



Bicycle Safety Improvement Programs: Survey of Practice

Requested by
David Cordova, Division of Design

December 15, 2017

The Caltrans Division of Research, Innovation and System Information (DRISI) receives and evaluates numerous research problem statements for funding every year. DRISI 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. The contents of this document reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the California Department of Transportation, the State of California, or the Federal Highway Administration. This document does not constitute a standard, specification, or regulation. No part of this publication should be construed as an endorsement for a commercial product, manufacturer, contractor, or consultant. Any trade names or photos of commercial products appearing in this publication are for clarity only.

Table of Contents

Executive Summary	2
Background	2
Summary of Findings	2
Gaps in Findings	7
Next Steps	7
Detailed Findings	8
Survey of Practice	8
Related Resources	21
Appendices	35

Executive Summary

Background

While the current Caltrans guide addressing bicycle safety (Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians) provides practical solutions to different types of crashes, more comprehensive guidance is needed. To address this need, the Caltrans Division of Traffic Operations is preparing to draft a bicycle safety improvement program for the agency. The new bicycle program will supplement other monitoring programs that produce reports directing traffic safety investigators to locations requiring a traffic investigation. Other related efforts within Caltrans include a scope of work in process for a research project that will likely include the development of a bicycle exposure model and a bicycle monitoring tool.

To inform development of its bicycle safety improvement program, Caltrans is seeking information about similar programs implemented by other state departments of transportation (DOTs) and local and regional transportation planning entities. Of particular interest are the criteria and practices used to assess bicycle-related collision locations, the use of countermeasures to improve bicycle safety, and other practices that promote bicycle safety.

To assist with this effort, CTC & Associates conducted an online survey to gather information about state, local and regional transportation agency practices associated with bicycle safety improvement programs. A literature search supplemented survey findings.

Summary of Findings

Survey of Practice

An online survey of members of the AASHTO Standing Committee on Highway Traffic Safety and representatives of selected local DOTs and metropolitan planning organizations gathered information about bicycle safety improvement programs that employ data and analysis to identify locations for traffic safety improvements. Fifteen agencies responded to the survey. Of these, five state DOTs (Florida, Georgia, Michigan, Minnesota and Nevada) and one local DOT (New York City) maintain a bicycle safety improvement program.

Survey results are examined in two categories in this report, beginning with agencies that maintain a bicycle safety improvement program followed by agencies without such a program.

Agencies with Bicycle Safety Improvement Programs

Project Screening and Selection

Respondents were asked about their network screening practices, the use of systemic safety tools or methodologies, and the practices used to rank or prioritize locations or projects for bicycle-related safety improvements.

Network Screening

Network screening has been defined as “the process of evaluating a network of facilities for sites likely to respond to safety improvements.” Three respondents employ network screening practices to identify locations for potential bicycle-related safety improvements:

- Michigan DOT uses simple ranking. A new bicycle risk assessment tool is in development and will determine high-risk areas across the state.
- Minnesota DOT uses a risk-based analysis.
- Nevada DOT uses road safety audits (RSAs) and safety management plans (SMPs) to identify roadway sections for possible mitigation of bicycle crashes.

Systemic Safety Tools or Methodologies

Network screening practices that identify specific locations, or “hot spots,” for potential improvement are contrasted with systemic safety tools or methodologies that are used to assess crashes occurring throughout a transportation system using systemwide crash data and engineering judgment. Three agencies are using or preparing to use this type of systemic analysis:

- Georgia DOT is using statewide crash data (all crashes and bicycle crashes) to prepare its bicycle and pedestrian safety action plan now in development.
- Michigan DOT is developing a risk assessment tool that provides a geographic information system-based risk score associated with pedestrian and bicyclist analysis zones throughout Michigan.
- Minnesota DOT’s systemic analysis of bicycle crashes considers characteristics and crash data when identifying locations in need of mitigation.

Ranking or Prioritizing Projects

All five respondents reported on procedures to rank or prioritize and select bicycle-related collision locations for traffic safety improvements:

- Georgia DOT prioritizes corridors based on the gross numbers of bicycle crashes.
- Michigan DOT identifies all high-risk locations, including those associated with bicycles, with the use of crash data, and ranks these locations based on fatalities and serious injury occurrence.
- Minnesota DOT analyzes intersections and networks for characteristics, determines which characteristics had high levels of crashes compared to the percent presence on the system, and ranks intersections based on high-risk characteristics.
- Nevada DOT uses data and analysis collected from RSAs and SMPs to determine where to make improvements.
- New York City DOT uses community requests, roadway geometry, network considerations, data analysis, ridership data and response to new opportunities to select locations for safety improvements.

