such measurements. The most common device, the James machine, was developed in the early 1940s and was the testing device specified by the Underwriters Laboratory (UL) shortly thereafter when it established--from laboratory test data corroborated by field experience--a minimum value of 0.5 for the static coefficient of friction for floor polish bearing the UL seal. Since then, 0.5 has become the commonly-accepted threshold for classifying slip resistance in products. Furthermore, the James

4.5 Ground and Floor Surfaces.
4.5.1 General.
Ground and floor surfaces along accessible routes and in accessible rooms and spaces including floors, walks, ramps, stairs, and curb ramps, shall be stable, firm, slip-resistant, and shall comply with 4.5.

4.5.2 Changes in Level.
Changes in level up to 1/4 in (6 mm) may be vertical and without edge treatment. Changes in level between 1/4 in and 1/2 in (6 mm and 13 mm) shall be beveled with a slope no greater than 1:2. Changes in level greater than 1/2 in (13 mm) shall be accomplished by means of a ramp that complies with 4.7 or 4.8.

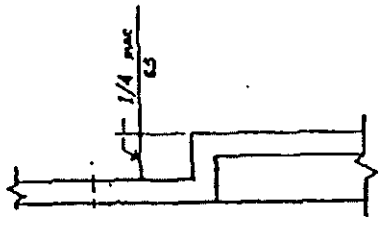


Figure 7(c)
Changes in Level

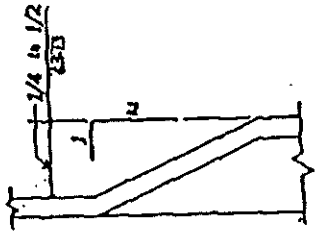


Figure 7(d)
Changes in Level

machine is the recognized test method and the 0.5 value (when measured by this tester) is the recognized minimum criterion for slip-resistant walking surfaces in courts of law in the United States.

Measurement by the James machine, utilizing a leather sensor, is the only method appropriate for assessing surfaces and products against the 0.5 UL standard for static coefficient of friction. Using a different sensor material, even if measured by the James machine, will give a different reading for the same surface material.

This is a significant point. An informal comparison of data collected under three different research protocols, involving four different friction-testers and four different shoe sensor materials, all applied to the same 8-inch by 8-inch ceramic tile surface, resulted in thirty readings--ranging from a low of .29 to a high of .99--for its static coefficient of friction. Even limiting values to those measured by the James machine but using both leather and Neolite sensor material resulted in a range of 0.57 (leather) to 0.79 (Neolite) for the same surface being tested.

It is impossible to correctly specify a slip-resistance rating without identifying the testing method, tester, and sensor material to be used in evaluating the specified product and equally invalid to compare values obtained through one methodology to those resulting from different testing protocols. Because a consensus test protocol has not yet been identified, the Access Board did not specify a value or testing method for determining the coefficient of friction along an accessible route.

The James machine continues to be a laboratory mainstay, but is not portable and thus cannot be used in field testing. In order to measure the slip-resistance of surfaces already in place, researchers at The Pennsylvania State University evaluated three portable testers:

- the NBS-Brungraber Tester (also known as the Mark I Slip Tester),
- the PTI (Pennsylvania Transportation Institute) Drag Sled Tester, and
- the Horizontal Pull Slipmeter.

Study criteria included *relevance* (the measuring results should correlate in a known and constant manner with human perception of the surface slipperiness); *versatility* (accurate measurements of slip resistance must be possible on various types of surfaces and under diverse conditions); *sensitivity to measuring technique* (the difference between measurements performed on the same surface and under the same conditions by different persons should be minimal), and *repeatability* (tests of the same surfaces under the same conditions should be consistent over time). In addition, the reliability and precision of the testers were assessed.

Based on the results of this study, the NBS-Brungraber Tester was recommended as the best portable device currently available for measuring slip resistance under dry conditions on all but carpeted surfaces. Easy to use, the NBS-Brungraber testing procedure can be mastered in 30 minutes. It measures the static coefficient of friction between a representative sample of shoe sole material and a flooring

4.5.3 Carpet.
If carpet or carpet tile is used on a g nd or floor surface, then it shall be s ely attached; have a firm cushion, pad, or backing, or no cushion or pad; and have a level loop, textured loop, level cut pile, or level cut/uncut pile texture. The maximum pile thickness shall be 1/2 in (13 mm) (see Fig. 8(f)). Exposed edges of carpet shall be astened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with 4.5.2.

