ADA COMPLIANCE AT TRANSPORTATION AGENCIES: A REVIEW OF PRACTICES

Requested by:

American Association of State Highway
and Transportation Officials (AASHTO)

Standing Committee on Highways

Prepared by:

Cesar Quiroga, Ph.D., P.E.
Research Engineer

and

Shawn Turner, P.E.
Research Engineer

TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas

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ABSTRACT

Transportation agencies nationwide must comply with provisions in the Americans with Disabilities Act (ADA). To assess ADA compliance, agencies need to develop a comprehensive inventory of pedestrian facilities, identify non-compliant locations, and develop a program for remedial repairs in order to bring facilities into compliance. The purpose of NCHRP Project 20-07, Task 249, *Asset Management Approaches to ADA Compliance*, was to gather information and develop a synthesis of practices, including best practices, on the various approaches transportation agencies use to address ADA compliance issues. The synthesis covered three main topics: asset data inventory, asset condition assessment, and programming of asset improvements. To make the project manageable, the focus was on pedestrian infrastructure on the public right-of-way, including elements such as sidewalks, curb ramps, pedestrian crossings, and obstructions. The analysis did not include buildings, facilities, or transit infrastructure. The synthesis also included the compilation of an extensive listing of asset inventory and condition data elements. The listing is intended as a preliminary menu that agencies could use as a foundation for the development of inventory programs that meet individual agency needs.

EXECUTIVE SUMMARY

Transportation agencies nationwide must comply with provisions in the Americans with Disabilities Act (ADA). To assess ADA compliance, agencies need to develop a comprehensive inventory of pedestrian facilities, identify non-compliant locations, and develop a program for remedial repairs in order to bring facilities into compliance.

The purpose of National Cooperative Highway Research Program (NCHRP) Project 20-07, Task 249, *Asset Management Approaches to ADA Compliance*, was to gather information and develop a synthesis of practices, including best practices, on the various approaches transportation agencies use to address ADA compliance issues. The synthesis covered three main topics: asset data inventory, asset condition assessment, and programming of asset improvements. To achieve this goal, the researchers conducted a literature review of practices, conducted an online survey to assist in the stakeholder identification process, gathered sample documentation, and interviewed officials from a sample of state and local agencies. To make the project manageable, the focus was on pedestrian infrastructure on the public right-of-way, including elements such as sidewalks, curb ramps, pedestrian crossings, and obstructions. The analysis did not include buildings, facilities, or transit infrastructure.

The synthesis also included the compilation of an extensive listing of asset inventory and condition data elements. The listing is intended as a preliminary menu that agencies could use as a foundation for the development of inventory programs that meet individual agency needs. Readers should note that an actual inventory program would logically include formal user need and data modeling phases to characterize data elements more precisely.

A review of the documentation gathered and feedback received led to the following conclusions:

- **Designing inventory data collection programs and data archival systems to support improvement programming activities is a best practice**. Best practices to support data collection and data archival programs include the following:
    - Use aerial photos or agency video logs as a screening tool and to focus resources.
    - Develop user-friendly data collection forms or input screens.
    - Use personal digital assistant (PDA)-based tools to automate information workflow.
    - Involve the agency's information technology group in designing data collection activities to ensure appropriate integration with other existing systems at the agency.

- **Having observers with adequate ADA training collect sufficient data and assess accessibility compliance levels in the field is a best practice**. The complex nature of standards and requirements related to accessibility is such that trained observers viewing a particular site directly will typically be in the best position to assess accessibility compliance levels. In some cases, it may be necessary to review additional documentation later in the office. However, it is frequently more difficult to assess

compliance later in the office when reviewing hand-written field notes, digital photographs, or other electronic data. Using properly trained personnel is also a critical requirement for quality control purposes.

- **Integrating ADA requirements into the project development and delivery process is a best practice**. Best practices involving the integration of ADA requirements into the project development and delivery process include the following:

    - Ensure that ADA requirements and standards are fully integrated into all of the agency's policy, planning, and design handbooks or manuals.
    - Ensure that all district planning and engineering staff (and not just an ADA coordinator) have the required training.
    - Ensure that ADA improvements can be funded through a variety of funding programs/sources.

- **Developing user-friendly web sites that provide comprehensive information is a best practice**. The researchers identified a few cases where the agency's website provided adequate information about laws and regulations, asset inventory activities, long-term and short-term projects, funding initiatives, complaint procedures, and community outreach. Such strategies help the agency to fulfill its mission and facilitate the development and implementation of programs as well as the interaction with the appropriate stakeholders.

- **Prioritizing inventory and improvement programming resources to focus on the most critical locations is a best practice**. Many agencies used a priority ranking system for their inventory data collection as well as their capital improvement programming. The priority ranking systems were typically based on importance (e.g., functional class of the roadway), adjacent land uses (e.g., public versus private facilities, high versus low pedestrian traffic), and the urgency of the improvement based on its condition. In some cases, the inventory process factored the priority ranking by collecting the most detailed and comprehensive data on high-priority road segments, while at the same time collecting simpler or less detailed data on lower-priority road segments.

Readers should be aware that the identification of "best practices" depends on the agency context in which the practices are to be implemented. In other words, one size does not fit all. For example, the researchers identified several agencies that use sophisticated systems to automate and streamline data collection, summary, and presentation of pedestrian infrastructure data. This is a best practice for agencies that have the necessary technical and institutional resources to implement and maintain those systems. In contrast, for agencies with fewer resources, a sophisticated system may quickly overwhelm agency staff and resources. For those agencies, a relatively simple paper-based or PDA-based approach would be a best practice.

CHAPTER 1
INTRODUCTION

Transportation agencies nationwide must comply with provisions in the Americans with Disabilities Act. Regardless of facility type (e.g., highways, rest areas, or trails), ADA compliance issues may surface throughout the lifetime of the facility, from planning and programming to operations and maintenance. To assess ADA compliance, agencies need to develop a comprehensive inventory of pedestrian facilities, identify non-compliant locations, and develop a program for remedial repairs in order to bring facilities into compliance.

The use of innovative approaches and technologies to inventory and characterize pedestrian infrastructure is increasing. Examples include geographic information systems (GIS), global positioning system (GPS) receivers, orthophotography, PDAs, and data management systems. Several agencies store pedestrian infrastructure data along with other infrastructure data in asset/facility management systems, which can include tools for ADA compliance. Agencies use these approaches and technologies to score facilities on ADA compliance, providing them a means to prioritize construction or maintenance needs. In many situations, these needs outweigh available resources. To optimize available resources, agencies are developing systematic ADA improvement, compliance, or transition plans to program repairs of non-compliant facilities. However, mechanisms need to be in place to verify that new or retrofitted facilities are compliant and that inventory and condition data are up to date.

The purpose of NCHRP Project 20-07, Task 249, *Asset Management Approaches to ADA Compliance*, was to gather information on the various approaches transportation agencies use to address ADA compliance issues in terms of (a) asset data inventory, (b) asset condition assessment, and (c) programming of asset improvements, with the primary objective being to share best practices among stakeholders. To make the project manageable, the focus was on pedestrian infrastructure on the public right-of-way and included elements such as sidewalks, curb ramps, pedestrian crossings, and obstructions. The analysis did not include buildings, facilities, or transit infrastructure.

This report summarizes the work completed as follows:

- Chapter 1 is this introductory chapter.
- Chapter 2 provides a literature review of standards, guidelines, and current practices.
- Chapter 3 summarizes the online survey procedure and results.
- Chapter 4 summarizes the process followed to conduct interviews and gather additional information from transportation agencies.
- Chapter 5 includes a summary of practices.
- The appendix includes the online survey form and amplifying questions.

CHAPTER 2
LITERATURE REVIEW OF STANDARDS, GUIDELINES, AND CURRENT PRACTICES

ACCESSIBILITY LAWS, REGULATIONS, AND STANDARDS

The Americans with Disabilities Act of 1990 provided comprehensive civil right protections to individuals with disabilities in areas related to employment (Title I), public services (Title II), public accommodations and services operated by private entities (Title III), telecommunications (Title IV), and miscellaneous (Title V). In particular, Title II prohibited the discrimination of individuals with disabilities in relation to benefits, programs, services, or activities offered by local and state governments. It also included provisions covering public transportation other than aircraft. Title V included the requirement to update existing minimum accessibility guidelines to ensure consistency with the ADA.

In 1992, the U.S. Department of Justice issued 28 Code of Federal Regulations (CFR) Part 35, *Nondiscrimination on the Basis of Disability in State and Local Government Services*, to implement Subtitle A of Title II of the ADA (*1*). In particular, this regulation extended the prohibition of discrimination in federally assisted programs already established by Section 504 of the Rehabilitation Act of 1973 to all activities of state and local governments, including those that do not receive federal financial assistance. The regulation also incorporated specific rulings to address provisions in Titles I, III, and V of the ADA.

A provision in the regulation, 28 CFR 35.150(d), included a requirement for state and local agencies to prepare a transition plan in accordance with the following requirements:

> (d) Transition plan.
>
> > (1) In the event that structural changes to facilities will be undertaken to achieve program accessibility, a public entity that employs 50 or more persons shall develop, within six months of the effective date of this part, a transition plan setting forth the steps necessary to complete such changes. A public entity shall provide an opportunity to interested persons, including individuals with disabilities or organizations representing individuals with disabilities, to participate in the development of the transition plan by submitting comments. A copy of the transition plan shall be made available for public inspection.
> >
> > (2) If a public entity has responsibility or authority over streets, roads, or walkways, its transition plan shall include a schedule for providing curb ramps or other sloped areas where pedestrian walks cross curbs, giving priority to walkways serving entities covered by the Act, including State and local government offices and facilities, transportation, places of public accommodation, and employers, followed by walkways serving other areas.
> >
> > (3) The plan shall, at a minimum --
> >
> > > (i) Identify physical obstacles in the public entity's facilities that limit the accessibility of its programs or activities to individuals with disabilities;
> > >
> > > (ii) Describe in detail the methods that will be used to make the facilities accessible;

(iii) Specify the schedule for taking the steps necessary to achieve compliance with this section and, if the time period of the transition plan is longer than one year, identify steps that will be taken during each year of the transition period; and

(iv) Indicate the official responsible for implementation of the plan.

(4) If a public entity has already complied with the transition plan requirement of a Federal agency regulation implementing section 504 of the Rehabilitation Act of 1973, then the requirements of this paragraph shall apply only to those policies and practices that were not included in the previous transition plan.

Another provision in the regulation, 28 CFR 35.151, included the following requirements regarding new construction and alterations:

(a) Design and construction. Each facility or part of a facility constructed by, on behalf of, or for the use of a public entity shall be designed and constructed in such manner that the facility or part of the facility is readily accessible to and usable by individuals with disabilities, if the construction was commenced after January 26, 1992.

(b) Alteration. Each facility or part of a facility altered by, on behalf of, or for the use of a public entity in a manner that affects or could affect the usability of the facility or part of the facility shall, to the maximum extent feasible, be altered in such manner that the altered portion of the facility is readily accessible to and usable by individuals with disabilities, if the alteration was commenced after January 26, 1992.

(c) Accessibility standards. Design, construction, or alteration of facilities in conformance with the Uniform Federal Accessibility Standards (UFAS) (appendix A to 41 CFR Part 101-19.6) or with the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) (appendix A to 28 CFR Part 36) shall be deemed to comply with the requirements of this section with respect to those facilities, except that the elevator exemption contained at § 4.1.3(5) and § 4.1.6(1)(j) of ADAAG shall not apply. Departures from particular requirements of either standard by the use of other methods shall be permitted when it is clearly evident that equivalent access to the facility or part of the facility is thereby provided.

(d) Alterations: Historic properties.

(1) Alterations to historic properties shall comply, to the maximum extent feasible, with § 4.1.7 of UFAS or § 4.1.7 of ADAAG.

(2) If it is not feasible to provide physical access to an historic property in a manner that will not threaten or destroy the historic significance of the building or facility, alternative methods of access shall be provided pursuant to the requirements of § 35.150.

(e) Curb ramps.

(1) Newly constructed or altered streets, roads, and highways must contain curb ramps or other sloped areas at any intersection having curbs or other barriers to entry from a street level pedestrian walkway.

(2) Newly constructed or altered street level pedestrian walkways must contain curb ramps or other sloped areas at intersections to streets, roads, or highways.

In 1991, the Architectural and Transportation Barriers Compliance Board (previous name of the U.S. Access Board) published the ADA Accessibility Guidelines (ADAAG) (*2*). In 2004, the U.S. Access Board published a revised version of the ADAAG as 36 CFR Part 1191 after a

decade-long process of review and update (*3*). In general, ADAAG (both the 2004 version and previous versions) focuses primarily on accessibility to buildings, facilities, sites, and elements (i.e., architectural or mechanical components of a building, facility, or site). ADAAG does not address requirements for public rights-of-way, with the exception of curb ramps and islands.

In 1991, the U.S. Department of Justice and the U.S. Department of Transportation incorporated ADAAG into their ADA implementing regulations, making ADAAG the enforceable standard under Titles II and III of the ADA (*4*). The U.S. Department of Justice issued regulation 28 CFR Part 36, *Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities*, to implement Title III of the ADA (*5*). The current version of 28 CFR Part 36 includes the 1994 version of ADAAG as Appendix A, *Standards for Accessible Design*. The U.S. Department of Transportation issued regulation 49 CFR Part 37, *Transportation Services for Individuals with Disabilities (ADA)*, to implement Subpart B of Title II of the ADA (*6*). With some modifications, the current version of 49 CFR Part 37 includes the 2004 version of ADAAG by reference to 36 CFR Part 1191.

DEVELOPMENT OF ACCESSIBILITY STANDARDS FOR PUBLIC RIGHTS-OF-WAY

In 1992, the U.S. Access Board published proposed supplements to ADAAG to address public right-of-way accessibility requirements (*7*). However, the transportation community expressed serious concerns about these proposed rules, including that the provisions would require substantial rebuilding of existing right-of-way structures and that the proposed rules did not properly address how public agencies develop and manage facilities in the public right-of-way (*8*). In 1998, the U.S. Access Board published ADA accessibility guidelines for state and local governments but decided to reserve action on several areas related to the public right-of-way pending further analysis (*9*).

In 1999, the Board established the Public Right-of-Way Access Advisory Committee (PROWAAC) with a charge to develop relevant ADAAG provisions and special application sections. In 2001, PROWAAC published the report *Building a True Community*, which included proposed standards for public sidewalks, protruding objects, street fixtures and furniture, sidewalk/street transitions, pedestrian street crossings, and vehicular ways and facilities (*8*). In 2002, the U.S. Access Board published draft guidelines for accessible public rights-of-way, based on recommendations from the 2001 PROWAAC report (*10*). Following a public comment and review process, in 2005 the U.S. Access Board revised the draft guidelines (*11*). The Board did not seek public comment on this revised draft. Instead, a Notice of Proposed Rulemaking (NPRM) will follow seeking public comment prior to publication of a final rule. Although not an enforceable standard, the Federal Highway Administration (FHWA) considers the draft guidelines—also known sometimes as *Draft Public Rights-of-Way Accessibility Guidelines (PROWAG)*—to be the currently recommended best practices in accessible pedestrian design for public rights-of-way (*12*).

ACCESSIBILITY STANDARDS AND REGULATIONS AT THE STATE LEVEL

States and local jurisdictions around the country have adopted their own codes and regulations on accessibility requirements and standards (*13*). Many states incorporate national guidelines and standards (e.g., ADAAG) by reference in their access codes. Other states have made modifications and/or additions, frequently introducing more restrictive accessibility requirements than the federal guidelines. In some cases, if there are conflicts between the state access code and the federal guidelines, the reason is that the state code has not caught up with a change in federal regulations. For example, in 2001, the U.S. Department of Justice decided to let the suspension on detectable warnings expire (*14*). Beginning that year detectable warnings were again required. Truncated domes are the standard design requirement for detectable warnings. However, a number of states still required other designs, such as grooves.

A finding of the literature review is that agencies have to navigate through many laws, regulations, and standards, and that it is common to have to identify and reconcile discrepancies between national guidelines and standards, state code, and local ordinances before undertaking a data collection program.

KINNEY VERSUS YERUSALIM CASE

The Kinney versus Yerusalim case in Philadelphia set a significant precedent concerning the definition of a roadway "alteration" for determining when it is necessary to program ADA requirements (*15*). In Kinney versus Yerusalim, a district court determined that resurfacing public streets in Philadelphia (defined as laying at least 1½ in. of new asphalt, sealing joints and cracks, and patching depressions of more than 1 in., spanning the length and width of a city block) was an alteration that affected the usability of the street and thus triggered the requirement for curb ramp installation at intersections. The significance of the case is that many transportation agencies consider relatively minor projects such as overlays as preventive maintenance projects, falling under the jurisdiction of maintenance sections and programs. Yet, those projects could be considered "alterations" according to the Kinney versus Yerusalim case. As a result, programming accessibility improvements usually involve not just regular highway construction projects but also a few maintenance projects that could qualify as "alterations."