Countermeasures

Tools, Methods and Procedures

Two agencies are using or developing tools to aid in the selection of countermeasures. Michigan DOT uses Roadsoft, a roadway asset management system, and AASHTOWare’s Safety Analyst to determine crash locations for further analysis. The agency’s risk assessment tool in development will enhance current practices. Minnesota DOT is developing a facility

selection tool that considers bicycle level of service, speed and average daily traffic; the tool is expected to be ready for use by fall 2018.

Other agencies rely on publications for guidance (Georgia and Nevada DOTs), or a process (Georgia DOT's RSAs and New York City DOT's street improvement process).

Other Practices Related to Countermeasures

Respondents were asked about their processes to determine how countermeasures such as bike lanes or cycle tracks will function within the greater bicycle system. Georgia and Nevada DOT respondents noted that new bikeways must integrate or align with local and regional bicycle plans and networks (Georgia DOT also uses its complete streets policy as a guide). New York City DOT "looks at connections to existing and planned routes, important destinations such as park entrances and bridges, as well as local ridership data."

A possible countermeasure to address the safety of bicyclists is to prohibit the use of bicycles on certain roadways. Minnesota and New York City DOTs do not prohibit bicycle use on any roadway. Florida, Georgia, Michigan and Nevada DOTs prohibit bicycles on limited or control of access freeways or facilities.

Countermeasure Successes

Among the countermeasure-related successes respondents highlighted are road diets that introduced a striped bike lane and center turn lane, and raised bike lanes (Georgia DOT); separated bike lanes and education programs (Michigan DOT); easing of crossings, increased yielding rates and increased separation of bicycles from traffic (Minnesota DOT); and protected bicycle lanes (New York City DOT).

Countermeasure Challenges

Respondents reported a range of challenges associated with bicycle-related countermeasures, including impacts on facilities and users (reduced parking and balancing the needs of all road users), maintenance and operations (weather-related challenges and poor infrastructure), public perception (pushback from communities related to road diets and bike lanes) and right of way (limited right of way where it is needed for separated bicycle facilities).

Other Practices

Incorporating Context Sensitive Design

Incorporating context sensitive design is a standard practice in Michigan DOT's bicycle-related design process. Minnesota DOT includes bicyclists as an integral part of the transportation system, but these road users are prioritized differently in different contexts. Nevada DOT's complete streets policy identifies facilities appropriate for adjoining land uses, and New York City DOT's bicycle-related designs are based on local conditions.

Participating in Traffic Safety Investigations

The stakeholder groups involved in respondents' traffic safety investigations of bicycle crashes include local transit providers; members of the public and local advocates; DOT staff and local agency staff with engineering, public works and planning expertise; and representatives from other state offices and agencies, including law enforcement and state highway safety offices.

Using Multidisciplinary Approaches to Improve Bicycle Safety

The “4 E’s” are defined by Federal Highway Administration (FHWA) as engineering, enforcement, education and emergency services. All five agencies employ the 4 E’s to improve bicycle safety. Below are some examples of agency practices:

- Florida DOT’s High Visibility Enforcement program funds law enforcement activities that are designed to target unsafe behaviors of motorists, pedestrians and bicyclists.
- Georgia DOT contracts with Georgia Bikes—a statewide bicycle advocacy organization—to provide bicycle education opportunities in Georgia.
- Michigan DOT produces informational brochures, pamphlets and videos, partners with law enforcement to conduct outreach, and participates in the Toward Zero Deaths campaign.
- As a Toward Zero Deaths state, Minnesota DOT uses the 4 E’s associated with that effort to inform all activities related to bicycle safety. The agency also provides engineering-related feedback and guidance to partner agencies.
- Nevada DOT’s efforts to improve bicycle safety include a state-funded education program, a complete streets policy and its Safe Routes to School program.
- New York City’s bicycle program has expanded through the collaborative efforts of the city’s DOT and Department of Health and Mental Hygiene.

