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OTREC

FINAL REPORT

**OREGON
TRANSPORTATION
RESEARCH AND
EDUCATION CONSORTIUM**

Active Transportation, Neighborhood Planning and Participatory GIS (Geographic Information System)

**OTREC-TT-08-02
September 2008**

A National University Transportation Center sponsored by the U.S. Department
of Transportation's Research and Innovative Technology Administration

ACTIVE TRANSPORTATION, NEIGHBORHOOD PLANNING AND PARTICIPATORY GIS (GEOGRAPHIC INFORMATION SYSTEM)

Final Report

OTREC-TT-08-02

by

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OTREC

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16. Abstract <p>Research on walking, the built environment, and healthy communities is a fairly recent area of inquiry, accelerated over the last ten years by an increased interest in the relationship between urban form and public health. A series of macro-oriented logic models and micro-focused data collection tools have been developed over this time in order to understand this healthy communities issue, as well as operationalize the hypotheses around the connection between the built environment and physical activity.</p> <p>None of these efforts, however, attempt to connect their assessment frameworks and tools with a public involvement process. The last ten years has also seen the development of a concentration of work known as Public Participation GIS (PPGIS), which aims to combine the spatial sophistication of GIS with expanded public access to the tools and data linked with GIS technology.</p> <p>This project advances this area of research and technology transfer in two ways. First, four new built environment audit tools using Mobile GIS technology have been developed with a focus on a community approach toward data gathering and usage. These tools include the School Environment Assessment Tool (SEAT), the Complete Streets Assessment Tool (CSAT), the Accessibility Audit Tool (AAT), and the Bicycle Assessment & Safety Index Tool (BASIT). Secondly, these tools have been tested with several communities across the country and have include non-technical, general members of the public interested in healthy communities and active transportation. The tools have been refined after each community workshop and two of the tools, SEAT and CSAT, are ready for a more robust national distribution.</p> <p>The work delineated in the following report pages progresses our understanding of community-based, participatory GIS tools that combine public involvement with technologically advanced tools for assessments of the active transportation environment.</p>			
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DISCLAIMER

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EXECUTIVE SUMMARY

Research on walking, the built environment, and healthy communities is a fairly recent area of inquiry, accelerated over the last ten years by an increased interest in the relationship between urban form and public health. A series of macro-oriented logic models and micro-focused data collection tools have been developed over this time in order to understand this healthy communities issue, as well as operationalize the hypotheses around the connection between the built environment and physical activity.

None of these efforts, however, attempt to connect their assessment frameworks and tools with a public involvement process. The last decade has given rise to the development of the Public Participation Geography Information System (PPGIS), which aims to combine the spatial sophistication of GIS technology with expanded public access.

This project advances this area of research and technology transfer in two ways. First, four new built environment audit tools using Mobile GIS technology have been developed with a focus on a community approach toward data gathering and usage. These tools include the School Environment Assessment Tool (SEAT), the Complete Streets Assessment Tool (CSAT), the Accessibility Audit Tool (AAT), and the Bicycle Assessment & Safety Index Tool (BASIT). Secondly, these tools have been tested within several communities across the country and have included non-technical, general members of the public interested in healthy communities and active transportation. The tools have been refined after each community workshop and two of the tools, SEAT and CSAT, are ready for a more robust national distribution.

The work delineated in the following report progresses the understanding of community-based, participatory GIS tools that combine public involvement with technologically advanced tools for assessments of the active transportation environment.

1.0 BACKGROUND

Research on walking, the built environment, and healthy communities is a fairly recent area of inquiry, accelerated over the last ten years by an increased interest in the relationship between urban form and public health (National Research Council (U.S.) Transportation Research Board and Institute of Medicine (U.S.) 2005). As the research has progressed, so has the interest in developing ways to collect data at a very fine scale – in essence, to be able to collect data at the streetscape level and link this data to active transportation behavior (Schlossberg 2007; Schlossberg, Agrawal et al. 2007).

In theory, such tools would allow planners to better understand the relationship between specific characteristics of the built environment and their relationship to either overall walking within an area or preferences for walking along one route or another. Once this relationship between the walking environment and walking behavior is established, specific recommendations to policy makers, planners, transportation officials, and other decision makers could be made to improve conditions for walking.

On the conceptual side, Moudon and Lee (2003) have focused their work on developing a framework for measuring walkability in order to help direct future research efforts. Their framework is called the Behavioral Model of Environments (BME), which seeks to account for personal, physical, and internal response factors that may explain the connection between an individual pedestrian and their walking environment.

McMillan (2005) provides an alternative framework on pedestrian accessibility, focusing more specifically on children and their journey to school. In addition to the urban form of an area, McMillan realized that a set of mediating and moderating factors also influence the decision to walk. Mediating factors include neighborhood and traffic safety, as well as household characteristics such as the availability of automobiles at home and the distance between home and school. Moderating factors include parental attitudes, social or cultural norms, and sociodemographic characteristics (McMillan 2005). McMillan's research points to the opportunity for public involvement in the evaluation of pedestrian environments to ascertain when transportation engineering interventions may be appropriate and where more programmatic efforts like walking school busses may help increase pedestrian activity.

In terms of specific data collection tools for micro-scaled pedestrian data, perhaps the best known and utilized is an environmental audit instruments called SPACES, a comprehensive tool that helps inventory the characteristics of and along a roadway segment (Pikora, Giles-Corti et al. 2003). The authors categorize different factors of a walking environment into five classifications: 1) functional (physical attributes of the street); 2) safety (characteristics of a safe environment); 3) aesthetic (elements such as trees or gardens); 4) destination (relationship of neighborhood services to residences); and subjective.

Clifton and Livi (2005) built on the SPACES tool for their instrument called the Pedestrian Environment Data Scan (PEDS) audit tool, which includes 78 measures of streetscape characteristics that other research has shown to influence walkability. Clifton and Livi have also studied the inter-rater reliability of the instrument and have found relatively high reliability scores for many of the questions contained within the audit instrument. An additional contributor to the development of these detailed walkability assessments is Ewing, Handy, et. al (2006), who have utilized input from urban design professionals to develop operational definitions of the built environment relevant to pedestrians and translated those definitions into a field survey instrument.

At the same time these research tools were developed, a series of other walkability assessment tools were created by advocacy organizations shared through different online resources such as the Pedestrian and Bicycle Information Center (PBIC), the Center for Neighborhood Technology (CNT), and the Active Living Resource Center (ALRC). These tools are often less technical in nature (such as simple check lists) and are designed to be used by community groups and a general citizenry interested in assessing and improving their local area for pedestrian travel. But what they gain in simplicity and wider accessibility, they often lose in the potential of a GIS-based spatial analysis.

None of these efforts, however, attempt to connect their assessment frameworks and tools with a public involvement process. The last decade has given rise to the development of Public Participation GIS (PPGIS), which aims to combine the spatial sophistication of GIS technology with expanded public access (Weiner, Harris et al. 2001; Tulloch 2003). Although in many self-identified PPGIS projects it is rarely clear exactly who the public is and how they are to participate (Schlossberg and Shuford 2003), the potential exists to combine the sophistication of GIS with local community knowledge and participation.

Public participation and the use of GIS is a complex endeavor (Schlossberg and Shuford 2003), yet the marriage of the two concepts can be powerful in relation to pedestrian and bicycle travel in that a cultural shift - as well as an adequate infrastructure - may be necessary to increase the number of active transportation trips taken. Public involvement can help aid in that cultural shift, especially if the public is responsible for the evaluation and planning of its local pedestrian infrastructure.

This project advances this area of research in two ways. First, new built environment audit tools have been developed with a focus on a community approach toward data gathering and usage. Second, the tools have been tested, with some initial evaluation, within several communities across the country. This work further progresses our understanding of community-based, participatory GIS tools that combine public involvement with technologically advanced tools for assessments of the active transportation environment.

2.0 PROJECT OBJECTIVES & RESULTS

2.1 TOOL OBJECTIVES

There were three key objectives of this project:

- 1) To develop and test a series of GIS-based active transportation assessment tools that can be utilized in a public involvement forum where data gathering, data synthesizing, and basic map production can be carried out with minimal training and minimal need for an outside technician.
- 2) To utilize these tools in community forums across the country and observe the effectiveness of these participatory GIS approaches to transportation planning at the local scale.
- 3) To package these tools into self-contained applications for distribution to communities throughout the country.

Each objective is discussed in more depth below.

2.2 OBJECTIVE 1: TOOL DEVELOPMENT

In order to assess the variety of elements that comprise a local transportation environment, a series of built environment audit tools were developed using GIS and PDA platform. To be effective and accessible in a public participation approach, the tools had to be easy to use but robust in their approach.

Four tools have been developed and tested (to varying degrees):

- School Environment Assessment Tool (SEAT) – This tool responds to Safe Routes to School, a national initiative that works to increase the number of children who walk and bike to school.
- Complete Streets Assessment Tool (CSAT) – This is the first national audit tool focusing on the emerging concept of Complete Streets.
- Accessibility Audit Tool (AAT) – This tool focuses on issues connected to accessibility and the Americans with Disabilities Act.
- BASIT – This tool focuses on the bicycle environment and assists with route identification.

2.2.1 School Environment Assessment Tool (SEAT) & Complete Streets Assessment Tool (CSAT)

The School Environment Assessment Tool (SEAT) and the Complete Streets Assessment Tool (CSAT) underwent the most testing and revisions during this project and, as such, are nearly finalized and ready for national distribution and use with minimal additional customization. As with all the tools, these two work on a Personal Digital Assistant (PDA) running ArcPad GIS software, which integrates seamlessly with ArcGIS, the standard GIS software that municipalities across the United States use. Users simply load a project that contains streets, intersections, and possibly some reference landmarks, such as parks or an aerial photograph (although the use of aerial photography was found not to be necessary). Once the map is loaded, a user simply taps on the appropriate street segment or intersection and completes the data entry form that automatically appears (see Figure 1).

