Informing a Pedestrian Safety Improvement Program

Requested by
Richard Haggstrom, Division of Traffic Operations

December 14, 2009

The Caltrans Division of Research and Innovation (DRI) receives and evaluates numerous research problem statements for funding every year. DRI conducts Preliminary Investigations on these problem statements to better scope and prioritize the proposed research in light of existing credible work on the topics nationally and internationally. Online and print sources for Preliminary Investigations include the National Cooperative Highway Research Program (NCHRP) and other Transportation Research Board (TRB) programs, the American Association of State Highway and Transportation Officials (AASHTO), the research and practices of other transportation agencies, and related academic and industry research. The views and conclusions in cited works, while generally peer reviewed or published by authoritative sources, may not be accepted without qualification by all experts in the field.

Executive Summary

Background

Caltrans is scoping the development of a Pedestrian Safety Improvement Program (PSIP). In its mission, organization or implementation, such a program might be analogous to the agency's existing Highway Safety Improvement Program (HSIP). The HSIP (see http://www.dot.ca.gov/hq/LocalPrograms/HSIP/Documents/HSIP_Guidelines.pdf) is a federally funded core program that implements countermeasures to improve safety on publicly owned roadway or bicycle/pedestrian pathways or trails. HSIP projects are consistent with California's Strategic Highway Safety Plan (http://www.dot.ca.gov/SHSP/).

This Preliminary Investigation centered around two data-related needs in support of a PSIP:

1. Methods for deploying and evaluating pedestrian safety improvement measures.
2. A broader understanding of data needs and collection approaches to support pedestrian safety programs.

Summary of Findings

We have presented the findings of this Preliminary Investigation in four categories: **Agency Approaches**; **Tools, Best Practices and Innovations**; **Data Issues**; and **Resources**. Following is a summary of findings by topic area.

Agency Approaches

- We identified several examples of programmatic approaches to pedestrian safety improvement at a municipal or state level, including California-based programs.
- Florida DOT provided a comprehensive summary of its pedestrian safety activities (Appendix A to this Preliminary Investigation), and Oregon DOT shared the program improvement processes laid out in its Public Performance Plan. Both states were cited as having noteworthy pedestrian safety programs.
- North Carolina DOT makes pedestrian crash data available on its web site.
- We present high-profile safety programs at cities throughout the United States: Oakland, CA; Miami; Portland, OR; and Seattle.
- The Federal Highway Administration (FHWA) international scan on pedestrian and bicyclist safety and mobility described pedestrian safety efforts in several European cities.

Tools, Best Practices and Innovations

- The Pedestrian and Bicycle Information Center developed two key tools: the software package **Pedestrian and Bicycle Crash Analysis Tool** and the web-based **Pedestrian Safety Guide and Countermeasure Selection System**.
- The Safe Transportation Research & Education Center focuses on four areas of particular concern to the center: using geocoding; assessing exposure; performing cluster analysis of pedestrian injury; and conducting benefit-cost analysis in countermeasure selection, implementation and assessment.
- FHWA's **SafetyAnalyst** software tool may have application specifically to pedestrian safety, according to Raymond Krammes at FHWA.
- Several reports address approaches to reducing pedestrian collisions, including an American Association of State Highway and Transportation Officials (AASHTO) safety guide, an FHWA guide for transit agencies and a National Highway Traffic Safety Administration (NHTSA) report on child pedestrian safety.
- A NHTSA report also presents a range of statistics on pedestrian crash trends since 1997.

Data Issues

- We spoke with Joseph Schofer at Northwestern University to discuss the overarching principles of using transportation data, as presented in his *Transportation Research Circular* article. He provided further details on specific data needs and gaps related to pedestrian safety.
- Novel data collection approaches include using geocoding and geographic information system technology, and developing a database that integrates police and hospital data.
- Deficiencies in data collection have been documented. Among these are errors stemming from collection methods and limitations in analysis based on an agency's approach to collecting data. Several citations point to deficiencies in exposure data.

Resources

- Several additional resources provide data and information on pedestrian safety data and crash data. Among these are relevant web pages published by NHTSA (including its Fatality Analysis Reporting System), the Insurance Institute for Highway Safety and FHWA.

Gaps in Findings

Pedestrian safety was often part of an agency's overall safety plan; this was the case both with Florida and Oregon. However, we did not identify how highway safety data collection needs might apply to or compare with pedestrian safety needs. Also, research into the topic of exposure yielded more questions than answers: Some need for exposure data has been established, but we could not identify its overall importance or any agreed-upon collection methodology.