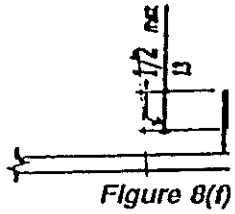


Figure 8(f)
Carpet Pile Thickness

4.5.5 Gratings.
If gratings are located in walking surfaces, then they shall have spaces no greater than 1/2 in (13 mm) (see Fig. 8(g)) wide in one direction. If g gs have elongated openings, then they shall be placed so that the long dimension is perpendicular to the dominant direction of travel. (see Fig. 8(h)).

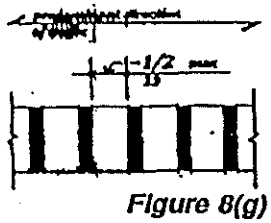


Figure 8(g)
Gratings

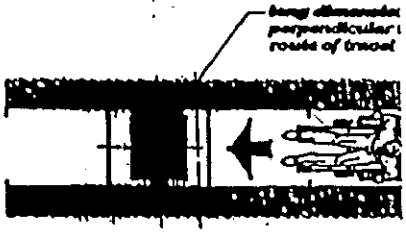


Figure 8(h)
Grating Orientation

surface. The result from the recording shaft is converted into an equivalent value of static coefficient of friction by means of a calibration chart supplied with the tester.

The PTI Drag Sled Tester performed well in the tests but was not commercially available at the time of completion of the report. The Horizontal Pull Slipmeter, which proved to be an excellent device for laboratory measurements of slip resistance, did not produce satisfactory results in field measurements. Detailed information about the three testers, including cost and availability, can be obtained by contacting the following persons:

- **NBS-Brungraber Tester** — Robert J. Brungraber, PhD
  409 South 21st Street
  Lewisburg, PA 17837
  (717) 524-0852

- **PTI Drag Sled Tester** — Bohdan T. Kulakowski, PhD
  The Pennsylvania State University
  201 Research Office Building
  University Park, PA 16802
  (814) 863-1893

- **Horizontal Pull Slipmeter** — Whitely Industries
  939 C East Street
  Tewksbury, MA 01876
  (508) 640-1177

Other portable testers that may be used to measure static coefficient of friction include the Mark II Slip Tester (available from the manufacturer of the NBS-Brugraber Tester) and the Model 80 Tester:

- **Model 80 Tester** — Donald C. Meserlian, PE
  Technical Products Company
  264 Park Avenue
  North Caldwell, NJ 07006
  (201) 228-2258

It is important to maintain the testing device in good working order and to calibrate it periodically. Changes over time in the measured value of a coefficient of friction can occur due to wear of the machine sensor shoe as well as to changes in the floor material and finish.

The slip resistance of indoor and outdoor walking surfaces already in place can be measured with one of the portable testers listed in this Bulletin in order to monitor the process of wear and polishing of walking surfaces. An initial reading of the coefficient of friction taken after flooring has been placed and finished will provide a baseline for future comparisons. However, do not attempt to compare such readings to the UL 0.5 coefficient of friction standard or to a

APPENDIX

This appendix contains material of an advisory nature and provides additional information that should help the reader to understand the minimum requirements of the guidelines or to design buildings or facilities for greater accessibility. The paragraph numbers correspond to the sections or paragraphs of the guideline to which the material relates and are therefore not consecutive (for example, A4.2.1 contains additional information relevant to 4.2.1). Sections of the guidelines for which additional material appears in this appendix have been indicated by an asterisk. Nothing in this appendix shall in any way obviate any obligation to comply with the requirements of the guidelines itself.

A.4.5 Ground and Floor Surfaces.

A4.5.1 General.

People who have difficulty walking or maintaining balance or who use crutches, canes, or walkers, and those with restricted gaits are particularly sensitive to slipping and tripping hazards. For such people, a stable and regular surface is necessary for safe walking, particularly on stairs. Wheelchairs can be propelled most easily on surfaces that are hard, stable, and regular. Soft loose sand or gravel, wet clay, and irregular surfaces such as cobblestones can significantly impede wheelchair movement.