DESIGN GUIDES AND OTHER RELEVANT DOCUMENTATION

The body of literature related to design guidelines and criteria to address ADA requirements, including inventory procedures, forms, and training materials, continues to grow. A number of agencies have published and/or distributed relevant documentation, including the U.S. Access Board, the U.S. Department of Justice, FHWA, state departments of transportation (DOTs), cities, counties, metropolitan planning organizations (MPOs), and universities. A few relevant examples follow.

In July 2007, the PROWAAC Technical Assistance subcommittee published the report *Special Report: Accessible Public Rights-of-Way Planning and Design for Alterations*, which

provides an overview of alteration project case studies from regulatory and project development perspectives (*16*).

In 2006 and 2007, the U.S. Department of Justice published a best practices toolkit to assist state and local governments to improve compliance with Title II of the ADA (*17*). Specifically, Chapter 6 of the toolkit described requirements for curb ramps and pedestrian crossings and included a checklist to assess overall agency compliance as well as a detailed survey form to assess compliance of individual curb ramp locations (Figure 1).

Between 1999 and 2001, FHWA published a two-volume series that Beneficial Designs, Inc., prepared on the design of sidewalks and trails for accessibility (*4*, *18*). Chapter 4 of the first volume summarized critical access characteristics and design elements for infrastructure components such as sidewalks, driveway crossings, medians and islands, crosswalks, pedestrian-actuated traffic controls, midblock crossings, sight distances, and grade-separated crossings. Chapter 11 of the second volume described a sidewalk assessment process (SWAP) to conduct sidewalk inventories and condition assessments (*19*).

SWAP is a modified version of a previous process for trails called the Universal Trail Assessment Process (UTAP) (*20*). SWAP uses several tools, such as a rolatape (i.e., a measuring wheel), a hand-held clinometer, a digital inclinometer (level), a tape measure, and a profile gauge. Critical sidewalk attributes, which surveyors can record on a stroll sheet, include grade, cross slope, changes in grade and cross slope, sidewalk design width, minimum clear width, vertical clearance, location of protruding objects, detectable warnings, and changes in level.

Separate element analysis forms enable surveyors to record attribute data for intersections, curb ramps, medians, refuge islands, and driveway crossings. As an illustration, Figure 2 shows the sidewalk assessment sheet, Figure 3 shows the intersection checklist, and Figure 4 shows the analysis form for curb ramps. More recent assessment forms are available on the Beneficial Designs, Inc., website (*21*). As an illustration, Figure 5 shows the curb ramp assessment form.

Curb Ramps

Construction/Alteration Date (circle one): **Before 1/26/92** **After 1/26/92**

Facility Name/Address:	**Date:**
Location:	**Surveyors:**

Record your measurements in the blanks when they are provided. Do not circle a response for a question you are directed to skip. If your answer to a question is no, but the choices are "Y" and "n/a," circle "n/a" (not applicable).
A circled "N" signifies a violation.

Describe each curb ramp's location:	Curb Ramp D:
Curb Ramp A:	Curb Ramp E:
Curb Ramp B:	Curb Ramp F:
Curb Ramp C:	Curb Ramp G:

Refer to #	Curb Ramp (CR) Questions	Curb Ramp A		Curb Ramp B		Curb Ramp C		Curb Ramp D		Curb Ramp E		Curb Ramp F		Curb Ramp G	
1	Is ramp of CR at least 36" wide (not including flared sides)?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			"		"		"		"		"		"		"
2	Does CR have a running slope of 8.33% or less?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			%		%		%		%		%		%		%
3	Does CR have a cross slope of 2% or less?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			%		%		%		%		%		%		%
4	Does CR have a gutter slope of 5% or less?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			%		%		%		%		%		%		%
5	Are transitions on and off CR flush and free of abrupt level changes? *Record the height of **any** level changes.*	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			"		"		"		"		"		"		"
6	Does CR have detectable warnings?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
7	Can CR be blocked by legally parked cars?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
8	Is the sidewalk at the "top" of CR at least 36" wide?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			"		"		"		"		"		"		"
9	Does CR have flared sides? *If yes, answer **one** of the next two questions. If not, skip to question **10**.*	Y	n/a	Y	n/a	Y	n/a	Y	n/a	Y	n/a	Y	n/a	Y	n/a
9.a	If the sidewalk at the "top" of CR is 48" wide or more, is the slope of the flared sides 10% or less?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			%		%		%		%		%		%		%
9.b	If the sidewalk at the "top" of CR is less than 48" wide, is the slope of the flared sides 8.33% or less?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			%		%		%		%		%		%		%
10	If no flared sides, is there an obstruction or grass on each side of CR that discourages pedestrians from traveling across ramp? *If the CR has flared sides, skip this question.*	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
11	If CR is built-up to the curb, is it outside the path of cars? *If CR is not built-up to curb, skip this question.*	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
	Answer the last two questions only if the CR is located at a marked crossing:														
12	Is ramp of CR contained in markings?	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
13	If corner-type CR, is bottom landing at least 48" long and contained in crosswalk? *If not corner-type CR, skip this question.*	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
			"		"		"		"		"		"		"

Comments:_____

_____

This survey form is designed to assist you in identifying common barriers to access – not all barriers. To identify all barriers, you must survey for compliance with §§ 4–10 of the ADA Standards.

Figure 1. U.S. Department of Justice ADA Toolkit Curb Ramp Form (*17*).

STROLL SHEET FOR SIDEWALK ASSESSMENT PROCESS (SWAP)

Block name: ___________ Starting X street: _________ Ending X street: _________ R/L side Page __ of __

Curb Ramp Measurements:

CR Distance m	Number of Ramps #	Type (⊥ II D C B)	Approach Slope %	Ramp Slope %	Ramp Length cm	Landing Length cm	Detectable Warning y/n

Station Measurements:

Distance m	Design Width cm	Cross Slope %	Running Grade %

Feature Measurements:

Feature Distance m	Feature	Dimension	Units	Comments

Notes:

Feature codes:

DC = Driveway
MG = Maximum Grade
CL = Change in level
PO = Protruding Object
MCW = Minimum clearance width
MCS = Maximum cross slope
MVC = Minimum vertical clearance
RCCS = Rapidly changing cross slope

Figure 2. FHWA Accessibility Stroll Sheet for Sidewalk Assessment Process (*18*).

Intersection Checklist:

Name of primary street:	
Name of cross street:	
Total number of lanes on primary street:	
Total distance across primary street (measure with rolatape):	
Total number of lanes on cross street:	
Total distance across street (measure with rolatape):	
Are there any left turn only lanes?	yes---no
Are there any right turn only lanes?	yes---no
Is a right turn on red permitted?	yes---no
Is there a right turn island?	yes---no
Is parking permitted on the primary street?	yes---no
Is parking permitted on the cross street?	yes---no
How many corners have curb extensions (bulbouts)?	
Is there a median?	yes---no
If so, is it designed as a pedestrian refuge?	yes---no
Is it identifiable to people with vision impairments?	yes---no
Is it accessible to people with mobility impairments?	yes---no
Does the intersection have four way stop signs?	yes---no
Does the intersection have two way stop signs?	yes---no
Is the intersection signalized?	yes---no
Is there a pedestrian actuated control signal?	yes---no
Location of control:	
Information emitted: audible vibrotactile infrared	
Is there a high contrast between the button and post color?	yes---no
Is there a tactile arrow indicating the street crossing direction?	yes---no
Height of control:	
Dimension of pedestrian button?	
Is 5 lbs of force or less required to operate the signal?	yes---no
Is the crosswalk marked?	yes---no
If so, what are the conditions of the markings?	
Duration of WALK interval:	
Comments:	

Figure 3. FHWA Accessibility Intersection Checklist (*18*).

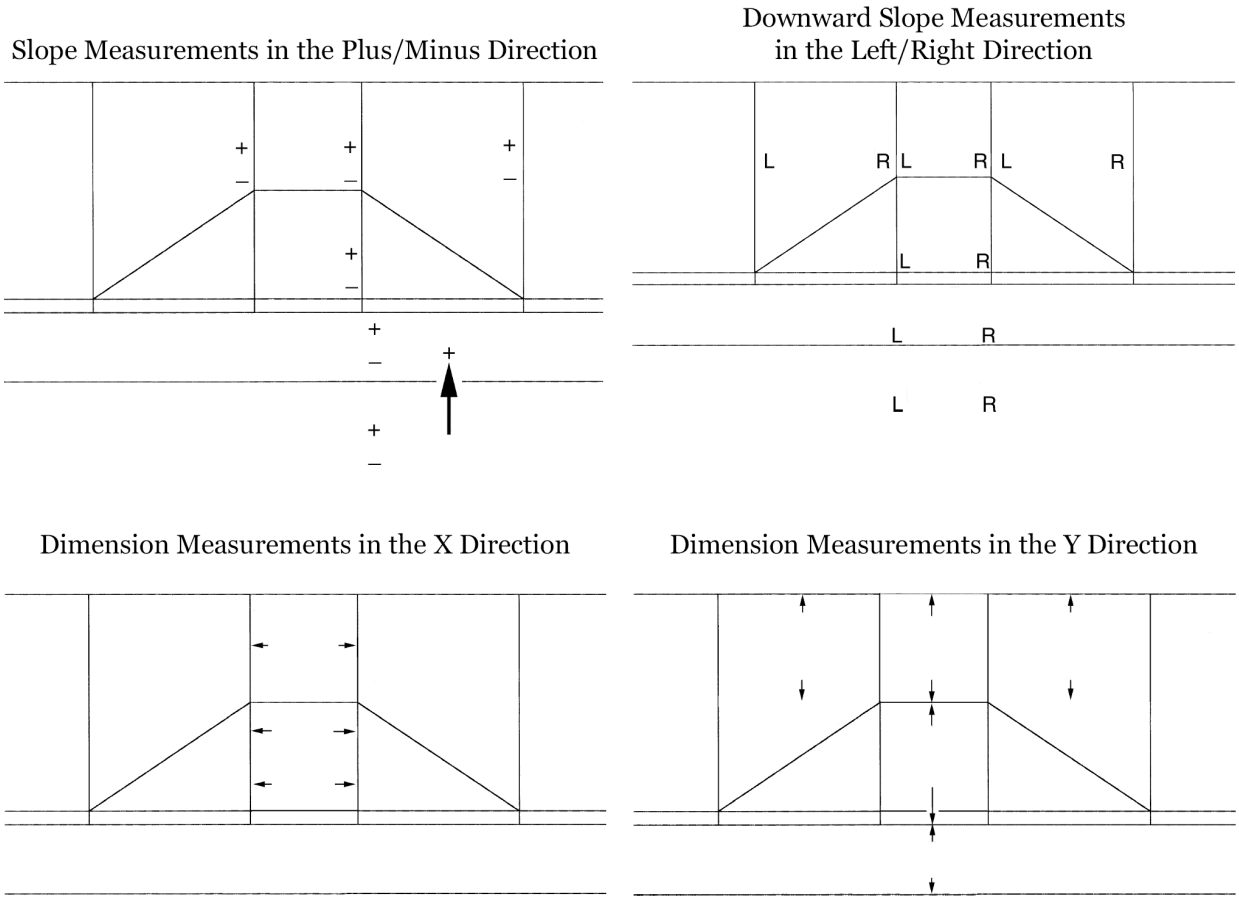


Figure 4. FHWA Accessibility Curb Ramp Element Analysis Form (*18*).

Curb Ramp Data Collection Form

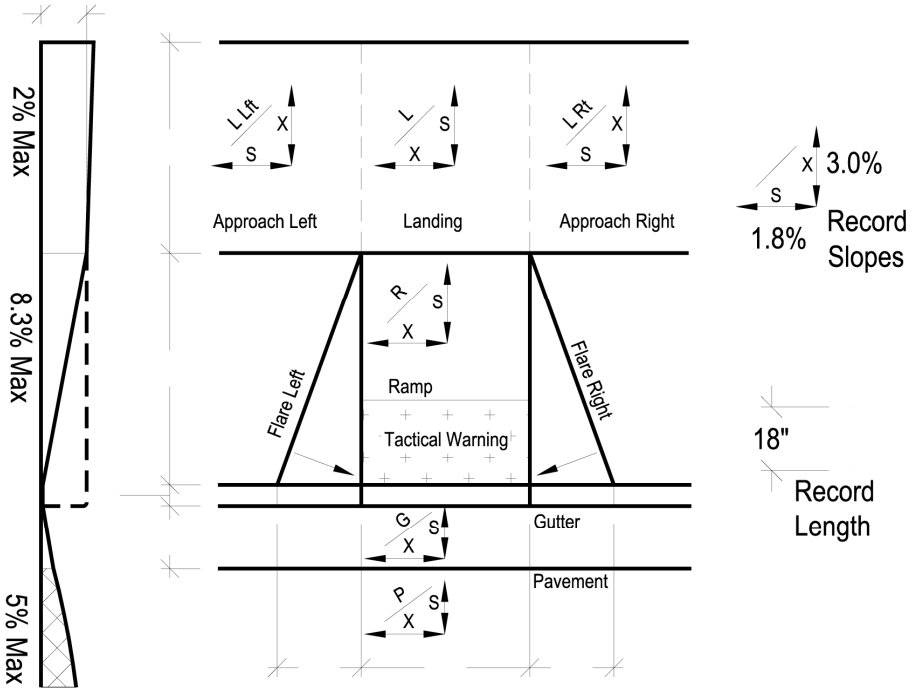
Date _____ Data Recorder _____

CURB RAMP LOCATION

Street Name _____ Side of Street N S W E

Nearest Cross Street(s) _____ Indicate Corner of Intersection N S W E / NW NE SW SE

GPS Coordinates N/S E/W _____ Adjacent Property Description _____



CURB RAMP CHARACTERISTICS/SIDEWALK ELEMENTS

Include all sidewalk elements (i.e. utility pole, sign, etc.) on the drawing to indicate their position.

Digital Image taken – frame # and description _____

Record any surface height transitions over 0.25 inches using a profile gauge.
Trace the transition on the back of this form, then indicate the location on drawing.

Curb Ramp Type:	Surface Material Type:	Recommended Action:	
☐ Diagonal	☐ Asphalt	☐ Repair	☐ Construct
☐ Perpendicular	☐ Concrete	☐ Reconstruct	☐ Monitor
	☐ Other:_____	☐ Other:_____	

Figure 5. Beneficial Designs Curb Ramp Assessment Form (*Courtesy*: Beneficial Designs, Inc.) (*21*).

In 2007, NCHRP published the report *Guidelines for Accessible Pedestrian Signals* in response to the call in PROWAG for the use of push button-integrated accessible pedestrian signals (APS) that provide audible and vibrotactile indications of the walk interval (*22*). Although the report did not address inventory issues, it did identify critical APS functions that should be included in all push button-integrated APS, regardless of intersection geometry or signalization, making these functions potential candidates for inclusion in asset inventory data collection efforts:

- pushbutton locator tone (any),
- clearly defined pushbutton that is tactually identifiable,
- tactile arrow,
- audible walk indication,
- vibrotactile walk indication, and
- ambient sound responsiveness.

In 2007, FHWA published the report *Pedestrian Road Safety Audit Guidelines and Prompt Lists* to provide guidance regarding the road safety audit (RSA) process and how to take into consideration pedestrian needs when conducting RSAs (*23*). RSAs are formal safety examinations of future roadway projects or existing facilities that are conducted by independent teams. All RSAs should include a review of pedestrian safety. In addition, some RSAs may be conducted to address an identified pedestrian safety problem.

The report included a knowledge base and a field manual. The knowledge base included basic RSA concepts, such as pedestrian characteristics, pedestrian crashes, and pedestrian considerations in the eight-step RSA process. The field manual included guidelines and prompt lists that provide detailed descriptions and general listings, respectively, of potential pedestrian safety issues. National standards and guidelines referenced in the report included ADAAG, the American Association of State Highway and Transportation Officials (AASHTO) *Policy on Geometric Design of Highways and Streets* (also called the "Green Book") (*24*), and the FHWA *Manual on Uniform Traffic Control Devices* (MUTCD) (*25*). The report highlighted the role of ADAAG as a minimum design standard (i.e., the starting foundation), emphasizing that additional measures may be necessary to ensure pedestrian safety, particularly in high-use areas and situations where motorists do not anticipate pedestrian traffic. The guidelines and prompt lists reflect this philosophy by including checklists that go beyond the minimum requirements included in ADAAG.