Next Steps

Caltrans might consider the following related to scoping a PSIP:

- Follow-up conversations with the key contacts at the Pedestrian and Bicycle Information Center and at the Safe Transportation Research & Education Center, and with the developers of the three analysis tools may help Caltrans assess next steps in putting a PSIP in place.
- Follow-up with Florida and Oregon DOTs on systematic approaches to identifying and addressing pedestrian safety on a statewide level might also be appropriate.
- The data deficiencies highlighted in this Preliminary Investigation may or may not be relevant in California. Caltrans might want to know whether systematic biases or other factors in data collection are affecting data that it would use as input to a PSIP.
- Factoring exposure into a pedestrian safety plan would address a need seen by many. Other approaches to collecting and analyzing data, such as geocoding and cluster analysis, may also be of interest.
- Audits of high-risk communities, as suggested by one expert, might also help provide a better understanding of the scope of pedestrian safety and exposure in California.

Contacts

During the course of this Preliminary Investigation, we spoke with the following individuals:

National

Federal Highway Administration
Raymond Krammes, Technical Contact for SafetyAnalyst Software, Office of Safety Research & Development, Turner-Fairbank Highway Research Center, (202) 493-3312, ray.krammes@fhwa.dot.gov

State

Oregon DOT
Susan Riehl**,** Bicyclist & Pedestrian Safety Program Manager, (503) 986-4197, susan.j.riehl@odot.state.or.us

Florida DOT
Dennis Scott, State Pedestrian & Bicycle Coordinator, (850) 245-1527, dennis.scott@dot.state.fl.us

University

Pedestrian and Bicycle Information Center (University of North Carolina)
Charlie Zegeer, Director, (919) 962-7801, zegeer@hsrc.unc.edu

Safe Transportation Research & Education Center (University of California, Berkeley)
David Ragland, Development Coordinator, (510) 642-0655, davidr@berkeley.edu

Northwestern University Department of Civil and Environmental Engineering
Joseph Schofer, Professor, (847) 491-8795, j-schofer@northwestern.edu

Agency Approaches

The citations below highlight best practices and innovative approaches to pedestrian safety at city and state levels nationwide as well as internationally. The agencies below do not represent a comprehensive list, but rather represent a range of programmatic approaches to improving pedestrian safety at different levels of government.

California

Caltrans—Safe Routes to School Programs
http://www.dot.ca.gov/hq/LocalPrograms/saferoutes/saferoutes.htm
This web site provides an overview of the California and federal Safe Routes to School programs. The concept of the state program (SR2S) and federal program (SRTS) is "to increase the number of children who walk or bicycle to school by funding projects that remove the barriers that currently prevent them from doing so. Those barriers include lack of infrastructure, unsafe infrastructure, lack of programs that promote walking and bicycling through education/encouragement programs aimed at children, parents and the community." The site provides a comparison of the state and federal programs; advice on submitting a project for funding; and resource links on best practices, training and program requirements.

Caltrans—Pedestrian Safety & Non-Motorized Branch
http://www.dot.ca.gov/hq/traffops/saferesr/ped.htm
This branch of Caltrans' Office of Traffic and Safety "provides expertise on safety and mobility aspects of the pedestrian and bicycle modes; participates in research and technology transfer in the field of pedestrian and bicycle facilities; and develops programs to improve the safety of highway infrastructure for pedestrians and bicyclists." This web page links to the July 2005 report, "Pedestrian and Bicycle Facilities in California: A Technical Reference and Technology Transfer Synthesis for Caltrans Planners and Engineers, July, 2005 " (http://www.dot.ca.gov/hq/traffops/survey/pedestrian/TR_MAY0405.pdf).

Oakland Metropolitan Transportation Commission—Safety Toolbox
http://www.mtc.ca.gov/planning/bicyclespedestrians/index.htm#safety
Oakland's Safety Toolbox provides the framework for a program to prevent collisions, prevent injuries and fatalities, and encourage walking and bicycling. The city seeks to achieve this through partnerships across multiple disciplines and jurisdictions and with the public. The Safety Toolbox describes roles for city and county governments, the problem identification process, and how to improve bicyclist and pedestrian safety.

The problem identification steps include:
- Process and considerations.
- What to look for.
- Where to look.
- How to analyze.
- How to use the results.

Steps for improving bicyclist and pedestrian safety include:
- Education and community participation programs.
- Engineering.
- Enforcement programs.

Florida

Florida DOT—Pedestrian and Bicycle Safety Program
http://www.dot.state.fl.us/safety/HighwaySafetyGrantProgram/hsgp/hsgpareas_pedestrian.shtm
Florida was cited as an exemplary state agency in improving pedestrian safety. We spoke with Dennis Scott, state pedestrian & bicycle coordinator. He provided a comprehensive summary of the state's pedestrian safety improvement efforts, attached as Appendix A to this Preliminary Investigation. This summary represents the agency's response to Transportation for America's report *Dangerous by Design* (http://t4america.org/docs/dangerousbydesign/dangerous_by_design.pdf). Among the programs and activities detailed in this summary are:

- Pedestrian safety design and planning workshops.
- Pedestrian safety action plans.
- "STOP for the Crosswalks" campaign.
- Focus on vulnerable users in the state's Strategic Highway Safety Plan.
- Walk Safe program.
- Florida school crossing guard program.
- Pedestrian law enforcement training.
- ProBikeProWalk conference.