Slip resistance is based on the frictional force necessary to keep a shoe heel or crutch tip from slipping on a walking surface under conditions likely to be found on the surface. While the dynamic coefficient of friction during walking varies in a complex and non-uniform way, the static coefficient of friction, which can be measured in several ways, provides a close approximation of the slip resistance of a surface. Contrary to popular belief, some slippage is necessary to walking, especially for persons with restricted gaits; a truly "non-slip" surface could not be negotiated.

manufacturer's slip resistance values unless the same testing methodology, machine, and sensor material was used in each instance.

What values are recommended for ground and floor surfaces along an accessible route?

The surfaces of the accessible route on a site or within a building or facility must be designed to provide slip-resistant locomotion for both level and inclined travel by persons with disabilities. Research findings suggest that such surfaces should have a slip resistance somewhat higher than might be provided for individuals without disabilities.

In the study sponsored by the Access Board, laboratory measurements from a Kistler force plate and computer analysis of the gaits of persons with mobility impairments (including crutch users and above- or below-knee amputees using artificial limbs) and persons without disabilities graphed the *dynamic* coefficients of friction necessary for safe ambulation. The m-shaped curves that resulted gave a range of values from touch-down to take-off (control group: 0.2-0.3; persons with disabilities 0.7-1.0). Wheelchair users were tested through a full cycle of push and recovery (0.5-0.7).

Correlating these values with a single *static* coefficient of friction (the relationship is complex and non-linear) is inexact and involves some approximation in order to facilitate simplified field testing procedures. In the Access Board research, the static coefficients of friction for a variety of common indoor and outdoor surfacing materials were measured in place using the NBS-Brungraber Tester with a silastic sensor material. Although this machine operates on a principle similar to that of the James machine, the use of a non-standard silastic sensor (instead of the leather required by the protocol for the UL standard) results in significantly higher values for the coefficient of friction of the surfaces being measured. As no correlation was made to any other standards or methodologies in the research, the values for coefficient of friction cannot be compared.

Researchers' recommendations for a static coefficient of friction for surfaces along an accessible route, when measured by the NBS-Brungraber machine using a silastiac sensor shoe, were approximately 0.6 for a level surface and 0.8 for ramps. These values are included in the advisory material in the Appendix to *ADAAG*, but are not in any way mandatory.

What materials may satisfy *ADAAG* requirements?

In new construction and alterations, surface materials must be specified to be slip-resistant. If there is a choice between flooring materials otherwise suitable for a particular application, we recommend choosing the material with the higher coefficient of friction, particularly for ramps.

Materials that might be appropriate for ramps and level surfaces include concrete wood float surfaces, asphalt, and some types of carpets and resilient tiles. Materials which might be expected to be satisfactory for level surfaces, but which might not be appropriate for

ramps, include concrete metal trowelled surfaces, ceramic tile, hardwood and flagstone. These finishes, tested during the Access Board research project, yielded coefficients of friction that fell within the recommended ranges for accessible routes.

The Occupational Safety and Health Administration recommends that walking surfaces have a static coefficient of friction of 0.5. A research project sponsored by the Architectural and Transportation Barriers Compliance Board (Access Board) conducted tests with persons with disabilities and concluded that a higher coefficient of friction was needed by such persons. A static coefficient of friction of 0.6 is recommended for accessible routes and 0.8 for ramps.

It is recognized that the coefficient of friction varies considerably due to the presence of contaminants, water, floor finishes, and other factors not under the control of the designer or builder and not subject to design and construction guidelines and that compliance would be difficult to measure on the building site. Nevertheless, many common building materials suitable for flooring are now labeled with information on the static coefficient of friction. While it may not be possible to compare one product directly with another, or to guarantee a constant measure, builders and designers are encouraged to specify materials with appropriate values. As more products include information on slip resistance, improved uniformity in measurement and specification is likely.

Cross slopes on walks and ground or floor surfaces can cause considerable difficulty in propelling a wheelchair in a straight line.

However, not all products of the type mentioned may provide the desired slip resistance and many other materials can be expected to be suitable even though they are not included here. For example, some types of materials for which the coefficient of friction is low, are available--or can be treated--with finishes that increase slip resistance.