Also related to safety concerns is the Partnership for a Walkable America's checklist to determine potential walkability problems (*26*). Indirectly, the walkability checklist can enable the collection of some data elements that may be needed to address ADA compliance issues.

University of Oregon researchers developed a prototype system to measure street walkability levels. This system uses PDAs preloaded with a GIS map and a questionnaire to capture data such as sidewalk width and condition, path obstructions, and street safety or attractiveness for walking (*27*). More recently, the researchers modified the PDA walkability tool to include an ADA audit module (Figure 6) (*28*). As described in more detail in Chapter 4,

the Oregon DOT is planning to use the modified audit tool to collect curb ramp and crossing data along state highways in Oregon.

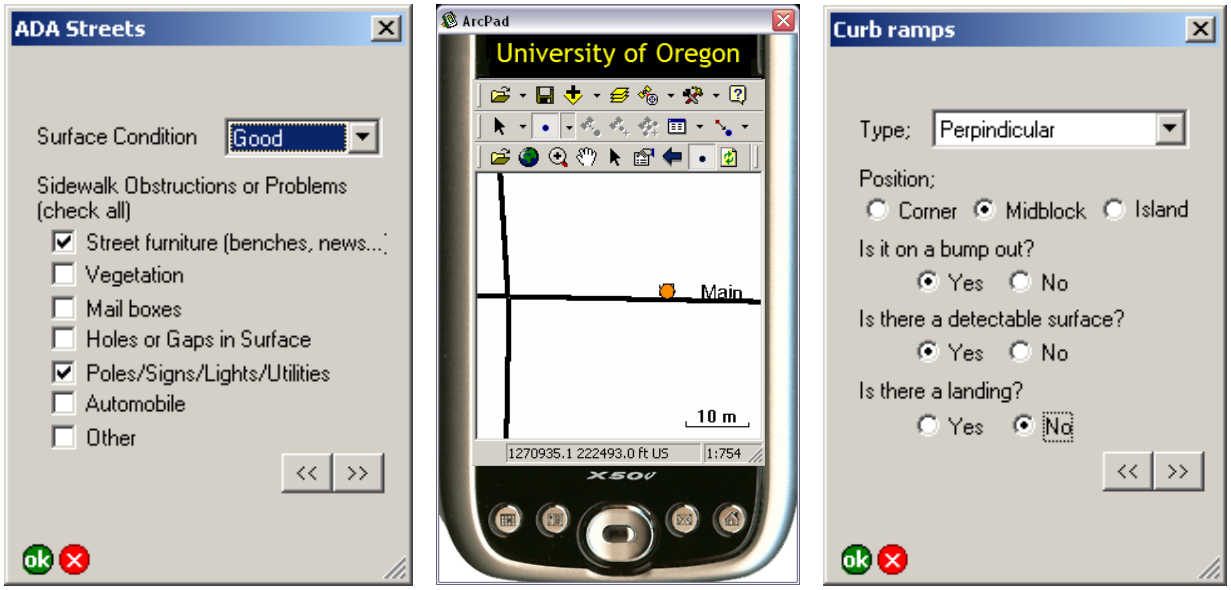


Figure 6. University of Oregon Prototype ADA Audit Module (*Courtesy*: Marc Schlossberg) (*28*).

Texas Transportation Institute (TTI) researchers developed a pedestrian accommodation/accessibility checklist document for the Texas Department of Transportation (TxDOT) to use in temporary traffic control areas (e.g., work zones) (*29*). The checklists provide guidance on pedestrian accommodation during the different stages of a construction project.

ADA-RELATED INVENTORY AND CONDITION ASSESSMENT EFFORTS

ADA compliance inventory and assessment efforts vary widely, from simple "yes/no" clipboard inventories of accessible elements (e.g., the presence of curb ramps) to detailed survey measurement of cross slope, grade, and vertical discontinuities. Increasingly, transportation agencies are using innovative approaches and technologies such as GIS, GPS receivers, orthophotography, PDAs, and data management systems. The sophistication of the assessments depends on several factors, including the intended application(s) of the assessment, the size and resources available to the public agency, and complaints or lawsuits.

A preliminary literature review enabled the researchers to identify a few examples of ADA inventory, condition assessment efforts, and/or transition plans relevant to this report:

- **State DOTs:**
    - Maryland State Highway Administration (MDSHA) (*30*)
    - Texas Department of Transportation (*31*)
- **Local Jurisdictions:**
    - City of Asheville, North Carolina (*32*),
    - City of Austin, Texas (*33*),
    - City of Bellevue, Washington (*34*),
    - City of Clarksville, Tennessee (*35*),
    - Cobb County, Geogia (*36*),
    - City of Colorado Springs, Colorado (*37*),
    - City of Oakland, California (*38*),
    - City of San Clemente, California (*39*),
    - City of San Antonio, Texas (*40*), and
    - Tucson Region, Arizona (*41*).

Chapter 4 describes in detail the asset inventory, condition assessment, and programming of needed improvement practices at a sample of selected agencies contacted by the researchers.

CHAPTER 3
ONLINE SURVEY PROCEDURE AND RESULTS

INTRODUCTION

The researchers developed a two-pronged strategy for gathering data from stakeholders, which included an online survey and follow-up telephone interviews. This chapter summarizes the online survey process and responses. Chapter 4 summarizes the findings from the interviews.

ONLINE SURVEY FORM

The researchers prepared a 12-question online survey form on pedestrian infrastructure data inventory practices. Because the intent was to conduct follow-up interviews, the online survey was intentionally short, designed to be completed within 10 minutes. To assist in this process, the researchers implemented the survey using a web-based survey form hosted on a TTI web server and invited the transportation community (by email) to participate in the survey. The appendix shows the online survey form as implemented on the TTI website. The researchers sent invitation emails as follows:

- State pedestrian coordinators: 50 individuals, one for each state.
- Association of Pedestrian and Bicycle Professionals (APBP) Email Listserv: 640 subscribers.
- Institute of Transportation Engineers (ITE) Traffic Engineering Council: about 545 subscribers. **Note**: The original intent was to send the email to ITE Pedestrian and Bicycle Council members. However, this council email listserv no longer exists.
- Other: 23 individuals, including representatives from the U.S. Access Board, FHWA, the National Highway Traffic Safety Administration (NHTSA), and the Pedestrian and Bicycle Information Center (PBIC).

The researchers also coordinated with the contractor in charge of NCHRP Project 20-07, Task 232, because that project also included a survey on ADA transition plans. There was some overlap between Task 249 and Task 232 in that the Task 232 survey asked high-level general questions about roadway asset inventory and condition assessment procedures in the context of updating ADA transition plans. Ultimately, the Task 249 online survey took place prior to the Task 232 survey.

ONLINE SURVEY RESULTS

The researchers received 12 responses: six responses from state agencies and six responses from city/county representatives. Although the response rate was very low, the feedback was informative nonetheless. Table 1 summarizes the results of the survey. For each

question choice provided, the table shows the number and percentage of respondents who selected that choice. The questions were not mandatory, which explains why the total of number of respondents for each question did not necessarily add up to 12.

Table 1. Online Survey Results.

Does your agency inventory pedestrian infrastructure, either as a standalone initiative or as part of a larger asset management program?		
Yes	92%	11
No	8%	1
N/A	0%	0
	Total	12

If yes, which pedestrian infrastructure types does your agency inventory?		
Curb ramps	91%	10
Sidewalks	91%	10
Crossings	82%	9
Pedestrian signals	64%	7
Transit facilities in the right-of-way	36%	4
Medians	27%	3
Refuge islands	27%	3
Signs	18%	2
Other:	18%	2
Drainage grates, pedestrian push bottons, side obstructions		
	Total	11

What pedestrian infrastructure attributes does your agency inventory?		
Sidewalk/ramp width	91%	10
Grade	82%	9
Detectable warnings	73%	8
Cross slope	55%	6
Obstacles	55%	6
Changes in grade and cross slope	45%	5
Deficiencies	45%	5
Horizontal clearance	45%	5
Condition	36%	4
Pedestrian push button characteristics	36%	4
Texture	36%	4
Vertical clearance	36%	4
Material	27%	3
Color	18%	2
Other:	18%	2
Poor drainage, separation from roadway		
Relative compliance with the Americans with Disabilities Act, not specific values (e.g., greater than or less than based on the Act)		
	Total	11

Table 1. Online Survey Results (continued).

What tools does your agency use to support the inventory?		
Clipboards	100%	11
GIS	73%	8
Digital cameras	64%	7
Relational databases	55%	6
Aerial photography	45%	5
Inclinometer	45%	5
Measuring wheel	45%	5
CAD	18%	2
PDAs	18%	2
Survey-level GPS receivers	18%	2
Video logs	18%	2
Low-end GPS receivers	9%	1
Mapping-level (1 m) GPS receivers	9%	1
Profile gauge	9%	1
Other:	18%	2
Video cameras mounted on a van		
Geodatabase and GIS based analysis		
	Total	11

Is your agency involved in the funding and programming of pedestrian infrastructure facilities?		
Yes	100%	12
No	0%	0
N/A	0%	0
	Total	12

Does your agency plan/design/construct pedestrian infrastructure facilities?		
Yes	100%	12
No	0%	0
N/A	0%	0
	Total	12

If yes, what design guidelines/tools does your agency use:		
ADA Accessibility Guidelines (ADAAG)	75%	9
Agency standards and specifications	75%	9
Local/regional/national standards and specifications	58%	7
Public Rights-of-Way Accessibility Guidelines (PROWAG)	58%	7
Other:	25%	3
Current research and FHWA Guidance		
Texas Accessibility Standards		
MDSHA's guidelines for pedestrian facilities along state routes		
	Total	12

Table 1. Online Survey Results (continued).

Does your agency measure ADA compliance of pedestrian infrastructure facilities?		
Yes	67%	8
No	33%	4
N/A	0%	0
	Total	12

Does your agency have an ADA Transition Plan in place?		
Yes	75%	9
No	25%	3
N/A	0%	0
	Total	12

Does your agency participate in the development of ADA standards?		
Yes	50%	6
No	50%	6
N/A	0%	0
	Total	12

Do you know of any other local/regional/national agencies that are involved with pedestrian infrastructure facilities and that are leaders or innovators in this field?		
Yes	11%	1
No	78%	7
N/A	11%	1
	Total	9

May we contact you at a later date for additional information?		
Yes	92%	11
No	8%	1
N/A	0%	0
	Total	12

Additional comments:
I did an informal survey of State DOT's about a year ago. I contacted about six Ped/Bike Coordinators and found that not one agency I contacted inventoried sidewalks. No one had information about condition, gaps, issues, or problem areas and few had funding sources for sidewalk construction. I did not ask about ADA compliance.
We collected our data back in 2000 and would do some things differently if we did it again. It was a one-time snapshot, not an ongoing inventory effort. We focused only on intersections - curb ramps primarily, but also median crossings and push buttons.
Most of the ADA compliance is handled by our CPM division and our signal design sections, neither of which I have any management control.
We have done extensive research in this topic and have developed a state of the art GIS system to guide the effort. I would be happy to share any of that knowledge with you.

SUMMARY OF FINDINGS AND CONCLUSIONS

Although the survey sample size was lower than desired, the online survey findings reinforce the findings from the literature review and other similar reviews of the state-of-the-practice in this area. Those findings are as follows:

- There is a wide range and level of sophistication in the use of technology to conduct sidewalk inventories and condition assessment. The primary determining factors for the type and use of technology appear to be the agency's prior experience, available resources, and amount of infrastructure to inventory.

- With some exceptions, local agencies (e.g., city, county, regional government) appear to have more experience and/or use more advanced tools for conducting pedestrian facility inventories and assessments. The researchers hypothesized several possible explanations for this phenomenon:

    - Local agencies are typically responsible for less road mileage than a state DOT, making implementation at a smaller scale more manageable.
    - Urban roads under the jurisdiction of local agencies typically have more sidewalks, as opposed to state DOTs with many miles of rural highways that have a different set of maintenance requirements than urban streets.
    - Decision making and standard setting typically take longer in a larger agency (such as a state DOT).

Other interesting findings that were specific to the online survey include the following:

- Eleven of the twelve agencies that responded have conducted inventories of pedestrian facilities, but there is variation in the type of elements that are inventoried. Most agencies inventory sidewalks, curb ramps, and crossings. Fewer agencies inventory or survey transit stops, median refuge islands, or pedestrian push buttons.

- There are also variations in the attributes that agencies collect as part of the data collection process. Most agencies collect sidewalk and curb ramp width and grade, as well as the presence of detectable warnings. Fewer agencies collect data about cross slope, obstacles, or specific deficiencies.

- Clipboards, GIS, and digital cameras are the tools of choice for most inventories. Fewer respondents use tools such as aerial photography, inclinometer, measuring wheels, and GPS receivers.

- Only one survey respondent knew of "best practices" from another agency. This observation is an indication of the need for more active information exchange among agencies.

CHAPTER 4
INTERVIEWS AND OTHER INFORMATION GATHERED FROM STAKEHOLDERS

INTRODUCTION

The researchers contacted individuals at 14 agencies for follow-up interviews: six state DOTs (Florida, Maryland, Missouri, New Jersey, Oregon, and Texas) and eight local jurisdictions (Austin, Texas; Bellevue, Washington; Charlotte, North Carolina; Cobb County, Georgia; Colorado Springs, Colorado; Oakland, California; Sacramento County, California; and Tucson Region (Pima Association of Governments [PAG]), Arizona). Of the 14 identified agencies, it was possible to conduct six interviews as follows: four state DOTs (Florida, Maryland, Oregon, and Texas) and two cities (Bellevue, Washington and Charlotte, North Carolina). In addition, there was ample documentation about the inventory programs for Sacramento County, California, and the Tucson region, Arizona. This chapter provides a summary of the accessibility inventory programs at these eight agencies.

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)

Asset Data Inventory and Condition Assessment Practices

Florida has about 2,500 centerline miles of sidewalks along the state highway network. FDOT inventories pedestrian infrastructure to determine correction and/or improvement needs, either as part of the regular maintenance rating program or in response to complaints and comments from the public. With the maintenance rating program, FDOT officials determine the condition of sidewalks, intersections, and other elements on a regular basis (once or twice a year). Officials assess pedestrian infrastructure conditions using a combination of procedures that include driving and walking. In response to complaints from the public, FDOT officials verify the characteristics, issues, and needs of the specific locations of interest.

To address accessibility inventory requirements, FDOT uses a number of checklists. For ramps, FDOT uses the U.S. Department of Justice's toolkit form (Figure 1). For sidewalks and intersections, FDOT uses different forms. As an illustration, Figure 7 shows the street crossing and curb ramp assessment form. To assist in the data collection effort, FDOT uses clipboards, digital cameras, measuring wheel, and inclinometer. Practices vary across the state, with most districts conducting pedestrian infrastructure inventories using paper-based approaches.

	QUESTIONS	YES NO	✔	POSSIBLE SOLUTIONS
	Street Crossings / Curb Ramps People with disabilities should be able to use the pedestrian facilities at intersections as freely as everyone else. Street crossings and curb ramps are key components of providing safe and accessible paths of travel at an intersection where pedestrians must cross a street.			
	If there is a curb, does it have a curb ramp? - Min. width of curb ramp is 36" - Max. curb ramp slope is 1:12 - Max. side slope is 1:12 - Curb must have 48" landing at top	☐ ☐ ☐ width ☐ slope ☐ landing	❑ ❑ ❑	Install curb ramp. Modify curb ramp. Install landing (see Fig. 2)
	If pedestrians are likely to cross curb ramp laterally, are there flared sides? - Max. side slope is 1:12 If there are street furnishings or fixtures that would prohibit crossing the ramp laterally, return curbs are permitted.	☐ ☐ ☐ side slope	❑ ❑	Modify curb ramp. Install side slopes
	Does the curb ramp have a detectable warning (tactile surface)? The curb ramp texture must contrast with adjacent materials.	☐ ☐	❑ ❑	Add a detectable warning - applied mat, thermoplastic Replace ramp with one with detectable warning - pattern impressed in concrete - concrete/brick pavers, tiles
	Are level changes 1/4" high or less, or if beveled edge, no more than 1/2" high? Especially important at the bottom of curb ramps where the ramp abuts the curb & gutter and the roadway pavement - Up to 1/4" change-in-level vertical - 1/4" to 1/2" requires 1:2 slope (max.) - Greater than 1/2" requires 1:12 slope	☐ ☐ ☐ height	❑ ❑	If there is a level change greater than 1/4" up to 1/2", grind or otherwise modify this edge. If there is a single step with a rise of greater than 1/2", add a short ramp.
	Does the curb ramp junction with the gutter or roadway have a reasonable counter slope? A counter slope of greater than 11% may catch foot rests or back rollers on some wheelchairs.	☐ ☐	❑ ❑	Add a 24" level landing at bottom of curb ramp. Reduce ramp slope to that counter slope is less that 11%. (see Fig. 3)

Figure 7. FDOT's Checklist for Street Crossings and Curb Ramps (*Courtesy*: FDOT).