Florida DOT—Quality/Level of Service Handbook, 2009
http://www.dot.state.fl.us/planning/systems/sm/los/pdfs/2009FDOTQLOS_Handbook.pdf
This handbook explains the basis of Florida's pedestrian level of service (LOS) model. Pedestrian LOS is based on four factors:

- Existence of a sidewalk.
- Lateral separation of pedestrians from motorized vehicles.
- Motorized vehicle volumes.
- Motorized vehicle speeds.

Each is weighted by relative importance, and a numerical score ranging from 0.5 to 6.5 is determined along with a letter grade. The complete formula is presented on page 27 of the handbook. The measurable variables are:

- Volume of directional motorized vehicles in the peak 15-minute period.
- Total number of directional through lanes.
- Posted speed limit.
- Percentage of heavy vehicles.
- FHWA's five-point pavement surface condition rating.
- Average effective width of outside through lane (which incorporates the existence of a paved shoulder or bicycle lane, if present).

Miami—Evaluation of Pedestrian Safety Countermeasures: Summary of Results, Conclusions and Lessons Learned, presentation by Sprinkle Consulting, Inc. and Science Applications International Corporation.
http://safety.fhwa.dot.gov/ped_bike/tools_solve/ped_scdproj/webinar052809/evaluation/
This presentation is an independent evaluation of a pedestrian safety project in Miami. The evaluation provides an assessment of the areawide impacts of all countermeasures combined and offers general lessons learned.

North Carolina

North Carolina DOT—Division of Bicycle & Pedestrian Transportation
http://www.pedbikeinfo.org/pbcat/ped_main.htm
North Carolina DOT's web site provides state crash facts and types, plus an interactive database that processes customized queries. The interactive database is based on information for almost 30,000 recent bicycle and pedestrian crashes with motor vehicles in the state. Data queries include:

- Standard tables based on data from police-reported crashes on a state, county and city level.
- Standard crash type tables developed from the Pedestrian and Bicycle Crash Analysis Tool software. (See reference under Pedestrian and Bicycle Information Center in this Preliminary Investigation.)
- Customized tables based on the user's selection of variables.

Oregon

Oregon DOT—Pedestrian Safety Program
http://www.oregon.gov/ODOT/TS/pedestrian.shtml#Program_Introduction_
Oregon was cited as another exemplary state agency in the area of improving pedestrian safety. We spoke with Susan Riehl**,** Bicyclist & Pedestrian Safety program manager, who discussed how pedestrian safety is addressed in the state's Public Performance Plan (http://www.oregon.gov/ODOT/TS/docs/2010PublicPerformancePlan.pdf). As shown on page 73 of the PDF, the safety plan consists of:

- Actions derived from the state's Transportation Safety Action Plan.
- Pedestrian safety problems, expressed numerically.

- Goals.
- Performance measures.
- Strategies.
- Summaries of projects intended to achieve the goals.

Portland—Pedestrian and Bicycle Safety
http://www.portlandonline.com/TRANSPORTATION/index.cfm?c=40513
This web site outlines Portland's engineering, education, enforcement and encouragement strategies for pedestrian safety.

Washington

Seattle—"Building America's Most Walkable City" program
http://www.seattle.gov/transportation/pedestrian.htm
The Seattle DOT Pedestrian Program "seeks to improve pedestrian safety and to encourage more walking by creating an environment where pedestrians can walk safely and comfortably." Among the resources is Seattle's Pedestrian Safety Master Plan (http://www.seattle.gov/transportation/pedestrian_masterplan/). Strategies include:

- Improve communication and coordination.
- Engage all Seattleites in the solutions.
- Recommend new and revised policies and programs.
- Maintain existing and prioritize investments in new infrastructure.
- Increase funding for pedestrian improvements.

International

International Scan Summary Report on Pedestrian and Bicyclist Safety and Mobility, FHWA, draft 2009.
http://www.international.fhwa.dot.gov/pubs/pbs/index.cfm
The countries visited and assessed in this international scan are Sweden, Denmark, Germany, Switzerland and the United Kingdom. The four topics of interest investigated in this research and summarized in the report are:

- *Improving Pedestrian and Bicyclist Safety*. Approaches (engineering, education, enforcement and policy) that have been successful in improving pedestrian and bicyclist safety.
- *Safe Routes to School Programs*. Approaches and policies for improving safety for child pedestrians and bicyclists, especially those that support programs like "Safe Routes to School."
- *Monitoring Usage Levels and Exposure*. Quantitative methods of monitoring pedestrian and bicyclist usage levels (for example, counts and surveys) and exposure to crashes.
- *Safety Research and Evaluation.* Recently completed or ongoing research and collaboration opportunities in pedestrian and bicyclist safety.