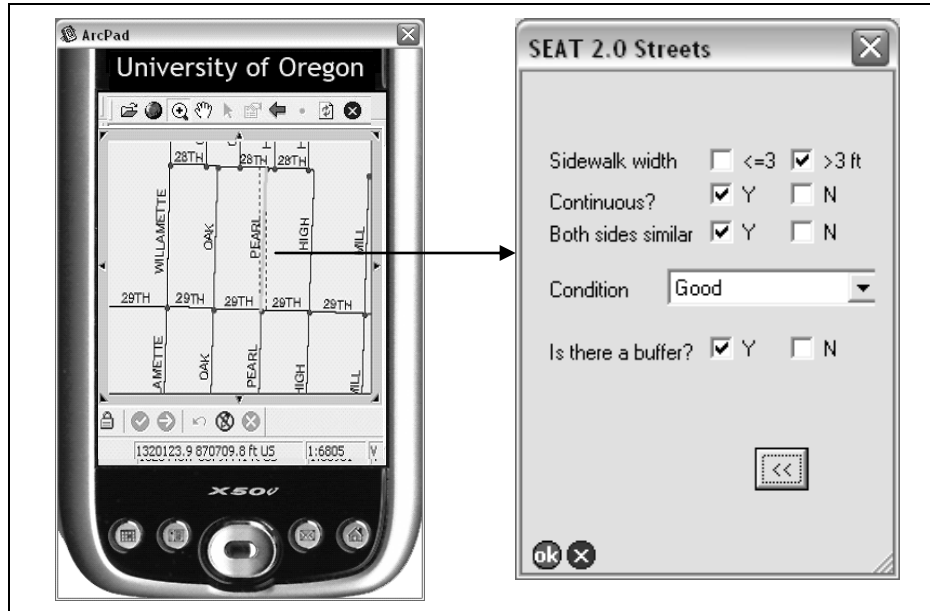


Figure 1: GIS Data Entry on a Personal Digital Assistant (PDA)

Separate audit questions are directed at streets and intersections since a pedestrian or cyclist's experience walking along a street is much different than crossing one (similar to other modes, but perhaps more exaggerated due to the disproportionate safety consequences of pedestrian/bike conflicts with vehicles).

Assessing street blocks and intersections individually and in the field can be quite time intensive, so both the SEAT and CSAT tools can customize data collection based on street type because functions and characteristics of the transportation network differ by location. For example, when evaluating the conditions along an arterial road there will be many more attributes to collect than when collecting characteristics along a neighborhood road. The variations of condition, interaction with vehicles, and mixes of land use are simply greater along arterials, and it would

be a waste of time and energy to collect arterial-relevant variables while assessing less busy environments (see Figure 2).

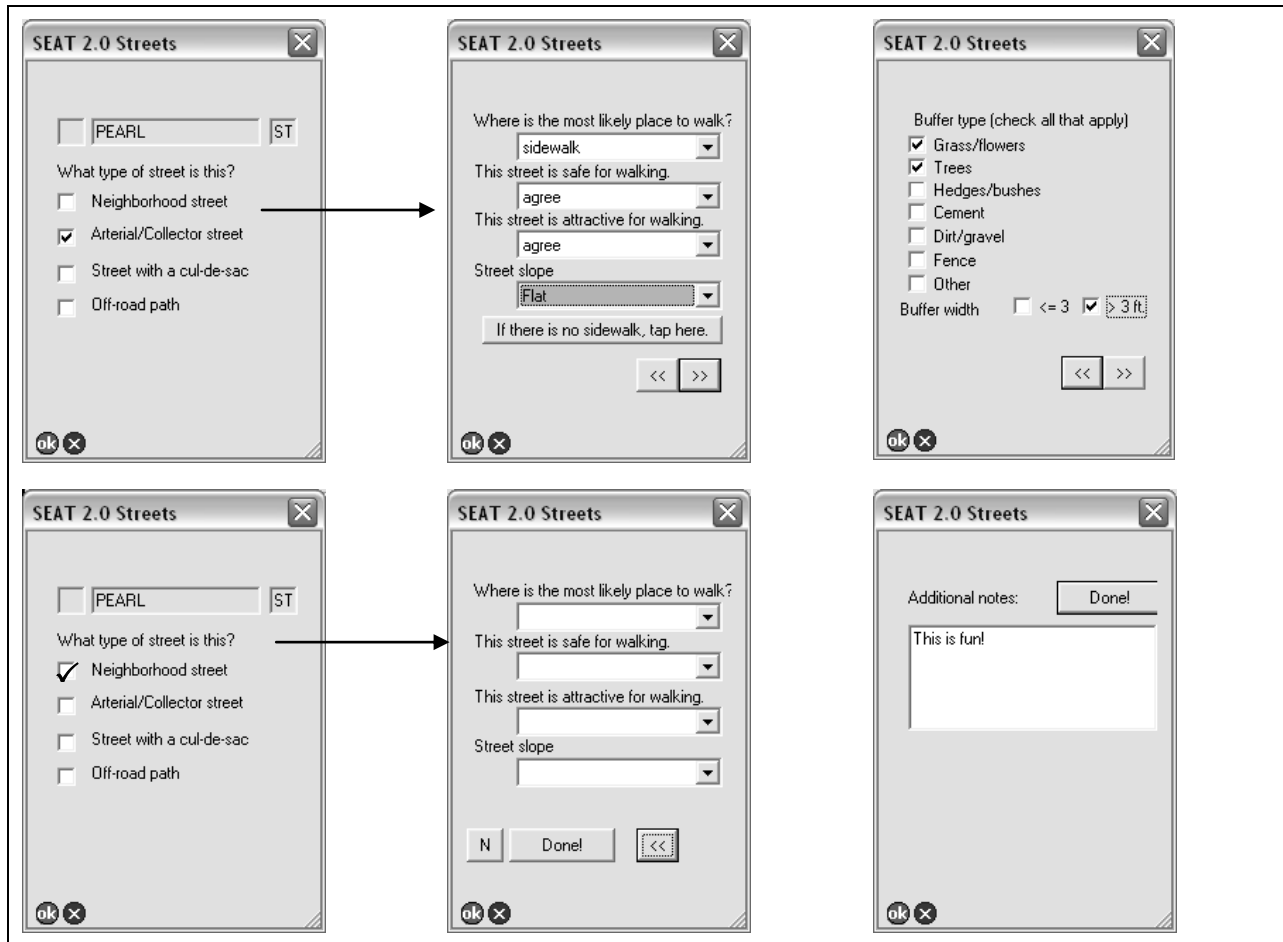


Figure 2: Sample SEAT Data Entry Forms by Street Type

The tools contain both objective and subjective questions and all are generally closed ended, with occasional opportunities to enter in unanticipated observations. Many transportation engineers and data-oriented people have difficulty with the subjective questions (i.e., “Is this a nice place to walk?”) because the answers can deviate based on each assessor’s opinion. In experience with these tools, it was found that such subjective questions are by far the most important for two reasons. First, at the end of the day if the intent is to understand if a certain place is a good place to walk (if focusing on pedestrian travel), and this subjective question gets right at it without having to figure out the specific attributes of a location. Secondly, the subjective assessments feed into subsequent community discussions that take place once the data has been collected. It is through this dialogue and discussion about what makes a walkable space, what the norms and standards should be, and how different people may interpret similar conditions that will lead to a consensus approach to push for changes. So, rather than seeing such subjective questions as an unreliable form of data, users provide the most important data with which to begin an analysis and a plan for change.

The Complete Streets Tool (CSAT) shares the basic approach to transportation assessment with the SEAT tool, but more explicitly focuses on a multimodal environment. With the CSAT tool,

separate evaluations are conducted on the pedestrian, biking, and transit environments along a corridor. Questions still differentiate by road type, but because the focus is on multimodalism the range of questions is more extensive. That said, the data entry form and question sequencing remain simple and straightforward for the public.

In the CSAT tool, questions for each mode are deliberately sequenced to maximize both subjective and objective evaluations. They are organized as follows (see Figure 3):

- Subjective assessment – Each mode begins with a subjective assessment intended to get the assessor’s “gut” feeling about a place utilizing a 1-5 scale.
- Objective criteria – A series of objective questions customized to a particular mode of transportation is then answered
- Overall evaluation – Finally, the assessor is forced to make a “yes” or “no” evaluation as to whether the area reasonably accommodates the particular mode of travel. This last question allows the assessor to combine his/her gut feeling with some objective observations to make a final recommendation about the adequacy of the transportation facilities. Results from this question for each mode can then be added up to create a master “Complete Streets” score.