A lawsuit against a number of agencies in the Tampa region, including the local transit agency, the county government, and FDOT, resulted in a settlement that is changing the way those agencies address ADA requirements. As part of the settlement agreement, FDOT agreed to spend $1.5 million over a 5-year period to correct ADA deficiencies. The other defendant agencies reached separate settlement agreements. FDOT District 7 allocates funds for every resurfacing project (around $9,000/mi) to fix minor ADA deficiencies of existing infrastructure, (e.g., cracked sidewalks or inappropriate ramps). Capacity projects already have accessibility requirement components. To assist in the data collection and assessment process, the district uses a number of tools, including the following:

- Digital cameras equipped with GPS antennas and the capability to display latitude-longitude data on pictures. Survey crews have GPS receivers in the field.

- Basic tools, such as a smart level, tape measure and/or measuring wheel, and clipboard.

- GIS that includes a number of layers, such as stop signs, highway project alignments, and bicycle routes (county-produced with FDOT assistance). By overlaying stop signs on the highway project layer, district officials can associate stop sign and project locations. A review of project plans enables the determination of potential changes to plans.

- Video log system that includes front and lateral views, which enables district officials to review roadway characteristics quickly. The image resolution is good enough to read stop sign and bus route numbers, as well as evaluate certain cases such as substandard benches. Video logs are updated every two years.

- Tools that include drive-by video clips, such as Google Maps, to help document cases.

- Crash data, which are useful for analysis, although there are issues with the positional accuracy of the linearly referenced crash location data (1/10 mi to 1/5 mi in some cases, according to district officials).

Programming of Asset Improvements

Florida codified ADA requirements through the Florida Accessibility Code (FAC), which became Chapter 11 of the Florida Building Code (FBC) in 2003 (*42*). This code covers buildings, although it also includes elements such as curb ramps. FBC meets ADAAG, except that for detectable warning surfaces FBC follows American National Standards Institute (ANSI) A117.1-1986 surface requirements (exposed aggregate concrete, cushioned rubber or plastic surface, raised strips, or grooves the full width and length of a curb ramp). These surfaces are not equivalent to the truncated domes as required in the U.S. DOT modifications to ADAAG (24 in. deep and full width) (*6*). The discrepancy between FBC and ADAAG is an area the state is working to resolve. FDOT's standard sheets for ramps are available online (*43*).

Depending on the nature and location of the specific accessibility improvement need, FDOT decides whether to use maintenance funds or general project programming. Through their

maintenance program, districts handle relatively small improvement needs. FDOT handles larger improvement needs using the normal project programming process. For highway projects, ADA coordinators are involved in all phases (planning, pre-design, design, and construction). During the planning phase, FDOT conducts inventories of pedestrian facilities for need assessment purposes. Prior to letting, ADA coordinators have an opportunity to review plans and offer suggestions to make sure the plans include appropriate accessibility features. After letting, ADA coordinators may have to address questions from field inspectors and, as needed, recommend specific changes to drawings. FDOT does not conduct post-construction surveys.

Additional strategies to meet accessibility requirements include making complaint forms available on the FDOT website and providing online and offline training opportunities. FDOT inspectors have undergone training. Many contractors have also received training.

FDOT does not have a formal transition plan but believes its procedures meet the intent of ADA regulations. The FHWA Florida Division Office has commented that FDOT's "mainstreaming" of accessibility features into most/all projects meets the intent of a transition plan. Over the last few years, FDOT has seen a decrease in the number of complaints from the public.

MARYLAND STATE HIGHWAY ADMINISTRATION

Asset Data Inventory and Condition Assessment Practices

In 2006, MDSHA began a GPS/GIS-based approach for the inventory of pedestrian infrastructure in the state with a focus on limited attribute data collection and in-the-field assessment of accessibility compliance. The motivation for this data collection approach was two main trends observed during a preliminary evaluation of practices at other transportation agencies: one trend focusing on only sample data gathering and a second trend focusing on very detailed attribute data gathering (e.g., for bus stops, there was a case where the number of attributes was around 50). Prior to the new inventory initiative, pedestrian infrastructure data collection was limited to a sidewalk attribute (yes/no) associated with roadway centerline segments as part of regular annual inventory activities at MDSHA. Video log data collection supports this inventory effort.

The goal of the new data collection effort was to use field measurements to make a determination of ADA compliance "on the fly." While crews collected data for all elements, MDSHA decided only to record attribute data for non-compliant elements. At the conclusion of the initial data collection effort, the results were as follows:

- Sidewalks: 874 mi (455 mi were compliant) (**Note**: The inventory has now grown to 910 mi of sidewalks, of which 489 mi are compliant)
- Bus stops: 2617 (1,304 bus stops were compliant) (**Note**: MDSHA forwarded bus stop data to the transit authority)
- Curb ramps: 24,981 (1,412 curb ramps were compliant)
- Driveway crossings: 18,198 (4,670 driveway crossings were compliant)

- Median treatments: 1,183 (817 median treatments were compliant)

MDSHA uses a checklist (Figure 8) for the inventory and condition assessment of pedestrian facilities, which is included in MDSHA's *Accessibility Policy & Guidelines for Pedestrian Facilities along State Highways* (*44*). To collect data in the field, MDSHA developed a data dictionary in Trimble Pathfinder Office, which they uploaded to handheld GPS receivers. MDSHA also created maps for field crews with indications on what sidewalks to cover in their daily inventory efforts.

After collecting data in the field, operators brought the data into a GIS environment (Environmental Systems Research Institute (ESRI) personal geodatabase in Microsoft Access .mdb format). Part of the quality control involved overlaying GPS data locations on 6-in. resolution orthophotos and adjusting locations as needed. (**Note**: Some locations around airport facilities have 3-in. aerial photography.) Quality control also included conducting spot checks to verify the accuracy and completeness of the data collected. In the future, MDSHA plans to migrate the data to an enterprise system. MDSHA is also developing a mobile GIS application to enable field crews to access the database and update records in real-time as needed. MDSHA expects this application to be operational by mid 2009.

As part of the new inventory initiative, MDSHA provided data collectors with the same level of ADA training as what MDSHA already provides for consultants, developers, and contractors. This training includes a guidebook that each individual receives and a full day of instruction.

SHA – ADA CHECKLIST

This checklist has been developed to provide an itemized list of considerations that will help the designer to determine the best possible accessible facility or route.

Sidewalk

YES	NO	N/A	
☐	☐	☐	Is the sidewalk width 5 foot (60") exclusive of curb? If no, what physical constraint(s) exist to cause a reduction in sidewalk width?
☐	☐	☐	Where sidewalk width is less then 5 feet, are passing zones (60" x 60") provided at intervals no greater than every 200 feet.
☐	☐	☐	Is the sidewalk cross-slope no greater than 2%?
☐	☐	☐	Is the vertical elevation difference between adjacent surfaces no greater than ¼"? (for example stamped concrete, driveway entrances, etc.)
☐	☐	☐	If elevation differences between ¼" and ½" exist are they beveled at maximum 2:1 slope?
☐	☐	☐	Are sidewalks adjacent to steep slopes?
☐	☐	☐	If yes, are handrails provided?
☐	☐	☐	Are there protruding objects located in the sidewalk (ex: utility poles, mailboxes, signal poles, signs, etc.)?

Ramps

☐	☐	☐	Are all ramps free from obstacles?
☐	☐	☐	Are ramps perpendicular to the curb?
☐	☐	☐	Are the bottoms of ramps flush with roadway?
☐	☐	☐	Are ramps placed at each end and in-line with crosswalk.
☐	☐	☐	Are ramps (not including side slopes) located at least 2 feet (measured from inside to inside of crosswalk striping) within the limits of the crosswalk striping?
☐	☐	☐	Is a level area measuring 4 feet wide by 4 feet long provided when using a ramped median?

Driveway Crossing

YES	NO	N/A	
☐	☐	☐	Where the sidewalk crosses the driveway/entrance, is the cross-slope a 2% maximum?
☐	☐	☐	At the point of crossing, is the driveway/entrance profile in fact the sidewalk cross-slope?

Accessible Pedestrian Signals (APS) ***(To be developed by OOTS)***

☐	☐	☐	Are pedestrian signals being replaced or installed within the limits of the project?
☐	☐	☐	If yes, are Accessible Pedestrian Signals included?

Protruding Objects

☐	☐	☐	Are any objects mounted to a fixed structure between 27" and 80" above the ground?
☐	☐	☐	If yes, do the objects extend more than 12" from the fixed structure into the sidewalk?

Miscellaneous

☐	☐	☐	Is enough detail included to construct all ADA features properly? (i.e. curb elevations, etc.)
☐	☐	☐	Do plans include handicapped accessible Maintenance of Pedestrian Access plans?

YES	NO	N/A	
☐	☐	☐	Are crosswalks perpendicular to the lanes?
☐	☐	☐	If no, can they be perpendicular to the lanes?
☐	☐	☐	Are stop bars located a minimum of 4 feet from the crosswalk?
☐	☐	☐	Are pedestrian push buttons located 10 feet maximum from the curb and accessible?
☐	☐	☐	Are ramp running slopes no greater than 12:1?
☐	☐	☐	Are cross-slopes on the ramps no greater than 2%?
☐	☐	☐	Are side flares sloped 12:1?
☐	☐	☐	Is the minimum width of sidewalk ramps 40"
☐	☐	☐	Is a level (max. 2%) landing area provided at the top of perpendicular and diagonal ramps?
☐	☐	☐	Is the landing area 60" x 60"?
☐	☐	☐	Do construction notes on roadway plans include Detectable Warning Surfaces placement?
☐	☐	☐	Are ramps located to minimize pedestrian exposure to traffic?
☐	☐	☐	Are ramps located outside of sump areas where ponding could occur?
☐	☐	☐	If the project includes multi-use trails, is the ramp width equal to the width of the trail?

Median Treatments

☐	☐	☐	Is the minimum median width for pedestrian refuge 6 feet from face of curb to face of curb? If no, what physical constraint(s) exist to cause a reduction in the width?
☐	☐	☐	Is a 4-foot minimum clear width for pedestrian travel provided on cut through and ramped medians?
☐	☐	☐	Are median ramp slopes 12:1 maximum?

Figure 8. MDSHA's Accessibility Checklist (*Courtesy*: MDSHA) (*44*).

Prioritization of improvement needs has involved the use of techniques such as identifying areas with the highest concentration of non-compliant locations and overlaying layers, for example government facilities, transit facilities, pedestrian accidents, and fatality data. MDSHA is beginning to explore the possibility of developing automated decision support tools in the GIS to assist in these activities. MDSHA also looks at non-compliant locations in the context of current highway project locations. To support the overall planning process, MDSHA developed an intranet application in ESRI ArcIMS that overlays consolidated transportation program (CTP) projects (which include capital projects that are proposed for construction or for development and evaluation during the next 6-year period), aerial photography, video log imagery (taken every 50 ft), and crash data (from the Maryland State Police), as well as property lines and owner data.

MDSHA's goal is to increase ADA compliance by 2% every year, as established in the MDSHA Business Plan (*45*). In the last two years, MDSHA went from 52% to 57% compliance.

Programming of Asset Improvements

MDSHA is responsible for ADA compliance along state routes and reports directly to the governor on these matters. MDSHA has developed a set of guidelines for pedestrian facilities along state highways (*44*), which follows ADAAG and additional requirements unique to Maryland (*46*). MDSHA has also developed design pedestrian and bicycle facility guidelines (*47*).

MDSHA's coordination with local and regional stakeholders includes holding meetings with the disability community on a regular basis to discuss issues, programs, and projects. MDSHA officials usually bring a laptop that has all the relevant GIS layers to facilitate the discussion to those meetings. MDSHA's program to address ADA complaint requirements includes a formal complaint procedure, a complaint/grievance form, and an ADA complaint process flowchart (*45*).

MDSHA schedules projects to address improvement needs through the highway project development process and through a separate ADA program that focuses on improvement needs at locations where there are not active highway construction projects. MDSHA reviews plans at least at three points in the project development process: at the end of the preliminary design phase, roughly at 50 percent design, and at the end of the design phase. All construction projects, as well as access permit applications, undergo an ADA review. In addition, MDSHA does not release bond and does not turn over a project to maintenance until a final ADA review has taken place. In general, at the conclusion of a construction project, field crews visit the site and update records, which are later merged with the inventory database in the office. Currently, MDSHA has three consultant inspection crews: two crews for construction projects and one crew for access permits.

OREGON DEPARTMENT OF TRANSPORTATION (ODOT)

Asset Data Inventory and Condition Assessment Practices

ODOT's highway asset database ties sidewalks to highway centerline segments. According to the database, there are sidewalks along 900 centerline miles of state highways. However, this is just an estimate. In reality, ODOT does not know how many miles of sidewalks there are on the network or their condition. In addition, the inventory does not track curb ramps, crossings, or other pedestrian infrastructure elements.

To address this issue, in 2006 ODOT started a new inventory of pedestrian facilities (as part of a larger initiative at ODOT that is evaluating its entire asset inventory practices). The first phase focuses on a sidewalk inventory limited to state highways within urban growth boundaries (UGBs) (*48*). The new inventory program started in 2006 with a pilot test in which ODOT hired college students to extract as much information as possible from existing video log data, compile the data into Excel spreadsheets, drive the highway network to validate the data, and provide feedback needed to populate the inventory in a mainframe database. At the conclusion of the pilot test, the department decided to expand the data collection to the rest of the highway network located inside UGBs. ODOT expects to complete that activity later this year. The sidewalk inventory includes data elements such as sidewalk width, condition, and material. It also tracks whether a buffer separates curbs and sidewalks and whether there are midblock crossings. The inventory does not measure running slopes. For areas that do not currently have sidewalks, ODOT has instructed the students doing the data collection to make a determination on whether sidewalks are necessary. The assessment takes into consideration several factors, including video log data observations and land use characteristics.

The video logs used for the sidewalk inventory are the same video logs ODOT already uses for its highway asset inventory program (*49*). The resolution of the video log data is sufficient to read elements such as street names. However, it is not adequate for quantitative measurements such as widths or slopes.

After completing the sidewalk inventory, the plan is to continue with curb ramps and crossings. Realizing that video logs are not adequate for recording curb ramp data, ODOT plans to use a modified version of a PDA-based prototype system developed at the University of Oregon (*27*, *28*). Currently, ODOT has identified the data fields it would like to use for the inventory of curb ramps, and later this year, it expects to conduct a pilot test with University of Oregon researchers to determine the feasibility of the PDA-based approach.

Programming of Asset Improvements

Since 1971, state law in Oregon has mandated the inclusion of facilities for pedestrians and bicyclists wherever a road is built or re-built in the state (*50*). Because of this mandate, many roadways in Oregon have walkways. For example, most roads with curbs have sidewalks. Likewise, there are communities with more than 90% of bicycle and pedestrian facilities

complete. This level of penetration helps to generate demand for similar facilities in other areas of the state, aided by support from other segments of society (e.g., the public health community).

The determination of need for pedestrian and bicycle facilities is context sensitive and depends on factors such as type of roadway facility and local conditions (e.g., in rural areas with limited vehicle traffic, a road with narrow shoulders could be considered adequate for walking). Projects such as signal or signing improvements, landscaping, other incidental work, or preservation overlays (if the only intent of the project is to preserve the current riding surface in usable condition) do not fall under the category of building or re-building highways.

The 1995 Oregon Bicycle and Pedestrian Plan provides guidelines to ODOT, MPOs, counties, and cities for the implementation of bikeway and walkway systems; provides a history of relevant laws and regulations; and provides standards for planning, designing, and maintaining bikeways and walkways (*51*). The 1995 document is the fourth version of the plan (previously adopted bicycle plans were in 1984, 1988, and 1992), and the first one to include pedestrian facilities. According to this plan, in 1994 approximately 30% of urban state highways had sidewalks on both sides of the road. The plan for 2005 and 2015 was to have sidewalks on 80% and 100%, respectively, of urban state highways. The Oregon Bicycle and Pedestrian Plan also includes the criteria and rating process to select bikeway/walkway projects (Figure 9). In principle, projects are only eligible if they meet the requirements of the plan, relevant planning rules, and a recently adopted local plan. Rating criteria include system connectivity, roadway classification, intended users, potential daily usage, current conditions, compliance with ODOT standards, and relative costs with respect to other similar projects. Additional points are possible if a project provides for both bicyclists and pedestrians, reduces out-of-direction travel, or provides a connection to another mode of transportation.