Agencies Without Bicycle Safety Improvement Programs

Of the 15 agencies responding to the survey, nine state DOTs—Alabama, Delaware, Louisiana, Massachusetts, New Mexico, North Dakota, Rhode Island, South Dakota and Utah— have not developed a bicycle safety improvement program that includes criteria for data analysis and processes for selecting locations for traffic safety improvements.

Work is underway in three of these states to develop or implement a bicycle safety improvement plan or program:

- **Alabama.** The agency’s Vulnerable Road Users Guide is under development to address safety issues related to bicyclists and other vulnerable road users. Once this guidance is completed, potential bicycle-related improvements will be eligible for Highway Safety Improvement Program funding.
- **Rhode Island.** The agency will include bicycle safety in the next edition of its state highway safety program.
- **Utah.** Work is underway to improve bicycle safety as part of the agency’s active transportation efforts.

The remaining six survey respondents reported that their agencies address bicycle safety in plans, policies and studies, and by incorporating bicycle safety improvement projects into roadway projects. These agencies also conduct comprehensive crash analyses, support education and outreach efforts, and conduct RSAs specific to bicyclists.

Related Resources

Below is a summary of the key resources we identified that may inform Caltrans' efforts to develop a bicycle safety improvement program. Refer to the **Detailed Findings** section of this report for details and additional citations.

State Bicycle Safety Plans and Programs

Plans and assessments published by state DOTs identify potential countermeasures (Arizona), describe risk-based network screening (Oregon), discuss project selection (Utah), examine the use of RSAs to identify potential countermeasures (Virginia) and assess engineering challenges (Wisconsin).

Decision Support Tools and Models

National guidance includes NCHRP research projects in progress that will develop safety performance functions (SPFs) for inclusion in the Highway Safety Manual, and improve prediction models for crash types and crash severities. (FHWA defines an SPF as "an equation used to predict the average number of crashes per year at a location as a function of exposure and, in some cases, roadway or intersection characteristics (e.g., number of lanes, traffic control or median type).")

A 2013 FHWA publication presents a systemic safety project selection tool that "provides a step-by-step process for conducting systemic safety analysis." A supplemental report published by FHWA in 2016 describes use of the tool by Minnesota DOT to evaluate pedestrian and bicycle safety in urban areas.

State and local research includes an examination of SPFs (Colorado and Michigan), modeling for pedestrian and bicycle crash frequency, and a planning simulation framework that generates exposure information for crash prediction models (Florida), a review of risk factors for pedestrian and bicycle crashes that developed a risk scoring tool (Oregon), an access-based tool to predict crashes at different neighborhood levels (Tennessee), a framework for selecting and evaluating bicycle and pedestrian safety projects (Virginia), and a method to estimate pedestrian and bicycle exposure (Washington).

Countermeasures

Two NCHRP research projects in process are examining crash prediction models and intersection crash prediction methods, and a third is updating crash modification factors (CMFs) for the Highway Safety Manual. (FHWA defines a CMF as "a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site.") More information about CMFs is available through FHWA's online Crash Modification Factors Clearinghouse and documents published by the National Highway Traffic Safety Administration and FHWA that identify promising countermeasures.

Other Related Resources

Other publications address the use of the Highway Safety Manual predictive method to rank or prioritize bicycle safety projects, and examine network screening methods that identify bicycle hot spots. Planning and design guidance includes a 2016 FHWA publication that addresses design flexibility and measures to reduce conflicts between modes. State-related research considers the safety implications for bicycles in transit-oriented development (California), and design treatments for right turns at intersections with bicycle traffic (Oregon).

Gaps in Findings

Among the 15 survey respondents, only six reported on bicycle safety improvement programs. There are likely other state, regional or local transportation agencies that have developed this type of program.

Research efforts in progress will yield results of interest to Caltrans. These efforts include a risk assessment tool in development by Michigan DOT, and Minnesota DOT's facility selection tool that will consider bicycle level of service, speed and average daily traffic. Georgia DOT's bicycle and pedestrian safety action plan now in development may also inform Caltrans' plan development efforts. Various NCHRP projects in process will provide new information on intersection crash prediction methods, and update SPFs and CMFs related to bicycle safety.