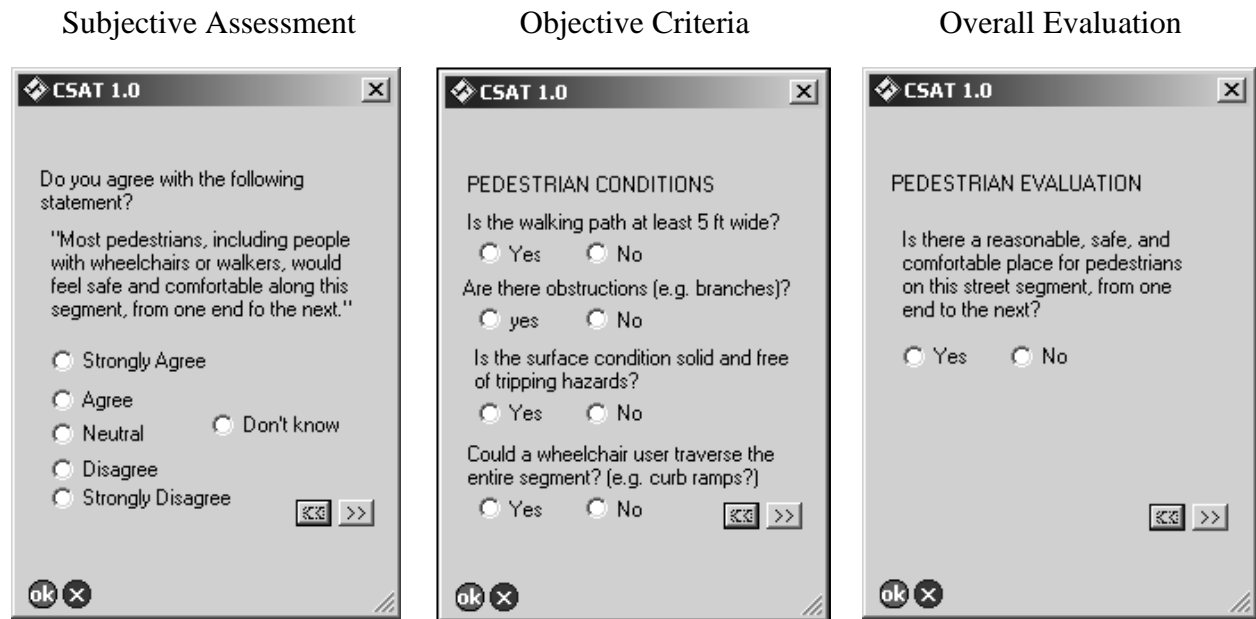


Figure 3: Data Entry Logic Model

Figure 4 displays a few additional data entry forms from the CSAT tool, including some of the general environmental questions that are useful to gather independent of a particular travel mode.

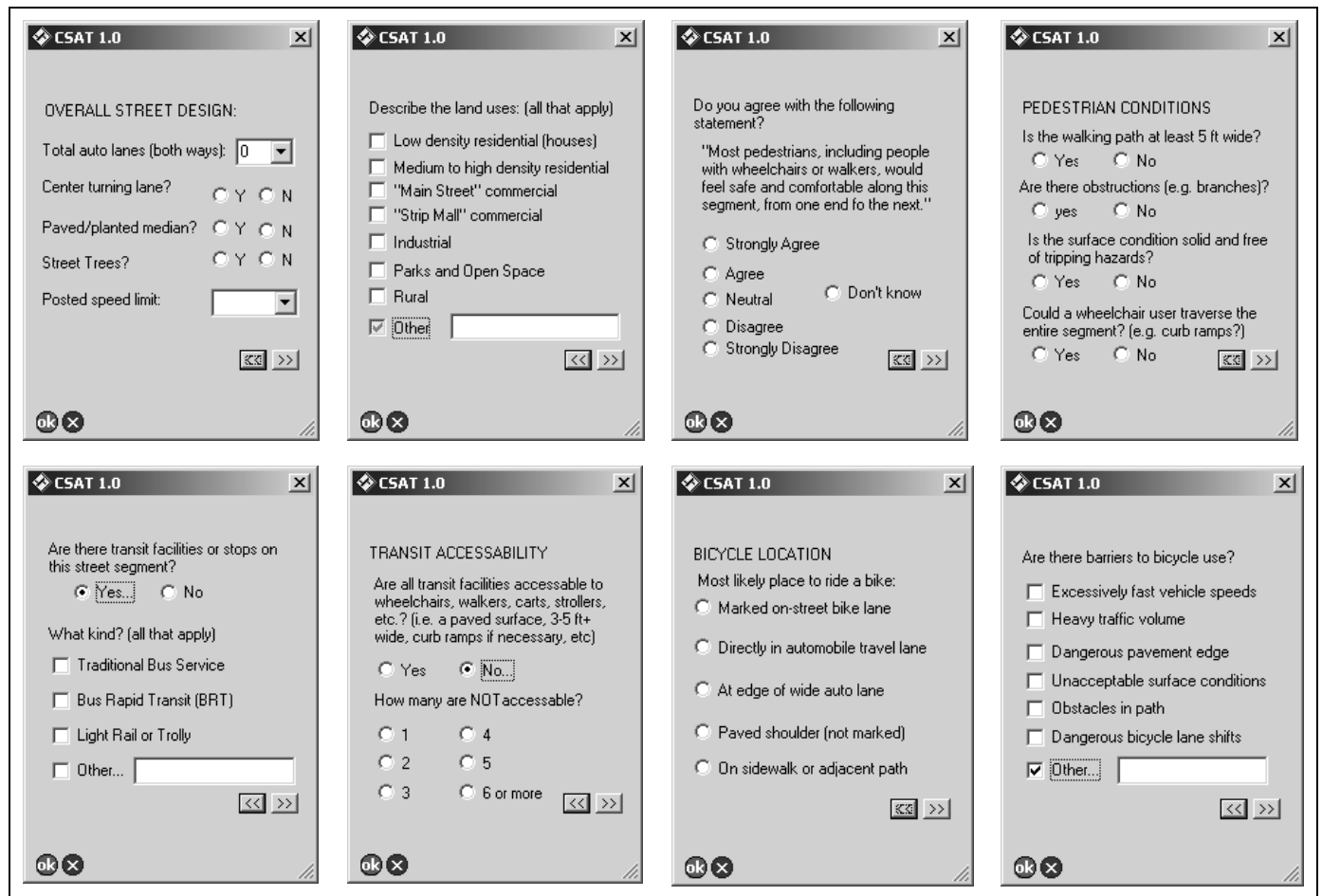


Figure 4: Sample Complete Streets Assessment Tool Data Entry Pages

2.2.2 The AAT Tool

The Accessibility Audit Tool (AAT) is geared toward measuring the walking infrastructure with a more direct connection to people with disabilities and to the standards set forth through the Americans with Disabilities Act (ADA). With this tool, the walking environment is evaluated more closely and in more detail, focusing on surface quality, ramp slope, materials at the interface of the ramp and street, pedestrian barriers, and other aspects (see Figure 5). These details may ultimately be important for any pedestrian assessment, especially for those engineers tasked with fixing or upgrading an area. However, for the non-AAT modules, they delve too deeply into the specifics of engineering standards for the more general awareness and coalition building those tools are designed to produce. The AAT tool is designed to directly evaluate legal and best practice standards regarding people with disabilities where the details of slope and condition, for example, are not areas of certain desired preferences, but are essential and necessary for safe accommodation of travel.

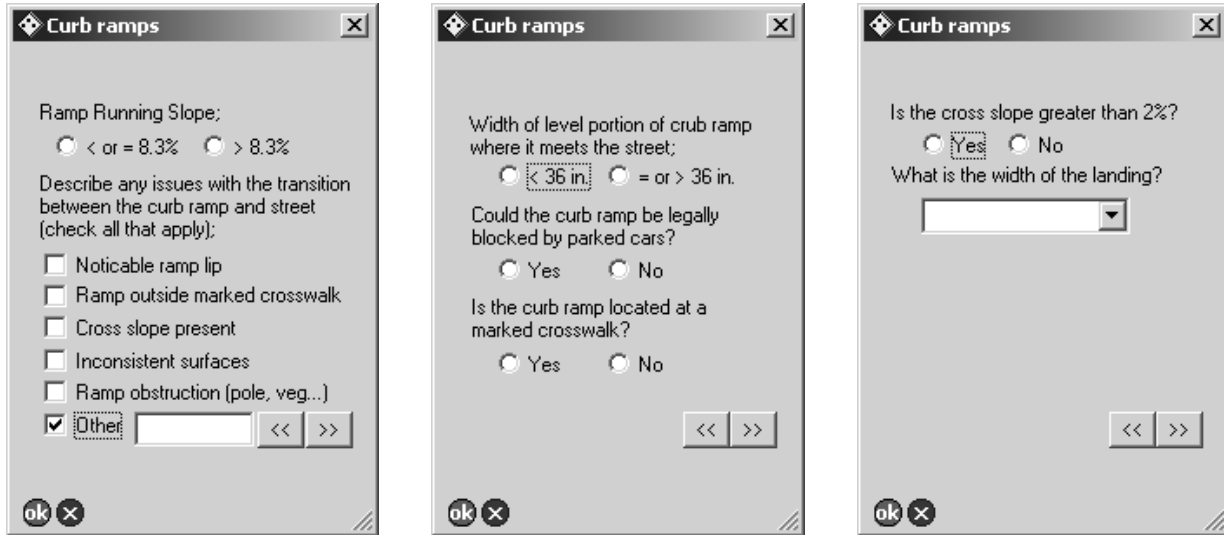


Figure 5: Sample AAT Screenshots

The audience for the AAT module may include advocacy organizations interested in the rights for those with disabilities as well as cities that either: 1) wish to honestly assess and improve upon the transportation infrastructure for all; or 2) recognize that it is in their best interest legally and financially to assess the infrastructure’s current condition and plan on continual upgrades to meet minimal federal ADA requirements. The AAT module will be tested during the 2008-09 academic year, with modifications and marketing to follow.

A spinoff of the AAT module is being developed for the Oregon Department of Transportation (ODOT). Upon seeing a demonstration of the AAT tool, ODOT became interested in using the mobile GIS technology to conduct a statewide assessment of all curb cuts (or absence of curb cuts) throughout the state highway system. Development, testing, and implementation of the ODOT Curb Ramp Inventory Tool is anticipated to take place during the 2008-09 academic year.