ODOT has a number of strategies to program accessibility improvements, including pedestrian infrastructure elements in highway construction projects, responses to address citizen complaints, Bicycle and Pedestrian Program grants, and Safe Routes to School grants (*49*). The Bicycle and Pedestrian Program at ODOT provides technical assistance with designing, constructing, and maintaining walkways and bikeways; recommending design standards; and reviewing construction plans to ensure compliance with current standards and specifications (*49*). The program is not involved during or after the construction phase, neither with conducting inspections or updating records in the agency's asset database after construction ends. The program also reviews local transportation plans for pedestrian and bicycle compatibility as part of Oregon's Transportation and Growth Management initiative, which is a joint venture between ODOT and the Oregon Department of Land Conservation and Development (DLCD) (*52*).

ODOT standard drawings include details for the design and construction of sidewalks and ramps (*53*). The standard drawings, which ODOT revises every 6 months, are based on the state's standards for curbing (*54*) and the PROWAAC report (*10*).

Applicant: _____ **Region:** _____
Roadway: _____ **Length:** _____
Section: _____
Cost: _____ **Cost/mile:** _____

Is it the appropriate type of bicycle/pedestrian treatment for the corridor served?
See the Oregon Bicycle and Pedestrian Plan for details.

Does the project satisfy the requirements of: (a) LCDC's Transportation Planning Rule 12, (b) the Oregon Bicycle/Pedestrian Plan, and (c) a recently adopted local plan?

A "No" answer to any of the above questions should disqualify a project from further consideration.

RATING CRITERIA: (circle relevant factors)	**POINTS**
1. Will it be an important part of a bikeway or walkway system? *Points: most direct route which links or completes a system: or essential core route which serves many users = 8; extends existing facility = 6; begins a planned system = 4; isolated project with no linkage = 2.*	8
2. What is the classification of the roadway being treated? *Points: arterial = 6; major collector = 4; minor collector = 3; local = 2*	6
3. Who will the main users be? *Points: 2 each for commuter/utility; school children; disabled; recreation/touring*	8
4. What is the potential daily usage (relative to projects of a similar nature)? *Points: very high = 6; high = 5; average = 4; fairly low = 3; low = 2; very low = 1;*	6
5. Current conditions: is the existing roadway a deterrent to bicycling or walking? *Points: (add each factor cumulatively: high = 2, moderate = 1, low = 0)* *Bikeways and walkways along roadway: ADT___; narrow___; curves___; other safety factors___ (trucks, etc._____).* *Intersection treatments: ADT___; speed___; width___; accesses, other threats___ (i.e. skew, sight distance, etc._____)*	8
6. Are ODOT adopted standards used? *Points: highest = 8; intermediate = 6; minimum = 4; below standard = 0*	8
7. Are the costs reasonable compared to projects of a similar nature? *Points: under 80% of usual costs = 6; within 20% either way of usual costs = 5; 20%-50% over usual costs = 4; 50%-100% over usual costs = 2; more than 100% over usual costs=1.*	6
BONUS POINTS: *Does the project provide for both bicyclists and pedestrians?* — *Points = 5* *Does the project reduce out-of-direction travel? (Mostly applicable to paths)* — *Points = 3* *Does the project provide a connection to another mode? (transit, car pool)* — *Points = 3*	
TOTAL POINTS POSSIBLE = 50 (w/o bonus points) **TOTAL POINTS:**	

Figure 9. ODOT Bikeway/Walkway Project Rating Sheet (*Courtesy*: ODOT) (*51*).

TEXAS DEPARTMENT OF TRANSPORTATION

Asset Data Inventory and Condition Assessment Practices

TxDOT undertook a comprehensive data collection program in 2001, with a focus on intersections, including curb ramps, crossings, and pedestrian push buttons. Given the size of the state and the extent of the state-maintained highway network, TxDOT implemented a data collection program that relied on a single standardized data collection form (Figure 10) but left to the discretion of the districts how to implement data collection activities within their jurisdiction.

DISTRICT INVENTORY OF PEDESTRIAN ACCESSIBILITY AT INTERSECTIONS

Form 2028 (6/2001)
Page 1 of 1

District: _____ Control-Section: _____
County: _____ Cross Street: _____
City: _____ Corner (NW, etc.): _____
Route: _____ No.: _____ Suffix: _____ Reference Marker: _____ + _____
Inventory performed by: _____ Date of survey: _____

Location information — Corner is near (within 3 blocks):
☐ hospital or retirement home ☐ school ☐ bus/transit stop ☐ major employers
☐ govt. bldg., public park or public facility (library, civic center, etc.)
Comments: _____

A. ☐ **No curb ramp**

☐ Curb exists
☐ Sidewalk exists
☐ Pedestrian path exists
☐ Curb cut exists

☐ No sidewalk or path currently exists (Skip to box C below)

Potential construction difficulties:
☐ 1) Drainage structure conflict
☐ 2) Utility conflict
☐ 3) Small sign relocation required
☐ 4) Signal support relocation req'd
☐ 5) Historic elements exist
☐ 6) High curbs/elevation obstacle
☐ 7) Other (please describe)
_____

B. ☐ **Has curb ramp**
☐ TDLR compliance certificate received for CSJ _____
(Skip to box C at left)

Number of curb ramps:
☐ Two per corner
☐ One per corner
☐ Serves two crossing directions (diagonal)
☐ Has 48" extension into crosswalk
☐ Serves one crossing direction
☐ Another ramp needed

Details for each ramp:

	RAMP 1 (N or S)	RAMP 2 (E or W)
Type[1]	☐ Perp ☐ Parallel	☐ Perp ☐ Parallel
Grade	%	%
Cross slope	%	%
Width	in	in.
Texture cont.[2]	☐ None ☐ Domes ☐ Grooves ☐ Aggr ☐ Other	☐ None ☐ Domes ☐ Grooves ☐ Aggr ☐ Other
Color contrast	☐ Yes ☐ No	☐ Yes ☐ No
Landings[3]	☐ Good ☐ None ☐ Small	☐ Good ☐ None ☐ Small
Obstructions	☐ Yes ☐ No	☐ Yes ☐ No
Ramp lands in crosswalk?	☐ Yes ☐ No	☐ Yes ☐ No
Flush trans[4]	☐ Yes ☐ No	☐ Yes ☐ No
Flares[5]	☐ Good ☐ Steep ☐ Curbed	☐ Good ☐ Steep ☐ Curbed
Curb returns protected?[6]	☐ Yes ☐ No	☐ Yes ☐ No
Slip resistant?[7]	☐ Yes ☐ No	☐ Yes ☐ No
Potential Constraints[8]	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

C. Pedestrian push buttons

☐ Pedestrian push button(s) present
☐ Push button not accessible from sidewalk and/or ramp
☐ Button height >42"
☐ Button diameter <2"

D. Crossings

☐ Striped crosswalk exists
☐ Median/Island crossings accessible

[1] Perpendicular (sidewalk remains at top of curb elevation)
Parallel (entire sidewalk grade drops to street elevation)
[2] Describe texture contrast on ramp surface or bottom landing
[3] Enter Small if less than 3' wide x 4' run
[4] Flush transition at street if <= 1/4" lip exists
[5] Enter Good if flare slope is <= 10%, Steep if >10%, or Curbed
[6] If curb returns (no flare), are pedestrians prohibited by landscape, furniture, planters, etc.?
[7] Painted surfaces are not slip resistant
[8] Enter 1-7 from list at left in Box A.

Notes:

Instructions: If site is under construction, complete form to reflect plan information.

COMPLETE ONE FORM FOR EACH CORNER AT AN INTERSECTION

Figure 10. TxDOT's Pedestrian Accessibility Data Collection Form (*Courtesy*: TxDOT).

The data collection form included fields for data elements such as district, county, city, route, control section, reference marker, proximity (within three blocks) to major activity centers, curb ramp characteristics, pedestrian push button characteristics, and crossing characteristics. For locations *with* curb ramps, the form enabled officials to bypass the curb ramp inventory if a Texas Department of Licensing and Regulation (TDLR) compliance certificate was on file for a relevant control section job (CSJ) associated with that curb ramp. (**Note**: In practice, TxDOT uses this option more often after construction has occurred as a mechanism to instruct districts that there is a previous record for that location in the database. If TDLR inspects the project, the instruction to the district has the effect of not having to re-measure the location to update the database.) For locations *without* curb ramps, the form also included fields to identify potential construction difficulties (e.g., drainage structure conflict, utility conflict, small sign or signal support relocation required, and high curb or elevation obstacle). Although including potential construction difficulties on the form seemed like a good idea, in practice the type of responses received from the field led to the conclusion that such assessments would actually require personnel with more training and expertise than what typical data collectors had.

Some districts used temporary summer employees who typically received some training but were not very knowledgeable of elements such as routes, control sections, and reference markers (which sometimes resulted in incorrect route or control section labeling); did not understand the importance or scope of the entire program; and did not understand the relative importance of several infrastructure elements within the right-of-way. Some districts used consultants (e.g., land surveyors). Other districts used district employees or TxDOT retirees. Typically, these personnel knew TxDOT processes well. Although the resulting data quality was more predictable than when external data collectors were involved, not too many districts had sufficient internal resources to undertake the data collection by themselves.

TxDOT inventoried all the intersections on the state highway system, with the exception of locations in rural areas with no curbs, sidewalks, pedestrian paths, striped crosswalks, or pedestrian-activated signals. The result was a database (currently in SQL Server) of some 121,000 corners. TxDOT also built a web-based application to enable district officials to access all the data within their jurisdiction and update the status of a particular location at the conclusion of a project. Upon request, TxDOT also provides access to the data in Microsoft Access format. The web-based application is a standalone application that does not have linkages to other information systems at the department. Division personnel can also access the database, look up individual records, and produce reports. Districts are asked to keep the database up-to-date by indicating when locations have been upgraded. In practice, this updating is sometimes difficult to accomplish due to heavy workloads and staff shortages.

In addition to the database and the web-based application, the consultant that TxDOT hired prepared a series of maps in GIS format to enable the visualization of priority levels in relation to individual corner locations. The initial prioritization plan that TxDOT developed followed a series of database queries (Table 2). For example, priority 1A was all curb ramps that had a running slope >12% and were located near major activity centers. Likewise, priority 3 was all locations where there were no curb ramps but there were striped crosswalks. In total, there were 13 priority levels. In retrospect, TxDOT officials indicated they would have chosen a

simpler prioritization scheme (e.g., high, medium, and low). Reasons that 13 priority levels were unnecessary include the fact that no corners were associated with one of the priority levels and there were a large number of intersections with corners that had different priority levels.

Table 2. Initial TxDOT Prioritization Plan (*55*).

Priority	Criteria
1A	Existing curb ramp with running slope >12% AND Location near hospital, school, transit stop, govt. bldg, etc.
1B	No curb ramp where sidewalk or pedestrian path exists AND Location near hospital, school, transit stop, govt. bldg, etc.
2A	Existing curb ramp with running slope >12% (NOT located near hospital, etc.)
2B	No curb ramp where sidewalk or pedestrian path exists (NOT located near hospital, etc.)
3	No curb ramp and striped crosswalk exists
4	One curb ramp per corner and another is needed to serve the other crossing direction
5A	Existing curb ramp with either running slope >1:12 or insufficient landing
5B	Existing curb ramp with obstructions in the ramp or landing
5C	Existing curb ramp with any of the following conditions: a) cross slope >3% b) width <36 in. c) no flush transition, OR Median/island crossings that are inaccessible
5D	Existing curb ramp with returned curbs where pedestrian travel across the curb is not protected
5E	Existing diagonal curb ramp without the 48” extension in the crosswalk
5F	Existing curb ramp without truncated dome texture contrast OR without color contrast
6	Pedestrian push button is not accessible from the sidewalk and/or ramp

In practice, having detailed data has enabled the department to answer certain types of questions. For example, if there is a question about why a specific curb ramp is non-compliant when all appearances are that it is compliant, officials can look up the data associated with that particular location and provide a more detailed explanation.

Programming of Asset Improvements

TxDOT addresses accessibility improvements using a variety of strategies, including the regular highway project development process, an ongoing curb ramp program that uses state funds to address the construction or replacement of curb ramps at on-system intersections for locations where highway construction projects are not programmed in the near future, and highway maintenance activities. In general, TxDOT schedules curb ramp improvements for any project that is at least a seal coat. Districts are responsible for addressing ADA complaints from the public. In practice, most complaints are in relation to projects that have just finished and the complainer believes the solution provided was incorrect or insufficient.

Most of the coordination needed to address accessibility requirements takes place at the district level through the district's bike/pedestrian coordinator. At the division level, there is some coordination with the Governor's Committee on People with Disabilities. Recently, there has been some coordination with the City of Austin to develop a video on accessible pedestrian facilities.

TxDOT has adopted PROWAG elements they feel confident will become part of the new federal standard. For example, TxDOT has now adopted 4-ft wide ramps. TxDOT also developed standard detail sheet PED-05 to detail curb ramps and other accessible features (*56*). In addition, TxDOT has a standard specification for sidewalks (Standard Specification 531), as well as special specifications that address specific needs for individual projects (e.g., curb ramps, landings, and retrofitting detectable warning surfaces on curb ramps) (*57*).

In addition to inspections by TxDOT inspectors during the construction phase, many projects are subject to inspections by TDLR (*58*), which is the state agency responsible for certifying compliance with the Texas Accessibility Standards (TAS) (*59*) and Texas Architectural Barriers Administrative Rules (*60*). For projects on public rights-of-way, project owners must submit construction plans to TDLR if the pedestrian elements in the project are expected to cost $50,000 or more. TDLR then conducts a plan review and construction inspection. For every other project (e.g., hike-and-bike projects or buildings), the threshold for submitting plans for TDLR review is a total project cost of $50,000 or more. Some elements in TAS are more stringent than ADAAG.

CITY OF BELLEVUE, WASHINGTON

Asset Data Inventory and Condition Assessment Practices

In 2006, the City of Bellevue started an ADA transition plan update that included an improvement of procedures to document existing barriers and program corrective actions. Bellevue considered a number of options for gathering data on its 336 mi of sidewalks, including traditional survey and light detection and ranging (LIDAR). Based on preliminary tests, the city concluded that the cost of using either one of these two technologies could be at least $1 million. After evaluating other technologies, the city decided to test a modified ultra-light, slow-speed inertial profiler (ULIP) mounted on a Segway Human Transporter (Figure 11). Testing of this technology was the result of a research partnership agreement with FHWA. Based on the results of an initial test during the summer of 2007, Bellevue staff decided to use the technology to develop a comprehensive inventory of sidewalks and curb ramps throughout the city. The year 2008 is the second year of operations.

Officials used the city's existing GIS inventory on the location 336 sidewalk miles to organize the data collection. Two technicians carry out the data collection in the field: one technician who operates the ULIP and conducts the sidewalk inventory, and a second technician who rides a bicycle and uses a Topcon GMS-2 handheld GPS receiver to conduct the curb ramp inventory.

The ULIP hardware sensor box includes a displacement measurement laser (for height measurement), three accelerometers, an optical trigger, and a distance measurement instrument (DMI). The addition of a gyroscope removes remaining errors due to pitch and roll. The grade (running slope) measurement uses the gyroscope pitch angle, the mechanical layout of the ULIP and the sensor box, the position and calibration of the laser, and the measured distance from the laser to the pavement. The cross slope measurement uses the gyroscope roll. The sidewalk fault (heaving) measurement uses an inertial profile based on laser, accelerometer, and DMI data.

An attached laptop computer stores ULIP data and uses a graphical user interface for real-time data collection display. The system also produces reports and data files in text format suitable for inclusion in the city's GIS. As an illustration, Table 3 shows sample ULIP running slope, cross slope, and heaving data. The bump category thresholds are ¼ in., ½ in., and 1 in. The system enables the collection of sidewalk surface data at a rate of 6 mph.

Figure 11. City of Bellevue's ULIP and Segway Human Transporter Equipment (*Courtesy*: City of Bellevue).

Table 3. Sample ULIP Running Slope, Cross Slope, and Heaving Data.