Next Steps

Moving forward, Caltrans could consider:

- Reviewing the bicycle safety plans and assessments cited in this report to identify common themes.
- Examining in detail FHWA's systemic safety project selection tool, including the case study illustrating Minnesota DOT's use of the tool, to determine if the tool or elements of it may be useful to Caltrans.
- Connecting with Michigan and Minnesota DOTs after work is completed on those agencies' efforts in progress to develop new tools to improve bicycle safety.
- Contacting the respondents using RSAs to improve bicycle safety (Florida, Georgia and Nevada DOTs) to learn more about that practice.
- Consulting with the three respondents reporting plans to develop bicycle safety improvement programs (Alabama, Rhode Island and Utah DOTs).
- Reviewing the practices of agencies not responding to the survey to identify any areas of interest to Caltrans, including:
 - Oregon DOT's Pedestrian and Bicycle Risk Scoring Tool.
 - Tennessee DOT's access-based tool that predicts the expected number of crashes at different neighborhood levels.
 - Virginia DOT's implementation of Strategically Targeted Affordable Roadway Solutions (STARS), which uses RSAs to identify high-crash locations.

Detailed Findings

Survey of Practice

Survey Approach

Members of the AASHTO Standing Committee on Highway Traffic Safety and representatives of selected local departments of transportation (DOTs) and metropolitan planning organizations received an online survey about bicycle safety improvement programs that employ data and analysis to identify locations for traffic safety improvements. The survey examined the agencies' use of screening and selection tools and methods, countermeasures and other practices related to bicycle safety improvement programs.

[Appendix A](#) provides the full text of the survey questions.

Summary of Survey Results

Fifteen agencies responded to the survey—14 state DOTs and one local DOT:

- Alabama.
- Delaware.
- Florida.
- Georgia.
- Louisiana.
- Massachusetts.
- Michigan.
- Minnesota.
- Nevada.
- New Mexico.
- New York City.
- North Dakota.
- Rhode Island.
- South Dakota.
- Utah.

[Appendix B](#) provides the full text of survey responses.

Survey results are examined in two categories in this report, beginning with agencies that maintain a bicycle safety improvement program followed by agencies without such a program.

Agencies with Bicycle Safety Improvement Programs

Of the 15 agencies responding to the survey, five state DOTs (Florida, Georgia, Michigan, Minnesota and Nevada) and one local DOT (New York City) maintain a bicycle safety improvement program that includes criteria for data analysis and processes for selecting locations for traffic safety improvements.

Below is a summary of survey responses in the following topic areas:

- Project screening and selection.
- Countermeasures.
- Other practices.

Project Screening and Selection

Respondents were asked about their network screening practices, the use of systemic safety tools or methodologies, and the practices used to rank or prioritize locations or projects for bicycle-related safety improvements.

Network Screening

AASHTO defines network screening as “the process of evaluating a network of facilities for sites likely to respond to safety improvements” (see <http://www.highwaysafetymanual.org/Documents/HSMP-1.pdf>). Only three respondents provided information about their network screening practices to identify locations for potential bicycle-related safety improvements:

- Michigan DOT uses simple ranking. A new bicycle risk tool that models risk is in development and will determine high-risk areas across the state.
- Minnesota DOT uses a risk-based analysis.
- Nevada DOT uses road safety audits (RSAs) and safety management plans (SMPs) to identify roadway sections for possible mitigation of bicycle crashes.

None of these agencies use segmentation criteria in connection with their network screening efforts. The New York City DOT respondent reported that network screening methods are not used.

Systemic Safety Tools or Methodologies

The survey asked respondents about their agencies’ use of systemic safety tools or methodologies. These tools or practices are used to assess crashes occurring throughout a transportation system using systemwide crash data and engineering judgment. This approach differs from network screening processes that assist in identifying specific locations, or “hot spots,” for potential improvement.

Three agencies reported using systemic safety tools or methodologies to address bicycle safety:

- Georgia DOT is using statewide crash data (all crashes and bicycle crashes) to prepare its bicycle and pedestrian safety action plan now in development (see [Appendix C](#)). Hot spot corridors and predominant crash types are also identified.
- Michigan DOT is developing a risk assessment tool that will aid in identifying high-risk areas across the state. When the research project producing the tool wraps up in February 2018, the agency will consider how to release the tool and prepare for statewide use.