2.2.3 The BASIT Tool

The Bicycle Assessment & Safety Index Tool (BASIT) is an evaluation tool that can help communities identify bicycle routes that maximize efficiency and safety. There are three main phases in utilizing BASIT:

1. **Phase One:** An area of community roads are assessed utilizing the tool with the goal of reducing bicyclist stress.
2. **Phase Two:** Through the data and assessment, acceptable bike routes are identified and community members link together acceptable segments into preferred routes.
3. **Phase Three:** Each intersection along the preferred routes are assessed for safety and efficiency of travel with the BASIT intersection module. Each intersection is evaluated

for right and left turns and through travel. The BASIT tool then automatically compiles a bikeability turn (or through travel) score that is displayed graphically on a map and alerts users (or parents of child users) about the comfort and safety of each intersection. The resulting data can then be displayed on publicly available Web maps for community use (see Figure 6).



Figure 6: BASIT Bikeability Assessments Displayed on Web Map (dark lines are more hazardous)

Figure 7 shows some of the basic data entry screens that lead to composite bikeability scores and route preference maps.

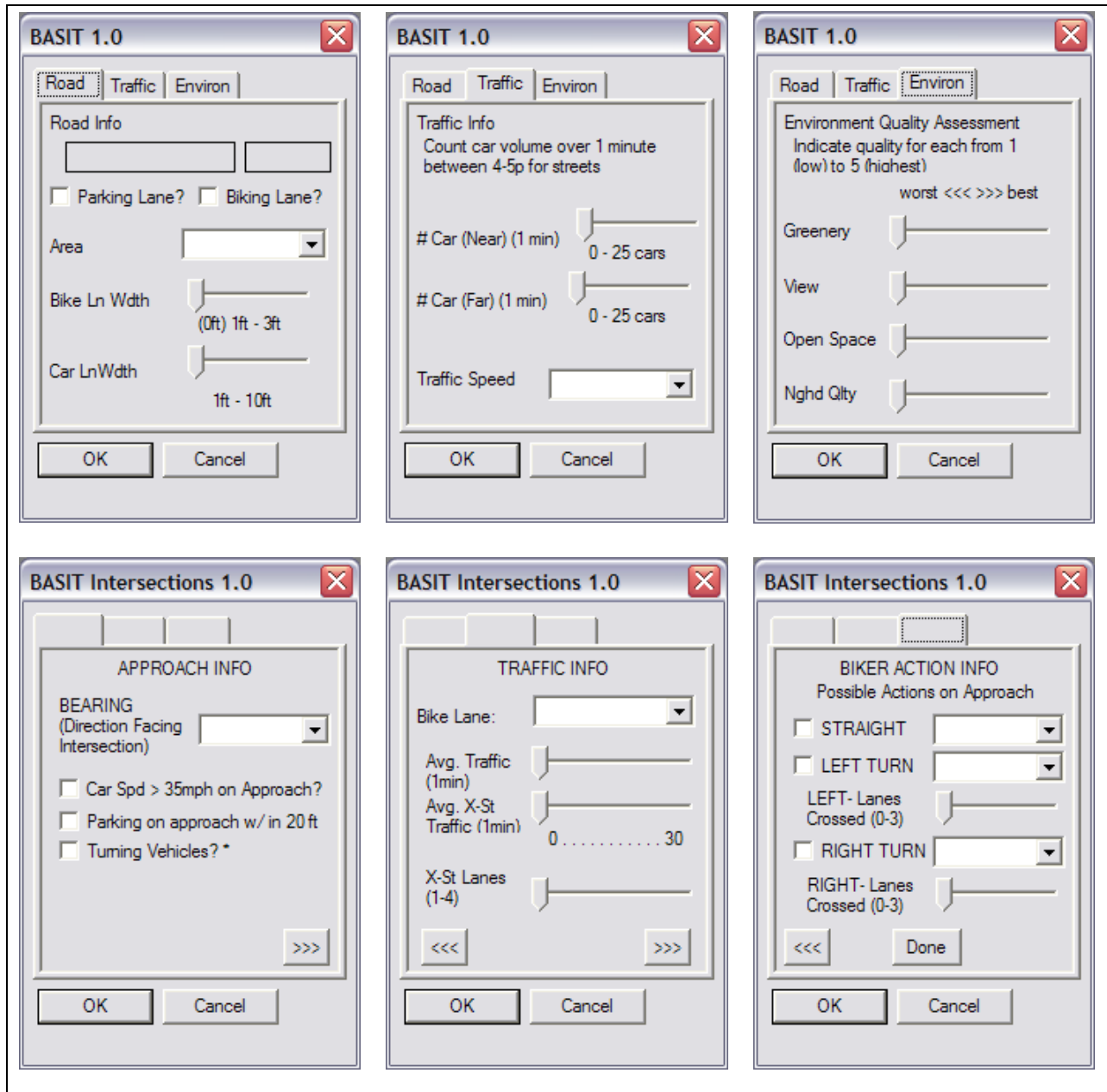


Figure 7: BASIT Street and Intersection Data Entry Forms

2.3 TRANSPORTATION ASSESSMENT TOOL PROCESS

Over the last two years, this suite of “Community Transportation Assessment Tools” has been designed to give citizens access to powerful GIS technology so they can produce rich data and develop political coalitions to bring about change in the local transportation environment. At the core of these tools is Mobile GIS, which allows users to collect GIS data using handheld computers. And while the technology may be sophisticated, the interface for users can be extremely straightforward. Figure 8 delineates a six-step process that a community interested in

assessing its transportation infrastructure would follow utilizing one of the tools (step-by-step descriptions follow the diagram).

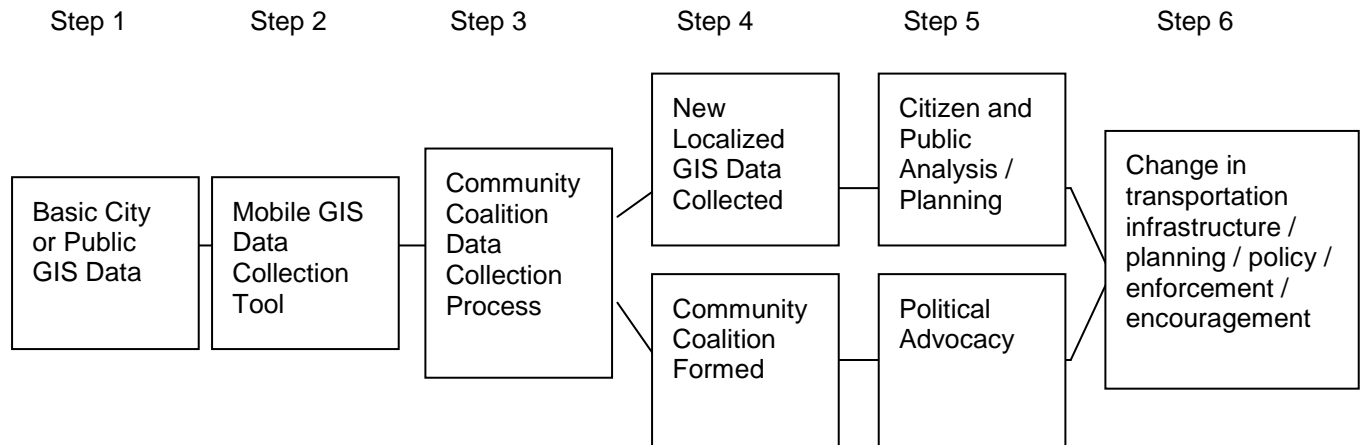


Figure 8: Six-Step Transportation Assessment Tool Process

2.3.1 Step 1: Base Data Acquisition

The first step in utilizing one of the assessment tools is identifying the base map data to use. There are four basic types of spatial data that the SEAT and CSAT community assessment tools focus on:

1. Attributes of the street block environment
 These tools are designed to collect attribute data along the street one block at a time. If local GIS street data exists, these tools can easily work with that data. Many small and medium-sized cities do not have their own customized street network data, so the freely available TIGER street centerline data becomes a good option and one that these tools also work with well.
2. Attributes of the intersections
 These tools (in their current form, at least) help evaluate various aspects of intersections and assign that data to a single intersection point. From a base map perspective, there is generally no pre-existing source for intersection points; thus, they must be created via a GIS program by someone with some basic GIS ability.
3. Specific barriers or points of interest along the street block
 In many areas, a street may be perfectly acceptable to walk along except for one or two key issues, such as a small gap in the sidewalk or foliage particularly overgrown in a specific area. This “points of interest” (POI) data is designed to be collected by the assessor in the field in an ad hoc manner. Technically, the data is being created from scratch, so no pre-existing GIS data set is needed.

4. Intersection crossings and conflict-ridden turning locations

Similar to the POI data, there may be particular street crossings or pedestrian-car turning conflicts that warrant specific identification; this component of the module is designed to allow users to easily represent those conflicts within the GIS data. Since this is observer-generated data, no pre-existing GIS data set is needed.

2.3.2 Step 2: Mobile GIS Data Collection Tool Preparation

The next step of the process is to customize the assessment tools for the local application area. This OTREC-supported work has focused on the tool development itself, but the primary work at this step for the community utilization is to link the pre-developed assessment tool to local community GIS data and possibly to customize the tool for unique local conditions. This process is not overly complicated, but does require technical assistance.

2.3.3 Step 3: Community Coalition Data Collection Process

The next step is to go out and collect the data. As a public involvement process, this step is critically important and should not be treated as simply a data gathering exercise where the data will be brought back to a centralized computer and evaluated at some later date. Contrary to most data collection efforts, the process by which the data is collected is as important as the collected data itself. It is through the data collection process that community capacity and investment is being created or enhanced, and the conversations and insights generated from the data collection process itself may be more valuable in leading to transportation changes than what the finalized set of data contains. That is, ultimately all decisions about transportation systems, land use planning, and city design are inherently and deliberately political, and this process of collecting data on the active transportation infrastructure is designed to enhance the political capital and capacity of a coalition of citizens and staff.

In order to achieve a balance between data collection, public involvement, and coalition building, a one-day workshop format delineated in Figure 99 was followed. Note that this workshop format is particularly suited for evaluating an area around a specific school (such as a half-mile radius) or a specific zone targeted for improvements, such as a key downtown area or important sets of corridors.