Sample Running Slope and Cross Slope Data				
Travel Distance (ft)	**Marker Distance (ft)**	**Time (sec)**	**Grade (%)**	**Cross slope (%)**
95.8	0.0	5.87	4.52	1.57
96.8	1.0	5.93	4.22	1.46
97.8	2.0	5.99	4.21	1.45
98.8	3.0	6.04	4.28	1.66
99.8	4.0	6.10	4.18	1.54
100.8	5.0	6.16	4.00	1.28
101.8	6.0	6.22	4.12	1.40

Sample Heaving Data			
Distance (ft)	**Time (sec)**	**Bump Category**	**Bump Height (in.)**
7.05	1.58	1	0.27
7.15	1.61	1	0.26
7.23	1.63	1	0.28
7.32	1.64	1	0.25
11.75	2.65	2	0.90
12.57	2.84	-1	-0.28
13.17	2.98	-1	-0.29

The system also enables operators to record video data and verbalized descriptions of obstructions that might affect accessibility (e.g., “branch,” “utility pole,” or “mail box”) by using a video camera connected to a 30 gigabyte hard disk and a Red Hen GPS encoder device. Although the unit uses a GPS receiver, it is not uncommon to lose the signal, making it necessary to rely on orthophotos and field observations to determine the location where data collection occurred.

The bicycle operator carries a Topcon handheld GPS receiver, which is equipped with a digital camera and a graphic interface with a data entry form. The positional accuracy of the GPS receiver is 1 to 3 meters. However, because the receiver can also load and display orthophotos, the operator can easily zoom in and create points associated with specific curb ramps. The spatial resolution of the orthophotos loaded on the GPS receiver is 1 ft per pixel. Table 4 shows the data dictionary loaded on the GPS receiver.

Table 4. City of Bellevue's Data Dictionary for Curb Ramps.

Element	Options
Ramp Type	Directional Perpendicular Parallel Diagonal Construction None (indicates no ramp where ramp is needed)
Gutter Running Slope	Compliant (<5%) Non-compliant (>5%)
Gutter Cross Slope	Compliant (<5%) Non-compliant (>5%)
Transition	Free of heaves, gaps, and obstructions (yes/no)
Clear Space at Bottom	4' x 4' of clear space at the bottom of a diagonal ramp, within marked crosswalk (yes/no)
Detectable Warnings	A 2' x 4' yellow (or other high-contrast color) panel of truncated domes located adjacent to gutter transition (yes/no)
Marked Crossings	Curb ramp is wholly contained within crosswalk markings (yes/no)
Landing Slope	Landing slope does not exceed 2% in any direction (yes/no)
Landing Panel	None (non-compliant) ≥48 in. (best practices) 36–47 in. (compliant) <36 in. (non-compliant)
Ramp Width	≥48 in. (best practices) 36–47 in. (compliant) <36 in. (non-compliant)
Ramp Slope	<8.3% (compliant) 8.3%–10% (non-compliant) >10% (non-compliant)
Ramp Cross Slope	<2% (compliant) 2%–4% (non-compliant) >4% (non-compliant)
Ramp Flares	None ≤10% (compliant) 10.1%–12% (non-compliant) >12% (non-compliant)
Returned Curbs	None (if no ramp flares) Compliant (ramp is situated such that pedestrians will not walk across returned curbs) Non-compliant (returned curbs may present tripping hazard)

Lessons learned from the use of the equipment and the new data collection approach that city staff identified include the need for software debugging (particularly during the first year) and identification of the range of operations of the equipment. For example, wet pavement can affect laser readings. The equipment is also sensitive to changes in tire pressure (tire pressure is an optimization parameter in the software). The Segway tends to buck back on hilly terrain, causing the laser unit to go out of range (a valid question is whether this is a serious problem given that it is difficult to find ADA compliant elements on very hilly areas anyway).

The city is beginning to track costs associated with the operation of the system, although it is still early for definitive assessments. Several aspects of the City of Bellevue data collection program are unique to this prototype implementation and may not be easily translatable to other jurisdictions. For example, FHWA owns the equipment and the software and agreed to absorb all the costs to customize and adapt the system (including changes to hardware and software) to enable the collection of pedestrian infrastructure data (at a cost of about $200,000). The city also negotiated with another agency to pay for the staff members who are involved in the inventory process.

A concern for city staff is the lack of guidance in ADAAG regarding distances over which to take measures in the field. The city now has the ability to collect ground data at extremely fine spatial resolution levels, but guidelines or procedures on how to derive measures at higher aggregation levels are not available. As a result, just by looking at individual data points in the city's data collection program, many elements might appear to be non-compliant. However, if averaged over a pre-established distance, say, 5 ft, it is quite possible that those elements could meet accepted standards. City staff identified a need to develop guidelines to address the issue of how to convert fine-resolution data into aggregated measures that can enable effective comparisons against the standard (or modify the standard so that it effectively includes elements such as distance).

Programming of Asset Improvements

After determining which facilities do not meet standards, the next phase will be to develop a prioritized list of improvement requirements in conjunction with the disability community and other stakeholders. The prioritized list would likely take into consideration factors such as proximity to transit, activity centers, and social services, as well as maximization of available resources by leveraging connections to other funded projects. For this effort, the city will use GIS to overlap data layers, each representing one of several characteristics, and determine the cumulative intensity of all characteristics throughout the city. In December 2007, the city conducted three informal focus groups with different segments of the disability community and intends to conduct a follow-up series of conversations over the next few months.

Once the prioritized list of improvement requirements is in place, the city will program needed implementation resources through the transition plan time horizon. The city already has a number of mechanisms in place to address needs as they arise, including sidewalk maintenance, curb ramp retrofit, and pavement overlay programs. In addition, the city incorporates ADA improvements into its capital projects and as permit conditions for development. The city also

maintains an online system and phone line that enable citizens to file requests to correct barriers (*61*). An ADA coordinator logs these requests and tracks their resolution. Requests tend to be concentrated in residential areas, with less than half of requests received having an accessibility component upon evaluation. The city also has a formal grievance process for ADA complaints.

The city schedules improvements to curb ramp infrastructure for any project that involves at least overlays. City officials review plan sets (e.g., at 30%, 60%, and 90% design complete) and conduct field assessments, which can result in recommendations for changes to drawings. Officials also review plans for subdivision and commercial developments. During construction, inspectors make assessments about the construction process to ensure the finished products meet the defined guidelines. The city is reviewing current practices to improve areas of communication between the various participants in the project development and implementation process to meet ADA requirements more effectively. For example, there are discussions about providing training on ADA requirements to inspectors and contractors.

In situations where PROWAG is more stringent than ADAAG, the city is using PROWAG under the assumption that those guidelines will eventually become the standard. For example, the city uses 4-ft wide landings. Transportation design standards, which include dimensions for curb ramps, driveway ramps, and sidewalks, are available online (*62*).

CITY OF CHARLOTTE, NORTH CAROLINA

Asset Data Inventory and Condition Assessment Practices

City of Charlotte officials determined that their inventory of pedestrian facilities was not sufficiently accurate or up-to-date. For example, according to one estimate, the city needs about 1,900 mi of new sidewalks. However, city officials are not sure about the accuracy of this estimate. Likewise, the city has approximately 1,900 mi of existing sidewalks, but there is no certainty regarding this value or the condition of the sidewalk infrastructure. To address this situation, the city has started a program to improve the quality and coverage of its inventory of pedestrian facilities. The city has just completed the development of a preliminary data model (Figure 12), which outlines general design characteristics and requirements of the data collection program. The plan is to collect data elements such as sidewalk widths, ramp locations, and ramp surface treatments. The city already inventoried pedestrian signals.

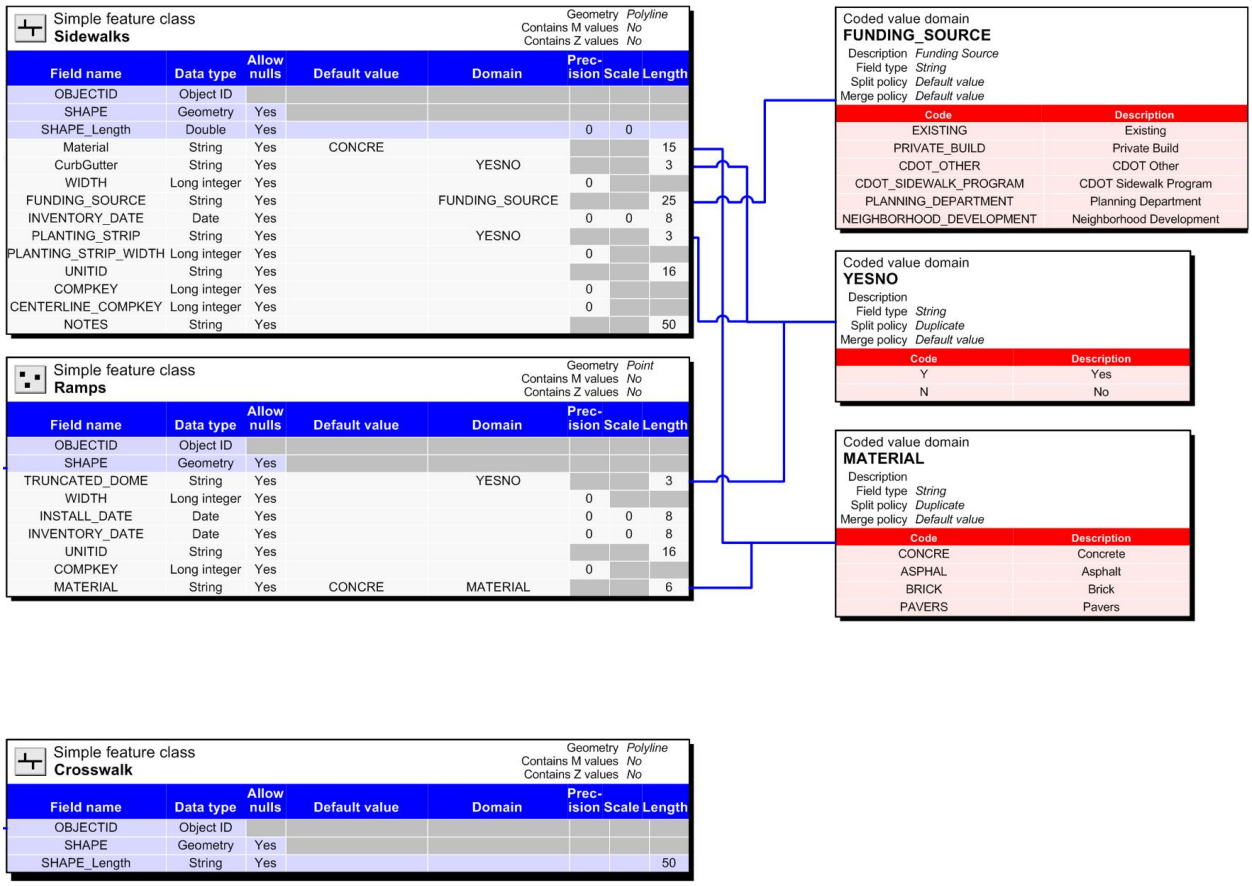


Figure 12. City of Charlotte's Preliminary Data Model (*Courtesy*: City of Charlotte).

The second phase, which should start within the next few months, will involve collecting data at sample locations in the field using two different methodologies: a Segway Human Transporter and orthophotography. Orthophotography has been part of current data collection procedures in the region for years. The city and Mecklenburg County have a program to collect aerial imagery over the entire county approximately every 2 years. Staff has access to ½-ft pixel resolution imagery. In addition to orthophotos (which are available to both government agencies and the public), city officials have access to high-resolution oblique photography to assist in situations where sidewalks are not visible on the orthophotos. This data resource is only available to city officials. The city does not have a video log program to support asset inventory activities.

Programming of Asset Improvements

The City of Charlotte's Sidewalk Retrofit Policy outlines the city's plan to rank, add, and improve pedestrian infrastructure (*63*). The city also has a strategic plan that recommends developing a pedestrian master plan, street design guidelines, a new methodology for pedestrian level of service at controlled intersections, and pedestrian mid-block crossing guidelines. Sidewalk project prioritization uses a variety of criteria, including roadway and pedestrian infrastructure characteristics, connectivity, proximity to activity centers, and funding availability. Table 5 shows the City of Charlotte's sidewalk prioritization categories.

Table 5. City of Charlotte's Sidewalk Prioritization Categories (*63*).

Factor	Tier 1	Tier 2	Tier 3	Tier 4
Functional Class [Average Annual Weekday Traffic (AAWT)]	Thoroughfares (all criteria) [Varies]	Locals and collectors (all criteria) [>3,000]	Locals and collectors near school or park (four criteria) [1,000–3,000]	Locals and collectors (all criteria) [<3,000]
One side/both sides	One or both sides to be determined by staff	One side to be determined by staff	One side to be determined by staff. Staff will also identify critical adjacent streets that comprise the key route network to park or school. The network will be considered one single project.	One side to be determined by design constraints and neighborhood input
Identified by *	Staff	Staff	Staff	Residents and/or property owners
% neighborhood support required to be ranked	None	None	None	25% support of property owners or tenants on both sides of the street maximum of two signatures per lot or dwelling unit)
Public Input	Typically no public meeting	Typically no public meeting	Public information meeting held when project nears top of ranking list; residents given various opportunities to provide feedback regarding design issues, other comments	Public information meeting held when project nears top of ranking list; residents given various opportunities to provide feedback regarding design issues, other comments
Public notification	Both sides of street (4 communications typical-before survey, during design process, real estate notification, construction notification)	Minimum of both sides of the streets and HOA notification (4 communications typical-before survey, during design process, real estate notification, construction notification)	Notify all properties within ¼ mile and HOA (for public meeting and notification of construction)	Prior to public meeting, notify both sides of street of meeting. If subsequent petition submitted meets requirements and project is funded, both sides of street notified. (4 communications typical-before survey, during design process, real estate notification, construction notification)
Ranked by	Staff	Staff	Staff	Staff
Ranking Criteria	All	All	AAWT, Proximity to Park, Proximity to School, School Type	All
% neighborhood support/petition required for construction	N/A	N/A	N/A	A petition requiring at least 60% of all property owners on both sides of street is required (after public meeting). Tenant signatures are not counted as part of this process. 90 days allowed for petition to be completed.
Notes	When ranked highly and funded, moves forward due to safety concerns	When ranked highly and funded, moves forward due to safety concerns	When ranked highly and funded, moves forward due to safety concerns	Constructed within a clearly defined time frame; petition form supplied by city with key details to minimize project misinformation

* Residents may contact staff regarding streets in any tier, however, only the fourth tier has a formal process for citizen requests.

The city adds pedestrian infrastructure through several mechanisms, including a sidewalk program, roadway projects, land development requirements, and state participation. The sidewalk program, which is part of the capital improvement program, operates on a $5 million budget to build sidewalks on existing thoroughfares, collector streets, and local streets. The policy is to add at least 10 mi of new sidewalks every year. The city also participates in the cost of construction of sidewalks identified through the city's Neighborhood Reinvestment Program. The city adds sidewalks on all roadway construction projects within the City of Charlotte. The current plan is to add sidewalks on one side of local and collector streets and on both sides of thoroughfares. In the case of land development, the city's role is to coordinate and regulate the construction of sidewalks. Land developers and/or property owners absorb the cost of construction of sidewalks. The city and the North Carolina Department of Transportation (NCDOT) also have an agreement for the construction of sidewalks on state highways, in which the city and NCDOT share the cost of construction of sidewalks if NCDOT initiates the project. The city absorbs the cost if the city initiates a sidewalk project on a state highway.

In 2007, the city completed the development of the *Urban Street Design Guidelines* as a mechanism to provide information on acceptable, desirable design practices for the urban street design environment, as well as information on how to apply the guidelines and how to use specific design features for different types of streets (*64*). The guidelines include a procedure for the determination of pedestrian and bicycle levels of service at signalized intersections. The guidelines also include information about pedestrian infrastructure requirements.

TUCSON REGION, ARIZONA

Asset Data Inventory and Condition Assessment Practices

The Pima Association of Governments, Tucson region's metropolitan planning organization (MPO), conducted an initial sidewalk inventory in 2003 (*65*). PAG conducted the sidewalk inventory to identify areas with deficient or no sidewalks and to prioritize new sidewalk improvement projects. The Tucson inventory included about 4,000 directional miles of arterial and collector streets and took place over a 10-month period. The inventory also included shared use paths, as most paths are parallel to arterial streets and accommodate pedestrian travel. PAG inventoried sidewalks on a ½-mi to 1-mi road segment or between major intersections. A future phase will include an inventory of local streets to identify neighborhood-scale sidewalk needs.