Tools, Best Practices and Innovations

We identified research findings, methodologies and approaches for identifying where to deploy pedestrian safety countermeasures and how to measure their effectiveness.

National Centers

Two research and resource centers particularly relevant to this Preliminary Investigation are the Pedestrian and Bicycle Information Center and the Safe Transportation Research & Education Center. Their work in improving pedestrian safety is highlighted below.

Pedestrian and Bicycle Information Center
http://www.walkinginfo.org/
Operated by the University of North Carolina's Highway Safety Research Center and funded by FHWA, the Pedestrian and Bicycle Information Center provides several resources and references on pedestrian-relevant products. We spoke with Charlie Zegeer, director of the center, who recommended several resources available on the site that would be of interest to an agency developing a PSIP:

Pedestrian and Bicycle Crash Analysis Tool
http://www.walkinginfo.org/facts/pbcat
The Pedestrian and Bicycle Crash Analysis Tool (PBCAT) is a software package for typing crashes and developing a database to analyze the details associated with crashes between motor vehicles and pedestrians or bicyclists. It is intended to assist state and local pedestrian/bicycle coordinators, planners and engineers with improving walking and bicycling safety.

Pedestrian Safety Guide and Countermeasure Selection System
http://www.walkinginfo.org/pedsafe/
This countermeasure selection system provides background, crash statistics/analysis, information on how treatments can address needed pedestrian safety improvements and ways to implement these treatments. The interactive countermeasure selection tool is available at http://www.walkinginfo.org/pedsafe/location.cfm.

Training Courses
http://www.walkinginfo.org/training/pbic/index.cfm
The center offers a number of one- to three-day training courses that provide technical assistance to professionals and community members in developing pedestrian safety action plans and in improving walking conditions. Courses titles include:

- Developing a Pedestrian Safety Action Plan
- Designing for Pedestrian Safety
- Planning and Designing for Pedestrian Safety
- Creating Livable Communities through Public Involvement

Zegeer recommends the list of course reading materials as a useful reference tool:
http://www.walkinginfo.org/training/pbic/references.cfm.

Pedestrian and Bicycle Information Center Case Study Compendium, January 2009.
http://drusilla.hsrc.unc.edu/cms/downloads/pbic_case_study_compendium.pdf
This compendium presents over a hundred case studies highlighting safety practices and crash mitigation solutions across the United States. It categorizes solutions into several categories: comprehensive, education, engineering, encouragement and planning.

Safe Transportation Research & Education Center
http://www.tsc.berkeley.edu/
Safe Transportation Research & Education Center (SafeTREC, formerly known as the Traffic Safety Center) is affiliated with University of California, Berkeley's School of Public Health and Institute of Transportation Studies. The center conducts research and outreach to address "safety and travel risk in a multi-modal transportation system." We spoke with researcher and former SafeTREC director David Ragland, who discussed four of the center's research areas related to advancing pedestrian safety: geocoding of collision data, determining pedestrian exposure

to crashes, performing cluster analysis of pedestrian injuries (for which geocoded data might be used) and determining the benefit-cost ratio of safety countermeasure alternatives.

Additional Tools and Publications

SafetyAnalyst, FHWA.
http://www.safetyanalyst.org/index.htm
SafetyAnalyst is a software tool that can be used to manage a program of site-specific safety improvements. We spoke to technical contact Raymond Krammes at FHWA to discuss the application of SafetyAnalyst for pedestrian applications. He said that it does not currently feature a standard pedestrian module. However, it can be customized to allow for the input and analysis of such data as specific pedestrian crash types. The detail and value of the analysis are dependent on the detail and accuracy of the input values.

A Guide for Reducing Collisions Involving Pedestrians, AASHTO Safety Guide, *NCHRP Report 500*, Vol. 10, 2004.
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v10.pdf
This report presents strategies (by timeframe and relative cost) for four objectives: reducing pedestrian exposure to vehicular traffic, improving sight distance and visibility for motor vehicles and pedestrians, reducing the speed of motor vehicles, and improving pedestrian and motorist safety awareness and behavior.

Pedestrian Safety Guide for Transit Agencies
FHWA, February 2008.
http://safety.fhwa.dot.gov/ped_bike/ped_transit/ped_transguide/transit_guide.pdf
This guide provides "common pedestrian safety issues which are likely to be found near transit stations, bus stops and other places where transit (bus or rail) is operated; descriptions of specific engineering, education and enforcement programs that have been effectively applied by transit agencies to foster greater pedestrian safety; background information about pedestrian safety and access to transit; and references to publications, guides and other tools that can be used to identify pedestrian safety problems." The tools and approaches presented in this guide are complemented by several case studies from transit agencies nationwide.

National Strategies for Advancing Child Pedestrian Safety, National Center for Injury Prevention and Control and the National Highway Traffic Safety Administration, October 2001.
http://www.cdc.gov/MotorVehicleSafety/images/newpedbk-a.pdf
This multifaceted approach to child pedestrian safety builds on six strategies: public awareness, driver behavior, physical environment, safe-walking programs, additional research and data collection/quantification. The stated goal is to enhance the well-being and safety of children by reducing their risk of injury while walking and by creating a more pedestrian-friendly environment.