Basic SEAT Workshop Agenda (6 hours)

- Coffee (10 minutes)
- Introductions of participants and instructors (15 minutes)
- Safe Routes To School overview and discussion (35 minutes)
- Break (10 minutes)
- Guidance on how to use the data collection tool (60 minutes)
- Data collection – Workshop attendees break into small groups and walk one or more routes to collect physical information on the primary walking routes leading to/from school. Box lunches are distributed and can be consumed while walking or during a short break in the assessment period (2.5 hours)
- Group members reassemble to discuss their experience and begin to analyze their findings as their data is synthesized and projected as maps (plus have some food) (40 minutes)
- Wrap-up with a reflection of the day’s workshop and discussion of next steps (30 minutes)

Figure 9: Basic Workshop Agenda

The data collection workshop is divided into three main components: 1) issue context and tool training; 2) data collection; and 3) data synthesis and community discussion. Since one of the primary goals of this approach is to involve a cross section of the public (which can include city staff, elected officials, teachers, parents, advocates, kids, or a “general” public), it is critically important to orient participants to the basic context of the evaluation. In relation to the SEAT tool, this orientation involves a summary overview of both pedestrian friendly neighborhood design, reasons why increasing active transportation to school is a national goal, and an introduction to the national Safe Routes to School (SRTS) program. The introduction to these topics is best accomplished through visual examples of good and bad pedestrian facility design, a visual recounting of the change in obesity levels over time, and in showing the different aspects that comprise effective SRTS efforts.

Once the basic issue training is accomplished, the next step is to train participants on the assessment tools themselves and introduce them to Mobile GIS technology. The assessment tools discussed here have been designed to be easy to use by non-technicians and technophobes, and through experience of conducting the workshops, it was found that people of all backgrounds and technological comfort levels have been able to utilize these tools with surprising ease.

There are three key components to the technological training aspect of the workshop. First, it is important to explain the very basics of the hardware of the handheld computer, or PDA, which

even frequent desktop or laptop computers users may never have used. Second, it is important to guide users through the assessment tool itself utilizing a mock environment to evaluate. By displaying a photograph of a street segment or intersection, everyone involved can rate the same environment, work out differences in rating standards, engage in discussions about what makes a good walking environment, and become comfortable utilizing the tool. And third, it is important to go through potential problems users may encounter in the field and how to resolve them.

2.3.4 Step 4: Data Collection and Coalition Development

Once the training is completed, the second step of the overall assessment process is to conduct the assessment and collect data. In order to encourage community building among participants, it is recommended that participants go out in pairs of two. However, depending on the number of participants and circumstances, it is also possible for assessors to go out individually. Pre-specified areas are determined for each assessment team, which can vary depending on the size of the overall study area, number of participants, or particular features of the local community.

The Complete Streets tool employs a specific and deliberate sequence of subjective and objective questions for each mode of travel. To mimic the natural judgments that people make when out walking or biking about the “goodness” of a particular route they may choose to take, the data collection process begins by asking a subjective, intuitive question: How does the street feel in terms of comfort and safety from the perspective of a typical user? It is important to capture this impression up front before asking the assessor to engage in a more rational evaluation based on specific pre-defined criteria.

After this is accomplished, a detailed but essential set of objective environmental attributes is collected about the street segment or intersection. Again, working through these specific questions serves the dual goal of data collection and education. Finally, the assessor is asked to make a categorical “yes/no” judgment about whether or not the street accommodates each of the user types. Informed by both their intuitive, gut-feeling perception of the street and a specific, well-defined set of objective criteria, this final component offers the opportunity to flag significantly deficient street segments for priority action.

Once each team completes the assessment of their assigned area, they return to the workshop location and transfer their GIS assessment data to a central GIS database. When all teams have returned (after 2.5 hours in this model), their individual sets of data are quickly synthesized into a master data file and maps are instantaneously created and projected on the wall for participants to see. From this point forward, facilitation of a discussion is key because the intent of these tools is to both collect the data and to catalyze a constituency to do something with it. With an initial map projected on the wall (using a map that asks assessors to answer the subjective question: “Is this a nice place to walk?” is a good starting point), the workshop facilitator initiates and leads the discussion with three basic questions:

1. How did the assessment go and what did you notice?
2. What patterns and issues arise from the map(s) projected on the wall?

3. What do you want to do to improve the transportation environment?

With a portable printer on site, each participant can leave the workshop with a representative map from the data they collected. More importantly, however, participants should leave the workshop with some commitment toward next steps.

For example, if the assessment was related to Safe Routes to School and participants included representatives from the school, city, and neighborhood, then the group may commit to a follow-up meeting to identify key priority areas and develop a short-, medium-, and long-term plan to address the problem areas. The data and maps may be used by this group to support a grant application for funds required to do re-engineering work on an intersection or to develop an encouragement campaign at the school.

Utilizing the shared assessment experience of the coalition of citizens actually collecting the data is a key component in translating the data into tangible action at the local level. As for the data, it can reside within a local city GIS system if one exists, or it could be translated into a Web-accessible map for easy community access.

2.3.5 Step 5: Community Planning and Advocacy

While agency planners often have the desire to enact positive changes in the built environment that support active transportation, the political will to implement these changes may be lacking. Many people are unaware of the environmental needs of travel modes they do not use (e.g., bicycling) and there may even be outright opposition to certain types of change. By participating in a Mobile GIS workshop focused on Safe Routes to School (SRTS) or Complete Streets, a broad range of community members can become informed, organized, and in a position to provide strong political support for positive environmental changes.

For both topic areas, SRTS and Complete Streets, a strong and well-established policy context is already in place. In many cases, communities simply require a coordinated effort among a diverse group of advocates in order to implement these programs and policies in their area.

2.3.6 Step 6: Community Change

While community members are out conducting the Mobile GIS assessment, they directly participate in and embody active transportation ideals (i.e., they are walking to conduct the audit). Through their training on the essential environmental requirements of a pedestrian, bicycling, or transit user, they come to recognize the presence or absence of these features in their day-to-day life.

Furthermore, in the case of the Complete Streets audit tool, people who rely primarily on one or other particular mode (e.g., riding the bus but not often commuting by bicycle), gain a new appreciation for other travel modes. Workshop participants can take on an integral role for ongoing advocacy and community change that seek a more livable and healthy transportation environment.

2.4 OBJECTIVE 2: TOOL TESTING

Based on past work, skepticism exists among some transportation professionals that citizens without transportation training can effectively utilize assessment tools and appropriately engage with the transportation community. The goals of broad and legitimate public involvement in transportation evaluations and decision making are laudable, but whether such approaches actually enhance the transportation decision-making process and result in enhanced pedestrian infrastructure and trips is unknown.

This project took the SEAT and CSAT tools out to communities and engaged a “general” public in data gathering, analysis and reflection in order to evaluate the tools. The primary emphasis of this work is technology transfer, the evaluation of the tools and their ease of use rather than the larger goal of increased walking or biking rates within target communities since such a goal would be achieved within a time frame beyond the scope of this tool development.

The SEAT tool has been tested in communities in Oregon, Minnesota, and Wisconsin, while the CSAT tool has been tested in communities in Maryland, Minnesota, and Virginia. Presentations of both tools have been made at a variety of regional and national conferences, and have been featured by a national organization promoting community walking and biking. With input and advice by national active transportation experts, and with an involved and committed public, these tools have in fact been very useful and extremely well-regarded.

For example, Roosevelt Middle School in Eugene, Ore., began some Safe Routes to School activities via parent volunteers. These parents wanted to increase the number of kids who walked or biked to school for the health benefits of physical activity, the environmental benefits of reduced driving, and for a general quality-of-life benefit afforded to parents and children who can better experience their immediate surroundings when traveling by foot or bike. The parent volunteers worked with teachers to implement some encouragement activities, but wanted to do more. They conducted a survey of students’ transportation behavior and also enlisted a group of community members to conduct a walkability assessment of a half-mile area around the school using the SEAT tool. Following the workshop schedule above, the community collected data that resulted in the maps shown in Figure 1010.