PAG used a variety of tools to conduct the inventory. First, they used local staff knowledge to identify roads without sidewalks since about 25% of roads are rural roads without basic design elements like curbs and sidewalks. Then they used digital orthophotos in the office to inventory many of the remaining streets in the Tucson region. On some urban streets, the digital orthophotos did not provide a clear view of the sidewalk and roadside area. In these cases, officials checked the Tucson DOT's video log for a better horizontal view. Finally, surveyors went to the field to gather inventory data at obstructed locations and to verify the inventory in certain growth areas. The final step involved importing the data collected into a GIS to assist in future project development and prioritization activities.

PAG classified sidewalk segments in four status categories:

- Sidewalk (Accessible): continuous sidewalk segments on both sides of the road (unless one side is entirely undeveloped) that appear to be accessible for persons with disabilities.

- Sidewalk (Partially Accessible): continuous sidewalk segments on both sides of the road that appear not to be accessible (e.g., because there are no ramps, the sidewalk is too narrow, slopes are too steep, or there are permanent pathway barriers).

- Partial Sidewalk: sidewalk segments for only a portion of the entire length of the roadway segment or only on one side of the roadway with existing development. In these cases, the sidewalk segment is considered not accessible.

- Shared-Use Path: designated asphalt or concrete-paved pathways shared by pedestrians, cyclists, and other non-motorized users. (**Note**: All shared-use paths are considered accessible for persons with disabilities.)

Programming of Asset Improvements

The goal of the PAG inventory effort was to include sidewalk improvements into short-range and long-term transportation plans. To support this goal, PAG staff developed a ranking system to prioritize the sidewalk segments, based on a 100-point scale using nine criteria:

- annual average daily traffic: 10 points
- transit ridership: 10 points
- population density: 10 points
- commercial land use within ¼ mi: 15 points
- schools within 1/3 mi: 15 points
- parks and recreation within ¼ mi: 10 points
- medical within ¼ mi: 10 points
- ADA eligible rider density: 10 points
- local priority/safety: 10 points

Many highly ranked sidewalk projects were funded through an annual capital improvement program. Other sidewalk projects were included in future roadway reconstruction projects.

SACRAMENTO COUNTY, CALIFORNIA

Asset Data Inventory and Condition Assessment Practices

The Sacramento County DOT began developing an ADA transition plan in 2002. The plan only covered the unincorporated areas within Sacramento County, which includes both developed and undeveloped areas with a wide variety of pedestrian infrastructure. The inventory

survey covered about 2,200 mi of streets (11,000 intersections or 45,000 street corners) over a 5-month period.

The inventory involved 23 data collectors. Each surveyor received at least 80 hours of training on equipment, data collection methods, and ADA principles and standards. The main tools used by the surveyors included GIS-enabled PDAs, digital cameras, tape measures, smart levels, clipboards, and notepads. Table 6 summarizes the data collection elements included in the PDAs. For the inventory, the county classified roads into three priority levels (high priority, medium priority, and low priority) based upon several criteria, including functional classification, adjacent land uses, geographic equity, high pedestrian crash locations, and locations with the greatest potential to serve pedestrian travel. More detailed inventory procedures and measurements were used on high priority locations, whereas a simpler survey and visual inspection were used on lower priority locations.

Part of the inventory effort involved combining and resolving conflicts and differences between the national guidelines (at the time it was ADAAG), California state law, and Sacramento County policies and standards.

Programming of Asset Improvements

One of the primary purposes of the sidewalk inventory was to develop a capital improvement program devoted to sidewalk, curb ramp, signal retrofit, and other types of pedestrian improvement projects. The county designed the asset inventory and condition database to facilitate the production of prioritized improvement lists and maps, as well as several types of summary reports.

The county assigned priorities to improvement projects based largely on existing agency policies, as follows:

- **Use Priority A (Public Input Requests)**: requests made by the public for accommodation (also known as public complaints).

- **Use Priority 1 (State and Local Governmental and Public Use)**: areas located within the public right-of-way that abut or serve public and governmental agencies and offices.

- **Use Priority 2 (Public Accommodations)**: areas located within the public right-of-way that abut or serve public accommodations that are privately owned, including hospitals, shopping malls, housing/apartment complexes, and major employment sites.

- **Use Priority 3 (Low-Density Residential and Other Uses)**: areas located within the public right-of-way that abut or serve single-family residential areas, industrial areas, and other areas not falling into the above priority groups.

Within each priority category, the county used a condition priority to rank projects based on the urgency of improvement, as follows:

- **Condition Priority 1**: locations where existing curb ramps have an unsafe condition that may cause a trip and fall. Examples are vertical displacement of the curb ramp, steep side slopes, and deteriorated conditions.

- **Condition Priority 2**: locations where there is no curb ramp to provide accessibility.

- **Condition Priority 3**: locations where a corner has one existing curb ramp and conditions allow for the construction of an additional curb ramp at the same corner, provided that traffic controls allow for a safe path of travel (only applies to intersections on arterial and thoroughfare streets).

- **Condition Priority 4**: locations with difficult physical conditions, such as major utility conflicts, physical barriers, or other constraints, that would create a hardship situation on the entity.

- **Condition Priority 5**: other locations that do not meet current federal and state accessibility standards (i.e., steep slopes, improper landings, and lack of detectable warnings). In general, lower priority is given to locations with elements that are closer to the required values (e.g., the lower the slope, the lower the priority).

Current Sacramento County DOT policy also includes priorities and evaluation criteria based upon pedestrian usage. A point system evaluates criteria such as proximity to facilities for the disabled, proximity to key facilities, density, and access to public transit. The policy also contains mobility evaluation criteria.

Table 6. Sacramento County Data Collection Elements.

Element	Comment
Crosswalks	Whether crosswalks are present at any or all crossings. If present, the width, type, alignment, presence of tactile guidestrips, presence of islands, and disabled access.
Curb Ramps	Whether existing curb ramp(s) are present at any of the corners within the intersection.
Directional Corner of Intersection	NE, SE, SW, and NW. (**Note**: All corners will be referred to by one of these compass points. If the street is not perfectly aligned north and south, the direction will be assigned within the nearest 45 degrees.)
Intersection Geometry	Whether the intersection is standard right angle, T-shaped, Y-shaped, skewed, or any other irregular geometry. Whether there are pedestrian island(s) or right turn lanes.
Islands	If present, then presence of curb ramps and push buttons.
Obstructions and Obstacles	The general presence and nature of abrupt changes in sidewalk level of greater than ½-in., paving obstructions, or accessibility obstacles immediately adjacent to the corner. The following obstacles near a corner will be recorded: utility pole, traffic light pole, drain inlet, fire hydrant, street furniture, and newsstand.
Pedestrian Signals	Whether visual or accessible pedestrian signals are present. If present, the type, size, height, and location of actuator buttons. The location parameters are "at curb," "on landing," "on ramp slope – arm length," and "on ramp slope – not arm length." Another location question asks if the pedestrian push button is parallel to the crosswalk alignment.
Sidewalk Present	Whether a sidewalk leading to and from the curb is present. If present, the paved sidewalk width at the intersection.
Tactile Guidestrips	Whether tactile guidestrips are present at any crosswalk. If present, the location, height, width, and color of the tactile guidestrips.
Traffic Control	Whether traffic signals, stop signs (all way vs. two-way vs. one-way), yield control, roundabout, or no control.
Transit Stop Type	The parameters of the transit stop type are none, light rail, bus, and other.
If a curb ramp is not present at a particular corner, the following data were collected:	
Curb Type	Whether a curb is present, and if present, the type (vertical or rolled).
Flush Corner	If there is no curb, whether a flush transition from the street to the sidewalk is present.
If a curb ramp is present (either one or two at a corner), the following data were collected for each curb ramp:	
Car Obstruction	Curb ramp not located so that it could be obstructed by parked vehicle.
Common Landing	Dimensions of any common landing for two curb ramps.
Curb Ramp Type	A general description of the curb ramp: flared, pan, chute, blended corner, or built-up.
Detectable Warnings/Truncated Domes	Whether truncated domes are present. If present, the dome location, size, type (e.g., plastic, concrete, concrete tile, brick, or other), and color. Truncated domes are placed at level landings to alert visually-impaired individuals of a transition between the sidewalk and the street or railroad tracks.
Grooved Border	Whether a 12-in. grooved border around all sides is present and its width.
Gutter Slope	Slope in percent of the gutter or street transition.
Lip	Whether a lip is present at the bottom of the curb ramp, and if present, the height to the nearest ¼ in.
Location in Crosswalk	Curb ramp wholly contained in marked crosswalk, if applicable.
Main Slope	Main slope of the curb ramp or level landing in percent adjacent to and perpendicular to the street.
Main Cross Slope	Cross slope of the main slope of the curb ramp or level landing, parallel to the street. The cross slope is perpendicular to the main slope of a curb ramp.
Side Slope(s)	Whether a side slope or parallel slope is present, and if present, the slope of each sloping side or flare parallel to the street in percent.
Slip-resistant Surface	Whether or not the surface is slip-resistant.
Street	Street the curb ramp is facing, or if facing the intersection (diagonal).
Top Landing Depth	Whether a 48-in. deep level landing is provided at the top of the curb ramp or at the top of each slope of a parallel curb ramp.
Transition Slope	Slope of the transition to the sidewalk, verifying slope of 5% or less for the right and left sides.
Width	Width of the curb ramp or pan. A pan or level landing exists when there is a lack of vertical separation between the sidewalk and the street.

CHAPTER 5
SUMMARY OF PRACTICES

CONCLUSIONS

The goal of this study was to gather and identify best practices for assessing ADA compliance in three main areas: 1) asset data inventory, 2) asset condition assessment, and 3) asset improvement programming. To achieve this goal, the researchers conducted a literature review of practices, conducted an online survey to assist in the stakeholder identification process, gathered sample documentation, and interviewed officials from a sample of state and local agencies.

A review of the documentation gathered and feedback received led to the following conclusions:

- **The identification of "best practices" depends on the agency context in which the practices are to be implemented**. In other words, one size does not fit all. For example, the researchers identified several agencies that use sophisticated systems to automate and streamline data collection, summary, and presentation of pedestrian infrastructure data. This is a best practice for agencies that have the necessary technical and institutional resources to implement and maintain those systems. In contrast, for agencies with fewer resources, a sophisticated system may quickly overwhelm agency staff and resources. For those agencies, a relatively simple paper-based or PDA-based approach would be a best practice.

  Closely related to this observation is the realization that existing laws and regulations provide considerable flexibility regarding the identification of physical obstacles that limit accessibility to individuals with disabilities. In other words, the standard for what constitutes acceptable practice (and, by extension, what could become a best practice) regarding data collection, condition assessment, and programming of needed improvements varies considerably and is subject to interpretation. For example, 28 CFR 35 Part 150(d) focuses on the requirement to include a schedule for curb ramps in transition plans, which could be interpreted as meaning that transportation agencies should focus on curb ramps first, both for inventory and for improvement programming purposes. At the same time, the regulation also includes the requirement for transition plans to identify physical obstacles that limit accessibility to individuals with disabilities, but it does not say that the inventory should be comprehensive from the beginning. This flexibility enables agencies to develop data collection, assessment, and improvement programming initiatives in a way that fits their current capabilities and limitations.

- **The study identified a few data collection strategies and programs worth noting**:

  - *Using existing aerial photos or agency video logs as a screening tool and to focus resources.* Several agencies used aerial photos or video logs to identify the presence or absence of sidewalks, as well as to identify those streets/sidewalks on which additional field data collection was required.

- *Developing user-friendly data collection forms or input screens*. In addition to training data collection personnel, having easy-to-use, understandable forms will improve the quality and consistency of asset inventory and condition data. This report documented several examples of user-friendly forms that can be used as-is or modified to suit specific agency needs.
- *Using PDA-based tools to automate information workflow*. Several agencies have used PDA-based tools to increase data collection efficiency and reduce data collection and transcription errors. In many cases, these tools allow the data collector to specify the location of interest (e.g., based on the agency's linear referencing system, by clicking a point on a background orthophoto image, or by using a GPS-enabled PDA) and then go through various checklists with drop-down menus (which are preferable and more efficient than simple text boxes). These PDA-based tools will have a clearer advantage in locations with extensive pedestrian infrastructure to inventory.
- *Involve the agency's information technology group in designing data collection activities to ensure appropriate integration with other existing systems at the agency*. Although it may be tempting to bypass this group to expedite data collection, the end result may be another "stovepipe" database that cannot easily be incorporated into standard agency practices and procedures. In particular, the use of formal data models and database and system design protocols is critical in order to ensure robust, scalable applications.

- **Having observers with adequate ADA training collect sufficient data and assess accessibility compliance levels in the field is a best practice**. The complex nature of standards and requirements related to accessibility is such that trained observers viewing a particular site directly will typically be in the best position to assess accessibility compliance levels. In some cases, it may be necessary to review additional documentation later in the office. However, several agencies indicated it was more difficult to assess compliance later in the office when reviewing hand-written field notes, digital photographs, or other electronic data.

  Using properly trained personnel is also a critical requirement for quality purposes. In general, relying on personnel without proper ADA training who, in addition, do not understand or share the requirements, objectives, procedures, and expected outcomes of the data collection effort tends to have a detrimental effect on the quality of the finished product. Properly trained personnel are particularly critical in situations where the data elements being collected in the field are relatively simple, making the accessibility compliance determination "on the fly" critical.

  Efforts such as those at the City of Bellevue, Washington, that rely on the collection of large datasets at extremely fine spatial and temporal disaggregation levels have the potential to significantly automate the identification of non-compliant locations in the field. For such data collection approaches to fulfill their potential, it would be necessary to develop algorithms and procedures that aggregate the data at manageable levels. Those algorithms and procedures could be used at the office while post-processing the

raw field data. However, they could also be used to enable the detection of out-of-compliance situations "on the fly," (i.e., while the data collection is taking place).

- **Integrating ADA requirements into the project development and delivery process is a best practice**. For example, one of the state DOTs interviewed indicated that they did not have a formal "transition plan" document, yet they believe they have met the full intent of ADA by integrating ADA requirements and standards throughout their project development process and delivery, from initial concept and scoping to final design to construction inspection. This same agency has been proactive about implementing ADA requirements since the early 1990s by training their employees, regularly updating their procedures, and participating in the development of guidelines for implementing ADA in the public right-of-way. At another agency, updates are underway to all of their project development guides to ensure that ADA requirements are adequately addressed.

  Best practices involving the integration of ADA requirements into the project development and delivery process include the following:

  - *Ensure that ADA requirements and standards are fully integrated into all of the agency's policy, planning, and design handbooks or manuals.*
  - *Ensure that all district planning and engineering staff (and not just an ADA coordinator) have the required training.* Because of evolving ADA standards and employee turnover, periodic offerings of training will be necessary.
  - *Ensure that ADA improvements can be funded through a variety of funding programs/sources.* For example, nearly all agencies surveyed made ADA improvements through standard construction/reconstruction projects. For relatively small improvement needs, most agencies used a maintenance budget. In other cases, if an improvement need could not be included in a maintenance budget and there was an active construction project, several agencies budgeted a separate and distinct funding category specifically for ADA improvements.

- **Prioritizing inventory and improvement programming resources to focus on the most critical locations is a best practice**. Many agencies used a priority ranking system for their inventory data collection as well as their capital improvement programming. The priority ranking systems were typically based on importance (e.g., functional class of the roadway), adjacent land uses (e.g., public versus private facilities, high versus low pedestrian traffic), and the urgency of the improvement based on its condition. In some cases, the inventory process factored the priority ranking by collecting the most detailed and comprehensive data on high-priority road segments, while at the same time collecting simpler or less detailed data on lower-priority road segments.

- **Designing inventory data collection programs and data archival systems to support improvement programming activities is a best practice**. The primary goal of an inventory effort to support the ADA compliance process is to enable the development of a prioritized list of improvement projects that can be incorporated into agency programs and budgets. GIS tools can be very helpful for determining priorities for improvements and displaying the corresponding locations on a variety of mapping interfaces.

At the same time, agencies should not lose sight of the fact that data collection efforts require the use of valuable, scarce resources. As a result, while addressing ADA requirements is a fundamental objective, a best practice would involve incorporating appropriate integration points with other data collection efforts and systems at the agency or region to ensure a more cost-effective, enterprise-wide use of resources. Ignoring those integration points can result in redundant data collection efforts, incur additional costs and implementation delays, and contribute to the perpetuation of stovepipe systems that do not enable effective data exchange and management.