National Pedestrian Crash Report, National Highway Traffic Safety Administration, June 2008.
http://www-nrd.nhtsa.dot.gov/Pubs/810968.PDF
This report analyzes the latest trends in pedestrian fatalities and police-reported motor vehicle crashes involving a pedestrian in the United States since 1997. Key findings reproduced here help frame pedestrian safety and risk in the United States:

- Pedestrian fatalities declined between 1997 and 2006. However, the probability of a pedestrian fatality in a crash increased while the probability of a pedestrian crash declined.
- About two-thirds of pedestrian fatalities were in urban areas. Of the nearly 42,500 cities or towns listed according to the U.S. Geographic Location Codes by the General Services Administration, only 13 percent of them accounted for those pedestrian fatalities in urban areas.
- Nationwide, nearly two pedestrians died in vehicle crashes per 100,000 population, and a pedestrian crash death occurred every 70 million miles walked.
- January 1 and October 31 were the two most deadly days of the year, having the highest number of pedestrian fatalities.
- Pedestrians are more likely to be killed in a crash between 3 a.m. and 6 a.m. or during the weekend on Saturday or Sunday.
- Males have a much higher probability than females to be killed in a crash.
- The older age group (over 64) has a much greater possibility than other age groups to be killed in a crash.

- As a pedestrian's blood alcohol concentration increases, the probability of a pedestrian getting killed in a crash increases.
- Pedestrians have a higher possibility to be killed in non-speeding conditions than in speeding conditions based on fatality per crash.
- Pedestrians are more likely to be killed in a crash under a sleet condition than under any other weather condition based on fatality per crash.
- Pedestrians have a higher probability to be killed in a crash under a dark condition than under other light conditions.
- With regard to posted speed limits, the higher the posted speed limit, the higher the probability of a pedestrian fatality.

Data Issues

As noted in the **Background** statement to this Preliminary Investigation, issues surrounding data are of primary interest to Caltrans. Such issues range from identifying data sources and assessing collection methods to ensuring data integrity and validity. The first source in this section outlines the broad challenges and issues associated with collecting, synthesizing and using data needed to drive pedestrian safety countermeasures.

Transportation Information Assets and Impacts: An Assessment of Needs, *Transportation Research Circular*, Transportation Research Board, No. E-C109, December 2006.
http://onlinepubs.trb.org/onlinepubs/circulars/ec109.pdf
This report provides relevant discussion on data collection and integration issues in two sections: "The Value of Data to Decision Makers" (pages 16-17) and "Integration and Interpretation" (pages 18-19). The report presents these "overarching principles" regarding data:

- Data are a transportation asset.
- Decisions are the product.
- Sharing data extends their value.
- Sustained data programs ensure timely response to decisions.
- Technology is changing the picture.
- There are needs beyond data.

The report further describes these key attributes related to using information:

- Timeliness.
- Responsiveness.
- Clarity (simplicity).
- Perfection or imperfection.
- Conciseness.

Author Interview
We spoke with the author of this report, Joseph Schofer, professor of civil and environmental engineering at Northwestern University. He highlighted a variety of issues and challenges that an agency considering implementing a PSIP should keep in mind:

- An agency needs a full and current picture on possible pedestrian safety problems. This is achieved in part with audits of communities; audits of communities with at-risk populations such as children or seniors are particularly important.
- Data on accidents should be complemented by data on pedestrian exposure to possible accident and injury. Schofer noted that there is currently no routine way of measuring pedestrian exposure; this is cited in a report in the **Deficiencies** section of this Preliminary Investigation.
- It is important to be proactive. An accident-free intersection is not necessarily safe. Conversely, it may be so unsafe that it is constantly avoided by pedestrians. Such an intersection could still be a candidate for pedestrian improvement measures.
- Identifying causes of pedestrian crashes and extracting causal patterns can be difficult. For example, with police data, the need for on-scene officers to immediately assign fault to the motorist or pedestrian can obscure an inherently unsafe traffic configuration that underlies the situation. Moreover, reporting standards for police and emergency responders vary considerably nationwide.

Collection Methods

These citations explore further various data collection issues, considerations and techniques.

Identification and Ranking of High Pedestrian Crash Zones Using GIS, 2005 Annual ESRI International User Conference
http://proceedings.esri.com/library/userconf/proc05/papers/pap2230.pdf
From the abstract: "This paper documents the development of a systematic methodology to identify high pedestrian crash zones, prioritize these zones and the development of a customized [geographic information systems-]based tool to assist in this process. The process identifies spatial concentration patterns and high pedestrian crash zones, uses the crash characteristics and population details of selected zones, and computes crash rates. The tool utilizes crash data recorded by law enforcement personnel, and street network characteristics."