Products or finishes applied to surfaces after installation are not covered by *ADAAG*, but may fall under the Department of Justice (DOJ) regulation governing the maintenance of accessible features. Moisture and debris contamination adversely affect the surface slip resistance of most installed finishes. While floor treatments are available that will increase the coefficient of friction of a walking surface, some products or furnishings, such as furniture wax overspray or loose throw rugs, may reduce slip resistance significantly. Others--for example, walkoff mats placed on lobby floors during rainy weather--do much to reduce the chance of slipping on a wet floor. Such mats are not considered carpets within the meaning of *ADAAG 4.5.3.*

What other surface considerations affect wheelchair travel?

In addition to slip resistance requirements, wheelchair users are affected by the rolling resistance of the surface of the floor and--on exterior surfaces--by cross slope. If the rolling resistance of flooring is high, wheelchair users must avoid those areas or expend extra energy maneuvering across the surface. In a limited study of wheelchair rolling resistance, the force needed to traverse four different surfaces was measured: concrete, linoleum, low-pile carpet (loop, 0.1-inch pile height, 10 stitches/inch, 16-ounce face weight excluding backing and glue, on jute), and high-pile carpet (cut, 0.5-inch pile height, 10 stitches/inch, 40-ounce face weight excluding backing and glue, on ActionBac).

Although the study was not intended to be comprehensive, the results provide some guidance in selecting carpet. With the force needed to traverse bare concrete as a baseline, the increase in force needed to cross each surface was measured to be: +3% for linoleum; +20% for low-pile carpet, and +62% for high-pile carpet. From these results it appears that linoleum and concrete equally require minor effort; low-pile carpet requires a noticeable, though moderate, increase in effort; and high-pile carpeting requires a significant increase in effort. Although the slip resistance ratings of carpet fall within the recommended ranges for use on ramps, its rolling resistance makes most types an inappropriate finish for sloped surfaces.

Exterior ramps and walks will generally be constructed with a cross-slope (perpendicular to the direction-of-travel slope) in order to provide positive drainage. Because the effects of cross-slope are particularly difficult for persons using wheelchairs--particularly along a steep running slope--*ADAAG* provisions limit accessible routes to a 2% cross-slope.

A4.5.3 Carpet. Much more needs to be done in developing both quantitative and qualitative criteria for carpeting (i.e., problems associated with texture and weave need to be studied). However, certain functional characteristics are well established. When both carpet and padding are used, it is desirable to have minimum movement (preferably none) between the floor and the pad and the pad and the carpet which would allow the carpet to hump or warp. In heavily trafficked areas, a thick, soft (plush) pad or cushion, particularly in combination with long carpet pile, makes it difficult for individuals in wheelchairs and those with other ambulatory disabilities to get about. Firm carpeting can be acheived through proper selection and combination of pad and carpet, sometimes with the elimination of the pad or cushion, and with proper installation. Carpeting designed with a weave that causes a zig-zag effect when wheeled across is strongly discouraged.

DOJ
28 CFR Part 36
§ 36.211 Maintenance of Accessible Features.

(a) A public accommodation shall maintain in operable working condition those features of facilities and equipment that are required to be readily accessible to and usable by persons with disabilities by the Act or this part.

(b) This section does not prohibit isolated or temporary interruptions in service or access due to maintenance or repairs.

This technical assistance is intended solely as informal guidance; it is not a determination of the legal rights or responsibilities of entities subject to the ADA.

What other considerations are significant for persons with disabilities?

Materials such as gravel, wood chips, or sand, often used for outdoor walkways, are neither firm nor stable, nor can they generally be considered slip-resistant. Thus, walks surfaced in these materials could not constitute an accessible route. However, some natural surfaces, such as compacted earth, soil treated with consolidants, or materials stabilized and retained by permanent or temporary geotextiles, gridforms, or similar construction may perform satisfactorily for persons using wheelchairs and walking aids.

ADAAG also contains provisions that limit surface discontinuities along an accessible route, including elevator cab leveling tolerances at landings, gaps between car and platform in transit facilities, the size and orientation of openings in walkway gratings, the profile of doorway thresholds, and the pile height and attachment of carpeting. *ADAAG 4.5.3* specifies that carpet and carpet tile be securely attached. This provision does not require that each tile--or the entire carpet or pad--be adhered to the floor surface provided the method of securement results in a surface that is stable, firm, and slip-resistant and does not pose a tripping hazard.

The *Staircase, Studies of Hazards, Falls and Safer Design*, by John Templer (The MIT Press, Cambridge, MA 1992) contains (Chapter 3) an excellent discussion of slip resistance on ramps that will be of interest to designers and specifiers.

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