From this perspective, structuring pedestrian infrastructure inventory databases purely as a mechanism to identify improvement needs can have the unintended effect of producing databases that only show locations where there are improvement needs at a specific point in time. Such databases tend to decrease in size over time and have a limited long-term value for asset management purposes. Under these conditions, it would be preferable to implement asset data collection programs that capture data about all assets, *including* those with ADA improvement needs to ensure that both general asset management requirements *and* accessibility compliance inventory requirements are met. The resulting inventory data collection and management system would enable agencies to incorporate asset updates (e.g., after building or re-building sidewalks or after collecting new or more detailed inventory) into the system.

- **Developing user-friendly web sites that provide comprehensive information is a best practice**. The researchers identified a few cases where the agency's website provided adequate information about laws and regulations, asset inventory activities, long-term and short-term projects, funding initiatives, complaint procedures, and community outreach. Such strategies help the agency to fulfill its mission and facilitate the development and implementation of programs as well as the interaction with the appropriate stakeholders.

INVENTORY ELEMENTS TO ADDRESS ACCESSIBILITY REQUIREMENTS

From the review of practice, the researchers compiled an extensive listing of asset inventory and condition data elements (see below). The listing is intended as a preliminary menu that agencies could use as a foundation to develop inventory programs that meet individual agency needs. **Note**: An actual inventory program would logically include formal user need and data modeling phases to characterize data elements more precisely.

General Survey Data

- Surveyor name(s)
- Survey date
- Survey/intersection location
    - District, county, city, street name, and nearest cross street
    - Agency linear referencing identifier

    - Coordinates
- Construction/alteration date: before 1/26/1992, after 1/26/1992
- Adjacent property/land use description
- Intersection geometry description: standard right angle, T-shaped, Y-shaped, skewed, other irregular geometry
- Traffic control: traffic signals, stop signs (all-way, two-way, one-way), yield control, roundabout, or no control
- Transit stop present, and if so, type: light rail, bus, none

Pedestrian Signal and Actuator Button Data

- Type of pedestrian signal: visual or accessible
- Is actuator button accessible from sidewalk or ramp? reach distance to button?
- Is actuator button parallel to crosswalk alignment?
- Type/manufacturer/model of actuator button
- Location of actuator button: at curb, on landing, or ramp slope-arm length, on ramp slope-not arm length
- Size/diameter of button (>2 in.)
- Height of button (<42 in.)
- Clear level landing at button (30 x 48 in.)

Sidewalk Data

- Is route of travel stable, firm, and slip-resistant, even when wet?
- Is the route at least 36 in. wide and clear of obstructions?
    - Route can be as narrow as 32 in. at a point not exceeding 24 in. wide, such as a utility pole, etc.
- Does the path of travel have a cross slope of 1:50 (2%) or less?
- Are level changes ¼-in. high or less, or if beveled edge, no more than ½-in. high?
    - Up to ¼-in. change in level vertical
    - ¼ in. to ½ in. requires 1:2 slope (maximum)
    - Greater than ½ in. requires 1:12 slope
- Can objects protruding into the circulation paths be detected by a person with a visual disability using a cane?
    - In order to be detected using a cane, an object must be within 27 in. of the ground. Objects hanging or mounted overhead must be higher than 80 in. to provide clear head room. Objects that protrude less than 12 in. from a post may remain.

Curb Ramp Data

- Location
    - Directional corner of intersection: NE, SE, SW, NW

    - Coordinates
    - Corner refuge island
    - Median refuge island
- Are curb ramp(s) present at this corner? If so, describe type: diagonal (corner), perpendicular, flared, pan, chute, blended corner, built-up, other.
- If no curb ramps are present at the corner:
    - Is a sidewalk present?
    - Is a pedestrian path present?
    - Is a curb cut present?
    - Is a curb present? If so, type: vertical, rolled
    - If there is no curb present, is there a flush transition from the sidewalk to the street?
- Can curb ramp be blocked by a legally parked vehicle?
- If type is a built-up curb ramp from street to sidewalk, is it outside the path of vehicles?
- Is the surface of the curb ramp slip resistant?
- Is a marked crosswalk present? If so, what is the width?
- If a marked crosswalk is present, does the curb ramp land in marked crosswalk?
- Detectable warning surfaces
    - Type and material: truncated domes, grooves, plastic, concrete, concrete tile, brick, other
    - Location with respect to ramp
    - Width (specify dimensions and whether full width) and depth of detectable warning surface
    - Truncated dome size and spacing: 0.2 in. (height), 0.9 in. to 1.4 in. (diameter), and 1.6 in. to 2.4 in. (center-to-center spacing)
    - Color: does detectable warning have an acceptable contrasting color?
- Curb ramp dimensions and slopes
    - Width, not including flared sides (3 ft minimum)
    - Running slope (8.33% or less)
    - Cross slope (2% or less)
    - Gutter slope (5% or less)
    - Flush transitions at sidewalk and gutter? (record the height of any level changes)
    - Top landing depth (36 in. minimum)
- If the curb ramp has flared sides:
    - If the top landing depth is 48 in. deep or more, is the slope of the flared sides 10% or less?
    - If the top landing depth is less than 48 in., is the slope of the flared sides 8.33% or less?
- If the curb ramp does not have flared sides, is there an obstruction or grass that discourages pedestrians from traveling across the curb ramp?
- If the curb ramp is a corner type, is the bottom landing at least 48 in. long and contained in the crosswalk?
- Are obstacles or obstructions present near the curb ramp? If so, describe/sketch type and location: traffic signal/utility pole, drain inlet, fire hydrant, street furniture, other.

Ramp Data (for grades along accessible routes)

- Are the slopes of ramps no greater than 1:12?
- Do all ramps longer than 6 ft have railings on both sides?
- Are railings sturdy, and between 34 in. and 38 in. high?
- Is the width between railings or curbs at least 36 in.?
- Are ramps slip-resistant?
- Is there a 5-ft-long level landing at every 30-ft horizontal length of ramp, at the top and bottom of ramps, and at switchbacks?
- Does the ramp rise no more than 30 in. between landings?

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ABBREVIATIONS, ACRONYMS, INITIALISMS, AND SYMBOLS

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines
APBP	Association of Pedestrian and Bicycle Professionals
ANSI	American National Standards Institute
APS	Accessible Pedestrian Signal
CFR	Code of Federal Regulations
CSJ	Control Section Job
CTP	Consolidated Transportation Program
DLCD	Department of Land Conservation and Development
DMI	Distance Measuring Instrument
DOT	Department of Transportation
ESRI	Environmental Systems Research Institute
FAC	Florida Accessibility Code
FBC	Florida Building Code
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
GASB	Governmental Accounting Standards Board
GIS	Geographic Information System
GPS	Global Positioning System
ITE	Institute of Transportation Engineers
LIDAR	Light Detection and Ranging
MDSHA	Maryland State Highway Administration
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NPRM	Notice of Proposed Rulemaking
ODOT	Oregon Department of Transportation
PAG	Pima Association of Governments
PBIC	Pedestrian and Bicycle Information Center
PDA	Personal Digital Assistant
PROWAAC	Public-Right-of-Way Access Advisory Committee
PROWAG	Public Rights-of-Way Accessibility Guidelines
RSA	Road Safety Audit
SWAP	Sidewalk Assessment Process
TAS	Texas Accessibility Standards
TDLR	Texas Department of Licensing and Regulation
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
UFAS	Uniform Federal Accessibility Standards
UGB	Urban Growth Boundary
ULIP	Ultra-Light, Slow-Speed Inertial Profiler

UTAP	Universal Trail Assessment Process

APPENDIX
SURVEY FORM AND AMPLIFYING QUESTIONS

ONLINE SURVEY FORM

NCHRP 20-07, Task 249 "Asset Management Approaches to ADA Compliance"

Introduction

The Texas Transportation Institute (TTI) is conducting a study for the National Cooperative Highway Research Program (NCHRP) to gather information about approaches transportation agencies are using to address Americans with Disabilities Act (ADA) compliance requirements, with the primary objective being to share best practices among stakeholders. The focus of the project (NCHRP 20-07, Task 249 "Asset Management Approaches to ADA Compliance") is on innovative practices and strategies related to asset data inventory, asset condition assessment, and programming of asset improvements.

We are requesting your participation in our data gathering process. To achieve this objective, we have prepared a short questionnaire that you can complete online on this web site. The purpose of the questionnaire is to gather basic information about the use of asset management techniques to address ADA compliance needs and requirements. As part of the questionnaire, we are also asking you to identify any other agencies at the local, regional, state, or national level that are involved with pedestrian infrastructure facilities and that are leaders or innovators in this field. Our goal is to follow up with a selected group of stakeholders to learn and discuss about lessons learned, best practices, documentation of practices, and data inventory details. To the extent possible, we will be requesting available documentation. We anticipate that all communications with the group of stakeholders will be by phone and email.

Note: You may have heard about a related project (NCHRP 20-07, Task 232 "Development of a Guide to Update ADA Transition Plans"). As a part of this project, the consulting team (Jacobs Engineering) will be contacting state department of transportation (DOT) officials for information. While Tasks 232 and 249 share some common elements, Task 249 is very specific and focuses on data inventory and asset management issues. By comparison, Task 232 is much broader in scope and addresses the entire ADA transition plan process.

For additional information about Task 249, please contact Cesar Quiroga (c-quiroga@tamu.edu, 210-731-9938) or Shawn Turner (shawn-turner@tamu.edu, 979-845-8829).

Thank you very much for your participation in this project.

Contact Information

Name:

Department/Division:

Agency:

Phone Number:

Email Address:

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For additional information about NCHRP 20-07, Task 249, please contact Cesar Quiroga (c-quiroga@tamu.edu, 210-731-9938) or Shawn Turner (shawn-turner@tamu.edu, 979-845-8829).

* Note: If you choose at any point not to continue this survey, you may close your browser. None of the responses that you entered will be retained.

NCHRP 20-07, Task 249 "Asset Management Approaches to ADA Compliance"

Basic Information

Does your agency inventory pedestrian infrastructure, either as a standalone initiative or as part of a larger asset management program?

◯ Yes ◯ No ◯ N/A

If yes, which pedestrian infrastructure types does your agency inventory?

- ☐ Sidewalks
- ☐ Curb ramps
- ☐ Crossings
- ☐ Pedestrian signals
- ☐ Signs
- ☐ Transit facilities in the right of way
- ☐ Medians
- ☐ Refuge islands
- ☐ Other

What pedestrian infrastructure attributes does your agency inventory?

- ☐ Grade
- ☐ Cross slope
- ☐ Changes in grade and cross slope
- ☐ Sidewalk/ramp width
- ☐ Horizontal clearance
- ☐ Vertical clearance
- ☐ Obstacles
- ☐ Detectable warnings
- ☐ Pedestrian push button characteristics
- ☐ Texture
- ☐ Color
- ☐ Material
- ☐ Condition
- ☐ Deficiencies
- ☐ Other

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NCHRP 20-07, Task 249 "Asset Management Approaches to ADA Compliance"

Basic Information Cont'd

What tools does your agency use to support the inventory?

- ☐ Clipboards
- ☐ PDAs
- ☐ Digital cameras
- ☐ Low-end GPS receivers
- ☐ Mapping-level (1 m) GPS receivers
- ☐ Survey-level GPS receivers
- ☐ Measuring wheel
- ☐ Inclinometer
- ☐ Profile gauge
- ☐ Video logs
- ☐ Aerial photography
- ☐ GIS
- ☐ CAD
- ☐ Relational databases
- ☐ Other

Is your agency involved in the funding and programming of pedestrian infrastructure facilities?

○ Yes ○ No ○ N/A

Does your agency plan/design/construct pedestrian infrastructure facilities?

○ Yes ○ No ○ N/A

If yes, what design guidelines/tools does your agency use:

- ☐ ADA Accessibility Guidelines (ADAAG)
- ☐ Public Rights-of-Way Accessibility Guidelines (PROWAG)
- ☐ Agency standards and specifications
- ☐ Local/regional/national standards and specifications
- ☐ Other

Does your agency measure ADA compliance of pedestrian infrastructure facilities?

○ Yes ○ No ○ N/A

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NCHRP 20-07, Task 249 "Asset Management Approaches to ADA Compliance"

Basic Information Cont'd 2

Does your agency have an ADA Transition Plan in place?

◯ Yes ◯ No ◯ N/A

Does your agency participate in the development of ADA standards?

◯ Yes ◯ No ◯ N/A

Do you know of any other local/regional/national agencies that are involved with pedestrian infrastructure facilities and that are leaders or innovators in this field?

◯ Yes ◯ No ◯ N/A

If yes, please provide contact information:

Name

Department/Division

Agency

Phone Number

Email Address

Name

Department/Division

Agency

Phone Number

Email Address

May we contact you at a later date for additional information?

◯ Yes ◯ No ◯ N/A

If yes, please click **here** to download a PDF copy of the amplifying questions we will use during the discussion with stakeholders by phone and/or email.

General Comments:

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For additional information about NCHRP 20-07, Task 249, please contact Cesar Quiroga (c-quiroga@tamu.edu, 210-731-9938) or Shawn Turner (shawn-turner@tamu.edu, 979-845-8829).

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AMPLIFYING QUESTIONS

Introduction

The Texas Transportation Institute (TTI) is conducting a study for the National Cooperative Highway Research Program (NCHRP) to gather information about approaches transportation agencies are using to address Americans with Disabilities Act (ADA) compliance requirements, with the primary objective being to share best practices among stakeholders. The focus of the project (NCHRP 20-07, Task 249 "Asset Management Approaches to ADA Compliance") is on innovative practices and strategies related to asset data inventory, asset condition assessment, and programming of asset improvements.

One of the activities in our research is to contact a selected group of stakeholders to learn about and discuss lessons learned and best practices that could be shared with the rest of the transportation community. We anticipate that all communication with each stakeholder will be by phone and email. To assist in this process, we have prepared a series of amplifying questions that we will use as a reference for the discussion.

For additional information about this project, please contact Cesar Quiroga (c-quiroga@tamu.edu, 210-731-9938) or Shawn Turner (s-turner@tamu.edu, 979-845-8829).

Questions

A. Asset Data Inventory Practices

A.1. Please describe the process and criteria to inventory pedestrian infrastructure facilities at your agency, including planning, frequency, costs, and quality control/quality assurance.

A.2. What forms does your agency use to inventory pedestrian facilities?

A.3. What is the experience of your agency with FHWA guidelines and practices to conduct pedestrian facility inventories?

A.4. What tools (including hardware and software) does your agency use to support data collection, data processing, and data storing?

A.5. Please describe coordination and integration with other databases (e.g., asset, project, document, features) at your agency.

A.6. What future inventory activities is your agency planning?

A.7. Please describe challenges and solution approaches for implementing pedestrian infrastructure inventory programs.

A.8. What techniques (including determination of benefits and costs) has your agency implemented to measure the effectiveness of the pedestrian infrastructure inventory program?

A.9. Does your agency use pedestrian infrastructure data to assist in financial reporting requirements [e.g., Governmental Accounting Standards Board (GASB)]?

A.10. Could you provide sample data and documentation to help us develop a better understanding of your current asset data inventory practices?

B. Asset Condition Assessment Practices

B.1. Please describe the process (including funding, programming, schedule, and cost) to measure the condition of pedestrian infrastructure at your agency.

B.2. What performance measures, standard condition rating, and criteria for evaluation does your agency use to assess the condition of the pedestrian infrastructure?

B.3. What statistical analysis techniques and historical data does your agency use to support asset condition assessments?

B.4. Does your agency use construction inspection reports to provide feedback to the inventory and condition assessment process?

B.5. What maintenance programs and schedules are in place to address pedestrian infrastructure maintenance needs?

C. Programming of Asset Improvements

C.1. Please describe how the long-range transportation planning process, including funding and programming, at your agency/region addresses ADA requirements.

C.2. Describe current public participation practices and programs at your agency to communicate pedestrian infrastructure inventory, needs, and plans to the public.

C.3. Please describe the process and criteria to prioritize ADA-related improvement needs.

C.4. What levels of coordination does your agency have in place to integrate pedestrian infrastructure requirements into the project development process (including schematic design, design, and cost estimates)?

C.5. Please describe how your agency uses design guidelines/tools such as ADA Accessibility Guidelines (ADAAG), Public Rights-of-Way Accessibility Guidelines (PROWAG), and local/regional/national standards and specifications to support the development of pedestrian facilities.

C.6. Please describe challenges and solution approaches for implementing pedestrian infrastructure improvements.

C.7. Describe methodologies and techniques your agency uses to measure costs and benefits associated with the implementation of pedestrian infrastructure improvements.