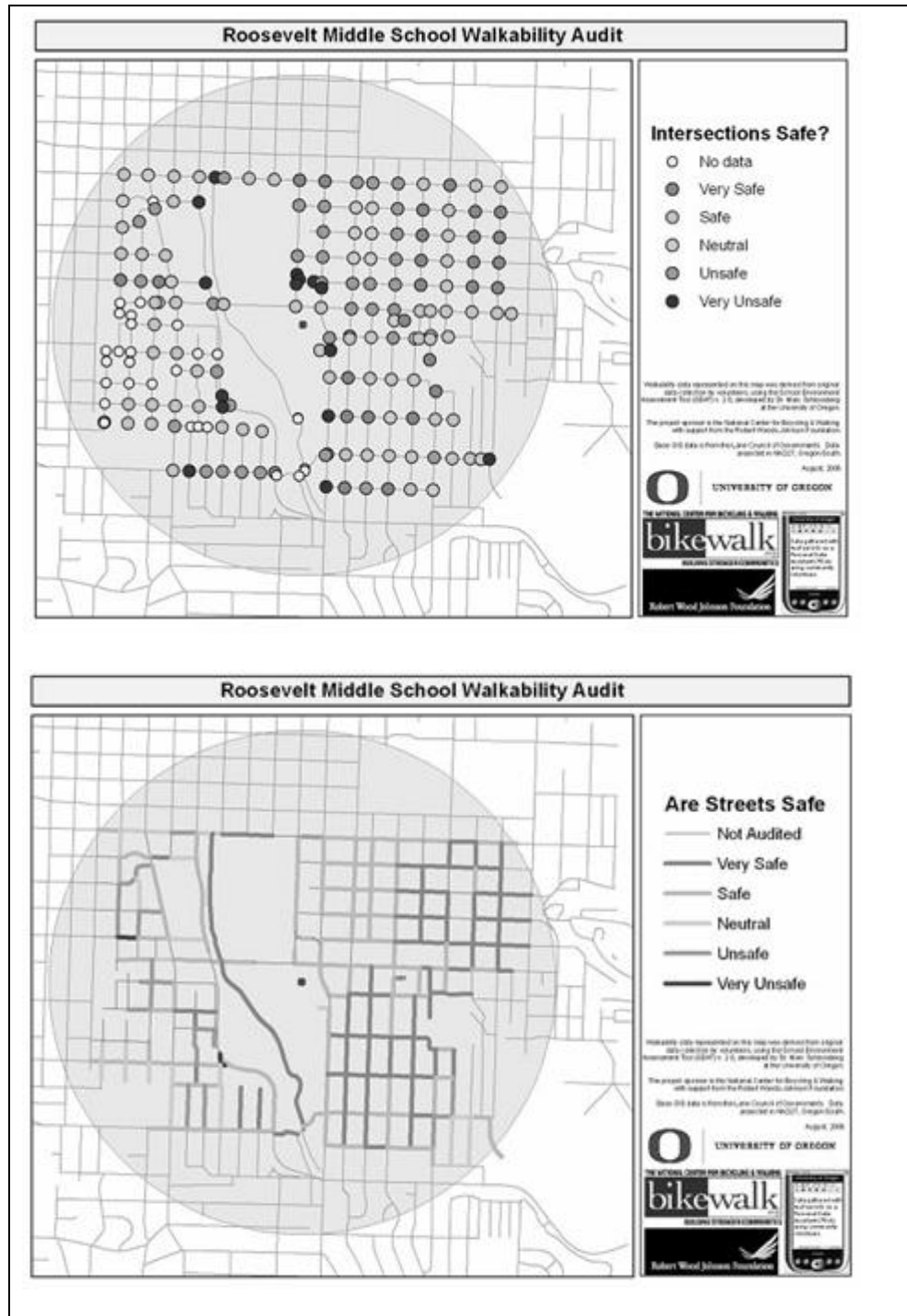


Figure 10: Sample SEAT Maps

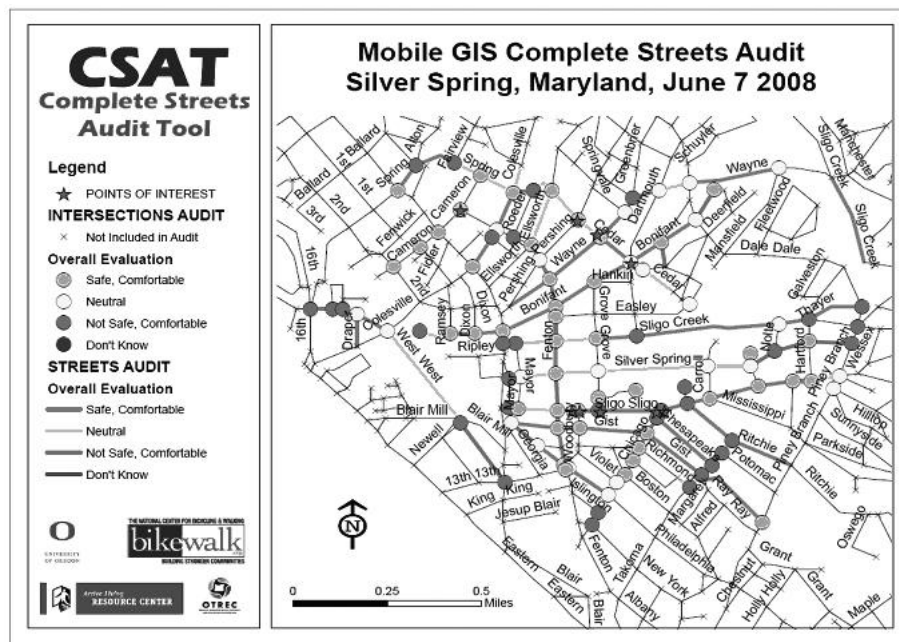
These maps led to some very interesting discussions with the primary result being that the community understood that most of the environment around the school served pedestrians quite well, with only a couple of key intersections posing any type of physical or safety barrier. With that understanding, the people involved in the assessment decided that the best course of action was not to ask the city for major engineering solutions, but to work on an extended informational

and encouragement campaign within the school to get kids (and their parents) to walk or bike more.

To accomplish this goal, the school group utilized this GIS data, as well as other data they collected, to write what became a successful grant application to the state under the Safe Routes to School Program. The grant allowed them to hire a half-time SRTS coordinator who has since been actively working to implement a range of ideas to increase active transportation to and from school.

Feeding on this momentum, the school succeeded in a subsequent proposal to work with design students at the University of Oregon to engage in a participatory process to redesign and improve the bicycle shelter at school. A similar project at a neighboring elementary school has completely revitalized the bike parking and has led, in part, to a dramatic increase in biking and use of the bike parking space as a community space rather than a discarded overflow space.

The community of Silver Spring, Md., carried out a Complete Streets assessment using the CSAT tool in June 2008. Although it is too early to see any long-term successes, the assessment process itself fulfilled many of the hoped-for community organizing and education functions (see Figure 111 for a sample map). The community members who gathered for a Complete Street workshop there were primarily concerned with the pedestrian environment. Few of them rode bicycles, and some of them were part of an organized effort among homeowners to oppose a proposed transit project in the area. During preparations for the workshop, the organizers even thought of "turning off" the bicycle and transit modules of the tool in order to focus on the expressed interests of the participants. It was decided, nevertheless, to include all modes in the audit and the workshop began with a comprehensive overview of Complete Streets.



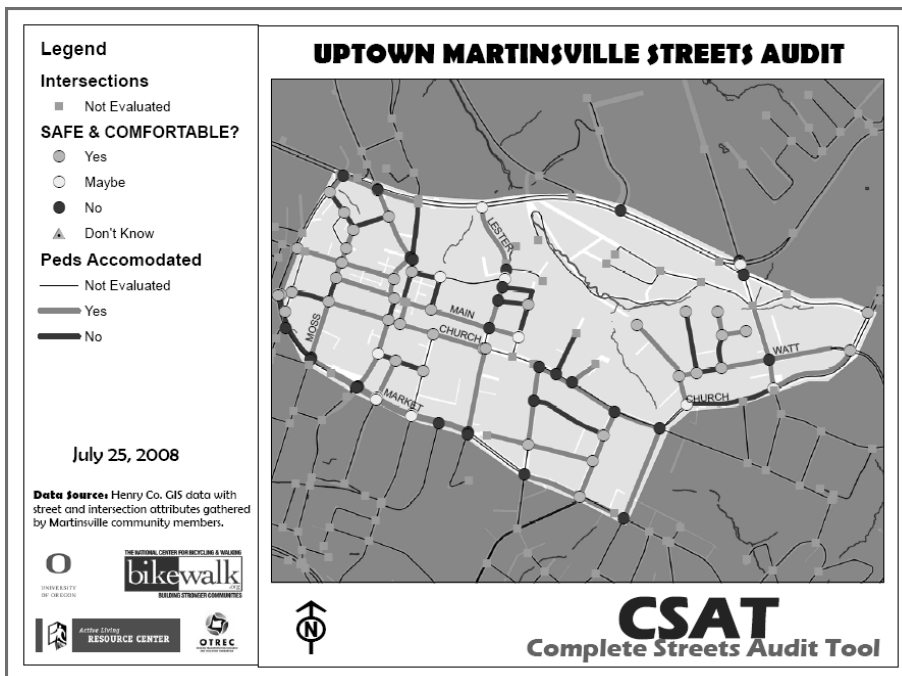
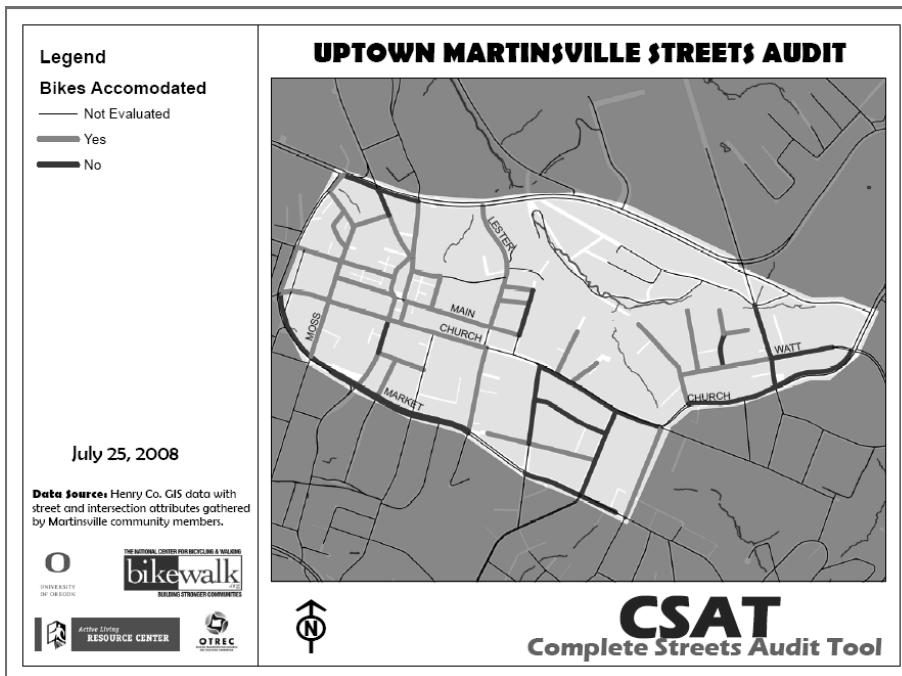


Figure 11: Sample Complete Streets Assessment Tool Map

When community members came back from their walking audit, many commented on the expanded awareness they now have of their community. People who had not used a bicycle for 20 years had a chance to reflect on how difficult it would be to ride on a fast, heavy-volume road without a bike lane, which is how many of the streets in that community are. Community members who had driven up and down the same road for years reported that they were now aware of a whole range of features of those streets, seen from the pedestrian perspective that they

never noticed before. Even those participants who were actively involved in an anti-transit campaign were beginning to re-evaluate their positions based on the new, multimodal perspective that resulted from the mapping exercise and community discussions.