A Comprehensive Approach to Geocoding Collisions from the California Statewide Integrated Traffic Records System (SWITRS), presentation by John Bigham, SafeTREC.
http://www.tsc.berkeley.edu/education/Bigham_May_28_geocodingSWITRS.pdf
This presentation provides the details of a project to geocode Statewide Integrated Traffic Records System data to the highest level of accuracy and precision, to document the methodology and process, and to provide public access to geocoded data.

Pedestrian and Bicycle Data Collection in United States Communities: Quantifying Use, Surveying Users, and Documenting Facility Extent, January 2005.
http://www.pedbikeinfo.org/pdf/casestudies/PBIC_Data_Collection_Case_Studies.pdf
This publication of the Pedestrian and Bicycle Information Center provides information on existing data collection efforts for practitioners who want to collect pedestrian and bicycle data in their communities.

International Scan Summary Report on Pedestrian and Bicyclist Safety and Mobility, FHWA, draft 2009.
http://www.international.fhwa.dot.gov/pubs/pbs/index.cfm
This report discusses how Sweden has implemented nationwide the STRADA (Swedish Traffic Accident Data Acquisition) database that integrates police crash data and hospital admissions data. The STRADA database addresses the underreporting problem that is common to walking and biking, and gives Swedish engineers and planners a more complete picture of walking and biking safety.

Deficiencies

The following publications specifically address problems in collecting data related to pedestrian crashes and fatalities as well as exposure to safety hazards.

Examining Deficiencies in Florida Pedestrian Crash Data, *Transportation Research Record:* Journal of the Transportation Research Board, Vol. 2002, 2007, pages 31-38.
http://trb.metapress.com/content/28x3k3h31722x15m/
This paper describes key factors that affect the value and usefulness of data: accuracy, precision, completeness and timeliness. “Emphasis was given to the methods that can be used to create a quality crash data set and to highlighting the additional insights that can be gained from the homicide reports and other resources, especially for the accurate determination of fault and crash causation.”

Estimating Pedestrian Accident Exposure: Approaches to a Statewide Pedestrian Exposure Database, Safe Transportation Research & Education Center, March 2007.
http://escholarship.org/uc/item/05g9s4m5
Excerpt: “This report discusses approaches to addressing the need for better and more widely available pedestrian volume data in the state of California. While a variety of approaches could be used, this report focuses on the strategy of a statewide pedestrian volume database … . One of its principal purposes would be to allow safety professionals at the state and local levels to estimate pedestrian exposure to risk at specific sites.”

Evaluation of Pedestrian Data Needs and Collection Efforts, *Transportation Research Record:* Journal of the Transportation Research Board, Vol. 1828, 2003, pages 12-19.
http://trb.metapress.com/content/w862u8m123wvw622/
This research describes how state data, as collected on traffic crash reports, limits the type and extent of the analysis that can be performed due to constraints and errors. It also addresses exposure, noting that “several agencies admitted that pedestrian volumes did not affect their pedestrian treatments.”

Resources

Additional relevant resources in the areas of pedestrian safety data and countermeasures are presented in this section.

Fatality Analysis Reporting System (FARS), NHTSA
http://www-fars.nhtsa.dot.gov/People/PeoplePedestrians.aspx
This site is a resource on pedestrian fatalities, including detail on vehicle type and crash-related factors. FARS supports queries by individual state and by year. Several citations throughout this Preliminary Investigation reference FARS as their data source.

Traffic Safety Facts 2008, NHTSA
http://www-nrd.nhtsa.dot.gov/Pubs/811163.PDF
This report provides statistics on 2008 pedestrian deaths, sorted by victim age and sex, crash time and day of week, and alcohol factors.

Insurance Institute for Highway Safety and Highway Loss Data Institute
http://www.iihs.org/research/fatality_facts_2008/pedestrians.html
The Insurance Institute for Highway Safety is a nonprofit research and communications organization funded by auto insurers. The affiliated Highway Loss Data Institute is a nonprofit research organization that publishes insurance loss statistics on most passenger vehicles. The joint web site presents an analysis of FARS data on pedestrian fatalities, including trends since 1975 in different categories (death by age and gender, deaths involving alcohol, deaths by place and time).

Pedestrian & Bicycle Safety Page, FHWA Safety Program
http://safety.fhwa.dot.gov/ped_bike/
This overview of FHWA's pedestrian and bicycle safety program focuses on "the 4 E's": engineering, enforcement, education and emergency services.

Pedestrian & Bicycle Safety Research Page, FHWA Turner-Fairbank Highway Research Center
http://www.tfhrc.gov/safety/pedbike/research/current.htm
This web site presents the overview, goals and plans for FHWA's pedestrian and bicycle safety research program.

Bureau of Transportation Statistics, FHWA's Research and Innovative Technology Administration
http://www.bts.gov/
This web site provides statistics on a wide range of transportation topics.