Before dispersing at the end of the assessment workshop, the community members decided to establish a specialized listserv about Complete Streets and the area they assessed. Since then, they have been actively exchanging information and ideas on how to move forward with planning this important transportation corridor in Silver Spring.

Following the workshop, the participants invited representatives from the Montgomery County Pedestrian Safety Advisory Committee to deliver a presentation on the results of the Complete Streets workshop, their experience with the Mobile GIS tools, and to present the mode-specific map set produced from the community's data. Tragically, a few weeks after this presentation, a pedestrian was killed by a motorist on one of the segments the community had identified as inadequate for pedestrian travel. The community plans to use the data they gathered to press their case to "complete the streets" so that all modes of travel are adequate.

This experience illustrates the exact purpose of these tools and the rationale behind their development: That ordinary citizens with an investment in their local community, particularly related to increasing the safety and numbers of people who walk and bike, are capable of conducting assessments of the transportation infrastructure themselves. And, equally, if not more importantly, the process by which the data is collected is of fundamental importance because it encourages and empowers the citizenry to take action.

Ultimately, improving pedestrian and cycling infrastructure is a political battle – cities have limited resources and city officials will allocate those resources to those who can organize and articulate their needs. That is a political process, not a scientific, objective or necessarily needs-based approach, but a political one. The SEAT and CSAT tools are designed to facilitate the political empowerment of people interested in healthy communities and active transportation.

These Mobile GIS tools also result in detailed, spatial data of the active transportation environment, including both objective and subjective assessments. Communities retain the ability to monitor progress; articulate focused areas for needed improvements; prioritize activities; and develop appropriate interventions, whether they are engineering-based (constructing new sidewalks or redesigning an intersection) or encouragement-based (working with school teachers and administrators to promote biking and walking).

2.5 OBJECTIVE 3: DATA AND TOOL DISTRIBUTION

Following the development and testing of the tools, the subsequent goal was to begin the process of packaging the tools for wider distribution to communities of interest, including distributing data in a usable form to communities following their data collection. Four main activities have occurred thus far, although much more needs to be done to transform these tools into "market ready" products. The four activities include:

1. Development of Web-based data visualization tools
2. Presentation of tools to public audiences
3. Development of marketing materials
4. Development of technical manuals

2.5.1 Development of Web-based data visualization tools

At the conclusion of this project contract period, the project team began developing a Web interface between the Mobile GIS-gathered data and easily accessible online mapping tools such as Google Maps and Google Earth, which can now be utilized within a Web environment. The prototype Website explores the application of these tools, as well as providing some basic information about participatory GIS, asset-based community development and other information that may provide a larger context to their localized mapping endeavors.

Figure 12 provides some screen shots that demonstrate the potential of redistributing the community-derived GIS data in a format the community can use over time independent of having any GIS skill, knowledge or infrastructure.



GIS COMMUNITY AUDIT TOOLS

HOME AUDIT TOOLS RECENT AUDITS

SCHOOL STREET BIKE ACCESS

ABOUT GIS-CAT TOOLS

OVERVIEW

PROCESS

MAKING CHANGE POSSIBLE

COMMUNITY PARTICIPATION USING MOBILE GIS TECHNOLOGY

All GIS-CAT tools work on a handheld computer using sophisticated geographic information system software, but can be used by anyone regardless of their technological comfort level. All tools provide the unique capability of allowing community stakeholders to be directly involved in the data collection process. In addition, since data is collected directly into a GIS database, data entry time and error is reduced.

After data has been gathered in the field, technicians import the data into a desktop GIS environment to display a map set at the workshop itself. These maps can be used to articulate goals, identify barriers and target appropriate intersections.

This process encourages community empowerment and community buy-in, making change towards sustainable transportation more possible.

BENEFITS OF APPROACH

- The planning and carrying out of community mapping activities is a joint process: i) Community stakeholders collect data themselves, leading to *community empowerment* and investment in future actions, and ii) data is collected directly into a GIS format, *reducing time requirements and data entry error*.
- Workshop format allows maps and data analysis to be conducted the same day data is collected
- Resulting data and maps can be used by the coalition to target appropriate walking interventions or put pressure on appropriate city/state officials to do so.

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

GIS combines layers of information about a place to give you a better understanding of that place. What layers of information you combine depends on your purpose—finding the best location for a new store, analyzing environmental damage, viewing similar crimes in a city to detect a pattern, and so on.
-GIS.com

Key GIS links:

- o ESRI
 - o GIS WWW Resource List
 - o GIS Lounge
-

PUBLIC PARTICIPATION GIS (PPGIS)

Collectively we use the term Public Participation GIS (PPGIS) to cover the range of topics raised by the intersection of community interests and GIS technology.

-NCGIA

Key PPGIS links:

- o Guiding principles of PPGIS
- o PPGIS.net
- o URISA Journal On-Line



Toggle KML Files:

- Bicycle Capability Index (Vector)
- Intersection Quality (Vector)

Toggle Graphic Overlays:

- Intersection Quality (Graphic Overlay)
- Bike Routes (Graphic Overlay)
- Intersection Action Index (Graphic Overlay)
- Stop Type (Graphic Overlay)

Graphic and Navigation Option

- Status Bar
- Navigation Control
- Scale Legend
- Mouse Navigation

AAT to be used by ODOT
June 2008

The Accessibility Assessment Tool will be adopted by the Oregon Department of Transportation for use in auditing ADA accessibility requirements for all state highways.

CSAT Complete

May 2008

The Complete Streets mobile GIS assessment tool has been completed and is being prepared for pilot testing.

Example School Walkability Audit:

Maps such as this are products of one day workshops and mobile GIS technology that puts the power of data production in the hands of community members.

This map helped Roosevelt Middle School in Eugene, Oregon focus their efforts by determining that the built environment was likely not the barrier stopping students from walking to school. You can find the results of their effort below.

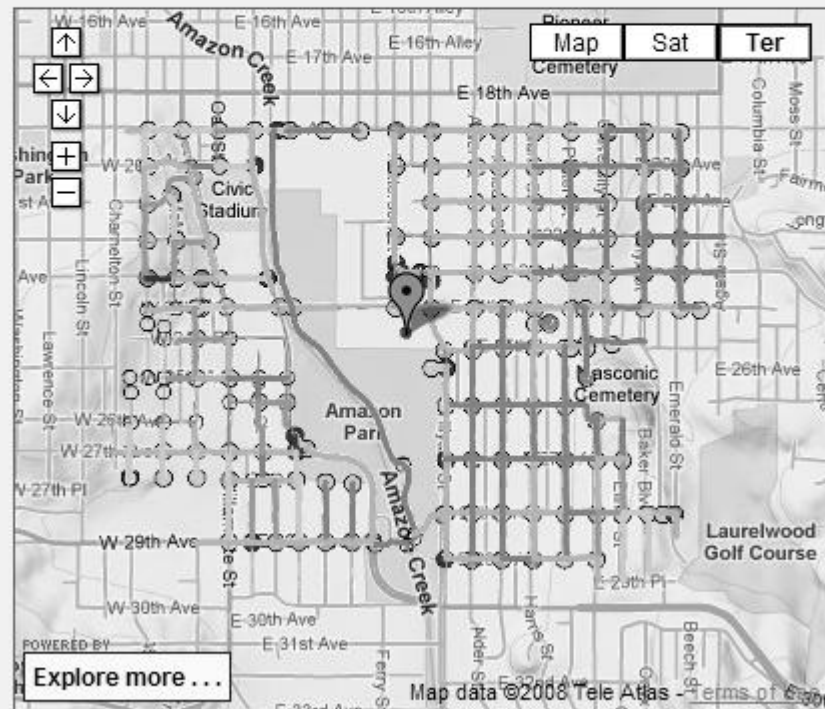


Figure 12: Sample Web pages showing community GIS data

Once the tools have been tested, it is the eventual goal to package the tools into a self-contained product that can be distributed to communities across the country that are interested in conducting their own pedestrian assessments, but may not necessarily have access to a GIS technician or local experts in pedestrian planning. The package will include easy-to-use templates and a training manual so that the technology can be transferred effectively and appropriately.

2.5.2 Presentation of tools to public audiences

These tools have been presented to a variety of public and private forums, including:

- Transportation Research Board annual national conference

- Transportation Research Board Tools of the Trade conference focusing on small and medium-sized cities
- National Pro Bike / Pro Walk conference of pedestrian/bike professionals and advocates
- Regional Northwest Transportation Conference
- Regional Oregon Planning Institute Conference

Subsequent to the development of these tools, a joint graduate and undergraduate course at the University of Oregon has been developed and taught focusing on Mobile GIS utilizing these tools as the foundation of the teaching. Although no data is available, this course is likely the only one in the nation focusing on Mobile GIS from a public participation and citizen empowerment perspective.

2.5.3 Development of marketing materials

Although the tools are not yet in their final form, some marketing materials have been developed in response to frequent inquiries by others as to how to access these tools for their own community assessments. Flyers for each tool have been created and distributed at each of the conferences mentioned above (see Appendix A: Tool F), as well as the Web presence highlighted in the above section.