Appendix A

Florida DOT's response to Transportation for America's *Dangerous by Design* (http://t4america.org/docs/dangerousbydesign/dangerous_by_design.pdf), a continuation in its "Mean Streets" series.

The Florida Department of Transportation (FDOT) and its safety stakeholders throughout the state are aware of the magnitude of pedestrian injuries and fatalities and are doing much to reduce these numbers. Though indeed, pedestrian fatality and injury rates in Florida are high when compared on a per capita basis with other states, it is felt that a basic assumption made by the authors of the Mean Streets report to use walk to work trips as a surrogate for overall walking exposure tends to exaggerate the risk of walking in Florida. It is believed that Florida may have relatively more walking for other types of trips, thus increasing actual exposure, and in real terms indicating that walking in Florida is not as risky as reported in Mean Streets.

Much is being done in Florida to reduce the serious toll of injuries and fatalities to pedestrians. In 2008, pedestrian fatalities fell from the previous year from 530 to 502, a reduction of 5.29%. These numbers are down from 576 in 2005. On an ongoing basis pedestrian injury and fatality data is analyzed as a means of directing resources more precisely in the endeavor to reduce the fatalities and injuries. For instance, earlier this year an analysis was initiated based on the realization that pedestrian fatality numbers were highest in the fourth quarters of the most recent two years. Some highlights of that analysis are noted below.

- A fourth quarter spike was noted the five most recent years of available data.
- A fourth quarter spike also consistently occurs nationwide
- The data suggests that a greater number of pedestrian fatalities occur during the transition period after Daylight Savings Time ends in the fall.
- From noon to 6 pm, Florida's pedestrian fatality rate (relative to population) was ~20% greater than average rate of other states.
- Between 6 pm and 6 am, Florida rate is more than twice as great. Florida's anomalously high pedestrian fatality rate is largely due to the much greater fatality rate during these hours.

Earlier analysis suggests that more walking occurs in Florida during winter darkness than in more northern areas with more severe winter weather. This can be seen as partially explaining why Florida's per capita pedestrian fatality rate is higher than the national average.

FDOT continues to have one of the longest running pedestrian/bicycle programs of any state DOT in the nation. This program, housed in the Safety Office, along with other offices within the agency and other organizations within the state continue to strive to make Florida safer for the pedestrian. Following are highlights of pedestrian safety activities.

FDOT has long had what is considered by the Complete Streets Coalition to be a "complete streets" policy for FDOT maintained facilities. **Section 335.065, Florida Statutes, Bicycle and pedestrian ways along state roads and transportation facilities:**"(1) (a) Bicycle and pedestrian ways shall be given full consideration in the planning and development of transportation facilities . . . Bicycle and pedestrian ways shall be established in conjunction with the construction, reconstruction, or other change of any state transportation facility, and special emphasis shall be given to projects in or within 1 mile of an urban area." Though this language was adopted well over 20 years ago, FDOT strives to improve our criteria and standards on an ongoing basis. The fact that FDOT provides for pedestrians in a majority of its urban area construction and reconstruction projects, means that it is difficult to specify the amount of funding expended for these provisions, as they are components of larger projects.

Details on accommodation of pedestrians and bicyclists are incorporated in a number of guidance documents used by the FDOT. For instance, the Plans Preparation Manual (PPM) has long had criteria and standards for the accommodation of pedestrians on and across the State Highway System. The majority of that information is found in Chapter 8 of the PPM http://www.dot.state.fl.us/rddesign/PPMManual/2009/Volume1/zChap08.pdf. The PPM has recently been updated to further improve pedestrian accommodation.

Other Pedestrian Safety Activities

- The Safety Office and various FDOT District Offices, along with local governments have promoted and coordinated FHWA Pedestrian Safety Design and Planning workshops throughout the state. These workshops have included group field visits to corridors and intersections difficult for pedestrians to safely navigate. Attendees developed strategies to improve safety at specific locations.

- The above mentioned Pedestrian Safety Planning workshops instructed attendees on how to develop Pedestrian Safety Action Plans http://www.walkinginfo.org/library/details.cfm?id=229. Such plans have been coordinated and developed through FDOT's District 7 Office (Tampa/St. Petersburg area) for Hillsborough and Pinellas Counties. This plan has been adopted in Pinellas and is the adoption process in Hillsborough.

- Based on the Pedestrian Safety Action Plans for Hillsborough and Pinellas Counties, the "STOP for the Crosswalks" campaign and enthusiasm to implement law enforcement and education programs designed to improve pedestrian safety, NHTSA has awarded funding to FDOT District 7 in coordination with the Safety office. This was competitive NHTSA funding specifically set aside for pedestrian safety enforcement and education programs in "lead" states and cities. Lead states and cities are those determined by FHWA to have greater pedestrian safety needs.

FDOT has been a national leader in pedestrian mobility and safety research. Some of these studies include: Statewide Survey on Bicycle and Pedestrian Facilities, Bicycle and Pedestrian Travel: Exploration of Collision Exposure in Florida and many others that can be found at http://www.dot.state.fl.us/safety/ped_bike/ped_bike_reports.shtm. A recently completed study, not yet available on-line is "Evaluation of the Rectangular Rapid Flash Beacon at a Pinellas Trail Crossing in St. Petersburg, Florida". Research underway includes improving pedestrian crossings and driver compliance in yielding, brighter and more durable (and audible and vibratory) pavement markings to help drivers better detect crosswalks and keep drivers in their lane. Two FDOT Districts (D4 and D7) have completed research on the conditions, which lead to pedestrian crashes and recommendations for improvements. Phased research has led to the development of pedestrian and bicycle level of service models that will be adopted into the new national highway safety manual.

- The Alternative Transportation Education program in the Orlando area outlines and describes alternate transportation options and identifies their benefits and limitations for the participants. The ultimate goal of the Alternative Transportation Education (ATE) course is to provide education to individuals regarding various types of commuting options. Often, these individuals do not have access to a vehicle, do not have the ability to drive, or have lost their license (may be court ordered). Course content includes: the benefits and limitations of walking, the meaning of traffic signs/symbols and how to cross roads safely. http://www.floridasafety.org/coursetext.asp?class=43

- FDOT in conjunction with many partner agencies and organizations developed and adopted a Strategic Highway Safety Plan (SHSP) in 2006. http://www.dot.state.fl.us/Safety/posted%20documents/Florida%20Comp%20SHSP%20for%20print.pdf This plan focuses on a select number of strategic areas, including Vulnerable Users. Vulnerable Users include pedestrians, bicyclists and motorcyclists. The plan is continuously monitored by a leadership group with representatives from the partner organizations that helped develop the SHSP. The group meets quarterly to discuss all traffic safety issues including pedestrian. An on-line Tracking Tool has been developed for partners around the state to post traffic safety projects and programs. These include many pedestrian safety projects. http://www2.dot.state.fl.us/safetyprogramtracking/

- The Walk Safe program, developed and funded with funds administered by FDOT, is an elementary school based pedestrian injury prevention program. http://www.walksafe.us/. This successful program was initiated in Miami-Dade County and is now being used in other areas in Florida.

- The Florida Traffic and Bicycle Safety Program has been funded by the Safety Office for over 15 years. The mission of this program is to reduce the number and severity of injuries and deaths to children from bicycle and pedestrian crashes by training them with the knowledge and skills needed to be competent and

safe in traffic. In December of 2008, the State Board of Education approved new benchmarks that all Florida physical education teachers are required to teach their students. Walking and bicycle safety basics are now included in the benchmarks for grades K-5.

- The Florida School Crossing Guard program has been managed for over fifteen years by the Safety Office and is considered the model school crossing guard program in the nation. Even now, Florida is the only state that requires the training and certification of crossing guards in all but the most rural counties. http://www.dot.state.fl.us/Safety/ped_bike/training/ped_bike_training.shtm

- The Safety Office administers highway safety funds for education or enforcement programs intended to improve pedestrian and bicyclist safety. In the fiscal years 2003-2009, $1,355,720 went toward programs at the local level. Statewide programs received $3,797,635 during that same period. One program that has been funded for a number of years is the Florida's Pedestrian/Bicyclng Safety Resource Center http://pedbikesrc.ce.ufl.edu/. The Resource Center provides safety materials upon request to agencies and organizations throughout the state.

- The FDOT Safety Office administers the Safe Routes to School (SRTS) program. This program is designed to improve the safety, and to increase the numbers of, children walking or bicycling to school (grades K-8). Since program inception, over $49 million in infrastructure (e.g., sidewalks, bike paths, bike parking) and non-infrastructure (education/enforcement) projects have been selected. One hundred nineteen projects will provide positive impact to well over 250 schools.

- The Transportation Enhancement Program is administered by FDOT's Environmental Management Office. Pedestrian related projects are among the eligible categories

- Pedestrian countdown signals are now the standard for new or replacement pedestrian signals. This new feature allows pedestrians to know how much time is left to safely cross the street. Several local agencies throughout the state are also installing this feature.

- The Safety Office worked with the Florida Bicycle Association to initiate the ProBikeProWalk Fl. conference. This conference provides attendees with knowledge and networking opportunities to improve conditions for walking and bicycling in Florida. http://floridabicycle.org/wordpress/2009/10/call-for-papers-probikeprowalk-florida-2010-the-dollars-and-sense-of-bicycling-and-walking/

- Through the past years, the Safety Office has funded Pedestrian Law Enforcement Training to train officers on the need to and how to enforce pedestrian related traffic laws. Also, this office has funded the Pedestrian Law Enforcement Guide.
http://www.dot.state.fl.us/safety/ped_bike/brochures/pdf/Pedestrian%20LEGuide-08.pdf