2.5.4 Development of technical manuals

The various audit tools are designed to be as simple as possible for the end-user (a general citizen). The tools' backend – the software programming and coding – also are designed to be as simple as possible even though the tools are built upon a sophisticated GIS platform. The project team is starting to assemble two primary technical manuals to assist communities understand the GIS preparation process for a community audit and assessment and run community workshops effectively.

The GIS preparation process is fairly in-depth and requires a series of technical steps to prepare base files for a community and connect those files with the assessment tools on a variety of handheld computers. Steps include:

1. Acquiring and clipping community street data;
2. Generating and cleaning intersection data;
3. Adding appropriate data fields to GIS street files;
4. Linking the audit tool GUI to the backend database of the new street file;
5. Dividing a community assessment area into appropriate zones;

6. Linking central GIS data to distributed files on handheld computers;
7. Updating central GIS files post-data collection; and
8. Developing map templates for real-time display during community workshops.

The technical training manual details each of the above steps, with step-by-step instructions and images to “walk” appropriate community technicians through the process if local capacity exists to do so. This manual is also intended to make the tools transferable to other university researchers or others who want to use or build upon this work.

The workshop manual provides guidance to communities on how to plan, organize, and run the community workshops utilizing these Mobile GIS assessment tools.

3.0 CONCLUSION

Most communities, whether they be municipalities or local neighborhoods, lack sufficient GIS skill and infrastructure to engage in large-scale, GIS-based, data collection, analysis and planning. Engaging citizens in gathering and analyzing GIS data could be a useful way to extend GIS reach and to include an expanded set of community members in the transportation planning and policy functions of local government. The benefits of this approach are both to collect very localized, spatially oriented data (especially important to pedestrian and biking modes of travel) and to engage the public in what is essentially a public (and political) dialogue – what is the purpose of the transportation system and how best to accommodate multiple modes of travel?

Tools that are more appropriate for city staff and their asset management functions also can be developed. For example, the project team is developing one tool that evaluates curb ramps throughout the Oregon state highway system and another that documents the location and attributes of parking spaces (car and bike) throughout the urban core of Eugene, Ore. Regardless of the target audience – the general public or city staff – Mobile GIS tools like the ones discussed here provide new ways for communities large and small to better plan and engage the public in creating sustainable transportation systems for the healthy communities of the future.


The timing for the use and distribution of these tools is ideal. The country is facing an obesity epidemic, a global climate change threat significantly accelerated by automobile dependence, and a lack of community cohesion and quality of life brought about by sprawling land uses and the isolating nature of automobile travel. Walking and biking are receiving attention from planners, policy makers, advocates, and community members as never before. A variety of assessment tools designed to help communities evaluate the current walking and biking conditions in their communities - from simple checklists to the robust Mobile GIS-based tools discussed in this report – are beginning to emerge. These tools, especially the Mobile GIS versions developed in this project, represent a powerful way for communities to assess their active transportation needs and assets, plan for the future, and catalyze and empower people to action. These are tools designed to help communities implement sustainable approaches for sustainable transportation.

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APPENDIX A: TOOL FLYERS

Mapping the built environment with mobile GIS technology




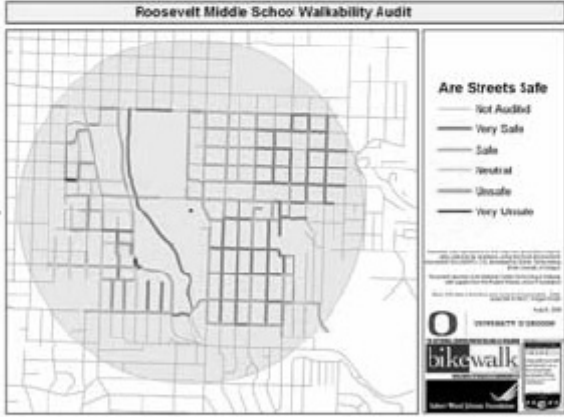
S.E.A.T.^{3.0}

SCHOOL ENVIRONMENT ASSESSMENT TOOL

The School Environment Assessment Tool (SEAT) is a tool that can help communities assess strengths and limitations of areas around schools in order to determine how consistent the neighborhood area is with walking and biking. Unlike other assessment tools, SEAT is designed with the dual emphasis of data collection and facilitating community organizing and capacity building.

SEAT works on a handheld computer using sophisticated geographic information system software, but can be used by anyone regardless of their technological comfort level. Data is collected with SEAT within a workshop format attended by a cross section of participants of relevance to walking to a given school.







The benefits of this approach are:

- Community stakeholders collect data themselves, leading to investment in future actions.
- Data is collected directly in a GIS format, reducing data entry error.
- Workshop format allows maps and data analysis to be conducted the same day data is collected.

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C.S.A.T.^{1.0}

COMPLETE STREETS ASSESSMENT TOOL



The Complete Streets Assessment Tool (CSAT) helps communities advocating for “complete streets” to perform a comprehensive assessment of the strengths and limitations of the local street network from the perspective of pedestrians, bicyclists, and transit users.

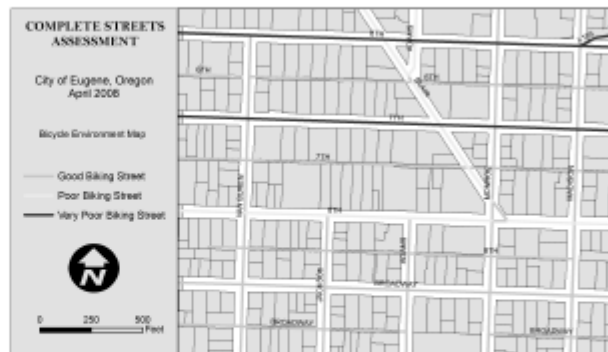
CSAT is designed with the dual emphasis of data collection and facilitating community organizing and capacity building. Safety and comfort is measured by gathering a unique combination of objective and subjective data.

Data is collected with CSAT within a workshop format attended by a cross section of participants working to build a local street network that supports the needs of all users.

CSAT works on a handheld computer using sophisticated geographic information system software, but can be used by anyone regardless of their technological comfort level. After data has been gathered in the field, technicians import the data into a desktop GIS environment to display a map set at the workshop itself.

The benefits of this approach are:

- Community stakeholders collect data themselves, leading to investment in future actions.
- Data is collected directly in a GIS format, reducing data entry error.
- Workshop format allows maps and data analysis to be conducted the same day data is collected.



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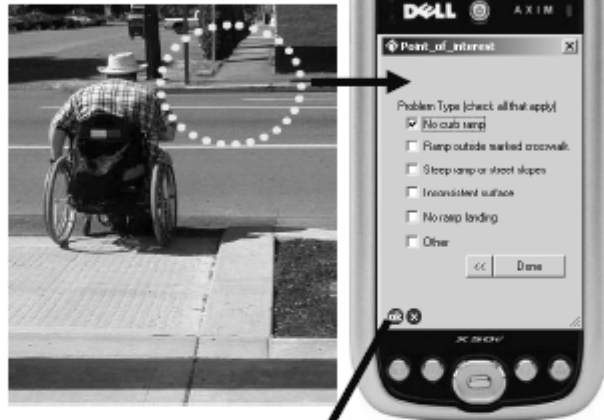
OTREC
OREGON TRANSPORTATION RESEARCH
AND EDUCATION CENTER



A.A.T. 1.0

ACCESSIBILITY ASSESSMENT TOOL

The Accessibility Assessment Tool (AAT) is used to identify and prioritize areas in need of accessibility improvements. The tool includes multiple assessment modules with varying levels of technicality, which makes it suitable for either a technician or community member with very little knowledge about accessibility issues. This approach allows community stakeholders to collect data themselves, leading to an investment in future actions.



AAT works on a handheld computer using sophisticated geographic information system software (GIS) but can be used by anyone regardless of their technological comfort level. After data has been gathered in the field, technicians import the data into a desktop GIS environment. Since data is collected directly into a GIS database, data entry time and error is reduced.

AAT includes separate modules which assess and identify accessibility issues with pedestrian crossings, intersections, curb ramps, sidewalks and targeted problem areas.



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BASIT^{1.0}

BICYCLE ASSESSMENT SAFETY INDEX TOOL

Identifying Bicycle Routes and Barriers to Use



The Bicycle Assessment & Safety Index Tool (BASIT) is a tool that can help communities identify bicycle routes that maximize efficiency (LOS) and safety. Unlike other assessment tools, BASIT is designed with the dual emphasis of data collection and facilitating community organizing and capacity building. BASIT works on a handheld computer using sophisticated geographic information system software, but can be used by anyone regardless of their technological comfort level. Data is collected with BASIT within a workshop format attended by a cross section of participants interested in promoting increased bikeability.

The benefits of this approach are:

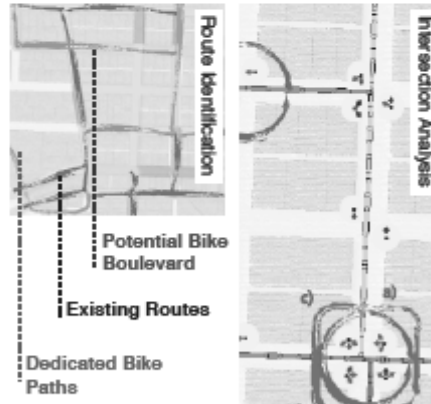
- Community stakeholders collect data themselves, leading to investment in future actions
- Data is collected directly in a GIS format, reducing data entry error
- Workshop format allows maps and data analysis to be conducted the same day data is collected
- Resulting maps can be used to target appropriate biking interventions

Data collection procedure

Phase One:
roads assessed referenced to
reducing bicyclist stress.

Phase Two:
routes identified as community
members link together the
bikeable streets

Phase Three:
intersections are assessed for
safety and efficiency of travel



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