The respondent provided this description of the risk assessment tool in development:

MDOT has completed the research project Developing Michigan Pedestrian and Bicycle Safety Models. This research developed a GIS [geographic information system]-based risk score for all of Michigan for pedestrian and bicyclists. Past and current efforts to understand pedestrian and bicycle behavior ha[ve] relied heavily on crash data. We know that fatalities and serious injuries are random within this field and this research looked at developing a more robust way to analyze and treat areas o[f] concern.

UMTRI [University of Michigan Transportation Research Institute] researchers developed an exposure model using census data, MI [Travel] Counts data, travel demand forecasting, etc., as one layer of this model. Additional layers include crash data, land use considerations, geometric aspects of the roadway, roadway volumes, speed data, crime data, etc. These layers were compiled, weighted and a risk score

assigned to small Pedestrian Analysis Zones [PAZs]. These PAZs are all mapped and color-coded to help practitioners focus on areas that could realize the greatest benefits with countermeasure installations. This gives us a tool that incorporates but doesn't focus solely on crash data, and lets us see areas of risk, allowing for more systemic applications to address pedestrian and bicycle safety.

Related Resource:

Research in Progress: Developing Michigan Pedestrian and Bicycle Safety Models, Michigan Department of Transportation, start date: March 2016, expected completion date: February 2018.

<http://www.atlas-center.org/wp-content/uploads/2015/08/UTC-Project-Information-Form-Hampshire.pdf>

From the document: The project objectives are

1. Document and learn from existing research on modeling/mapping pedestrian/bicycling safety areas.
 2. Gather new data on how to model/map ped/bike crashes in Michigan.
 3. Analyze this data in order to produce a model/mapping tool that best determines locations in Michigan that could benefit from ped/bike crash countermeasure installations.
 4. Report out methodology and results of this analysis.
 5. Produce a dataset for use in a GIS tool.
- Minnesota DOT's systemic analysis of bicycle crashes that considers characteristics and crash data is discussed in more detail below.

Ranking or Prioritizing Projects

Five agencies reported on their procedures to rank or prioritize and select bicycle-related collision locations for traffic safety improvements:

- Georgia DOT prioritizes corridors based on the gross numbers of bicycle crashes. The agency's current lack of bicyclist traffic volume data has prompted the use of what the respondent describes as a "simplistic method."
- Michigan DOT identifies all high-risk locations, including those associated with bicycles, based on crash data, and ranks these locations based on fatalities and serious injury occurrence. Locations with fatalities and serious injuries are considered for countermeasure implementation.
- Minnesota DOT analyzes intersections and networks for characteristics, determines which characteristics had high levels of crashes compared to the percent presence on the system, and ranks intersections based on five or six high-risk characteristics (more characteristics lead to a higher ranking). The agency does not use a weighted method although may in the future. To further fine-tune this approach, Minnesota DOT plans to overlay this ranking process with a needs-based analysis.

A December 2016 Federal Highway Administration (FHWA) publication provides details about Minnesota DOT's systemic analysis of bicycle crashes. Tables and graphs are

used to illustrate each step in the analysis process (see page 26 of this report for the citation to this FHWA publication):

Step 1: Identify focus crash types and risk factors.

Task 1: Select focus crash types. Identify the high-priority emphasis area—categories of severe crashes that represent the greatest opportunity for reduction.

Task 2: Select focus facilities. Identify where crash types most frequently occur.

Task 3: Identify and evaluate risk factors. Identify roadway characteristics to use as initial set of potential risk factors to be further evaluated for use in systemic network screening.

Step 2: Screen and prioritize candidate locations.

Tasks 1 through 3: Prioritize focus facility elements. Evaluate the risk factors of the systems and locations selected for analysis using roadway and traffic characteristics in order to rank/prioritize at-risk locations.

Step 3: Select countermeasures.

Task 1: Assemble an initial comprehensive list of countermeasures.

Task 2: Evaluate and screen the initial list to identify feasible countermeasures for implementation.

Task 3: Select countermeasures for deployment. Identify and select countermeasures for each focus crash type based on the evaluation of the countermeasures and consideration of agency priorities, practices and policies.

Step 4: Prioritize projects.

Task 1: Create a decision process for countermeasure selection. Develop a decision process to facilitate consistency in the selection of countermeasures.

Tasks 2 and 3: Develop and prioritize safety projects.

- Nevada DOT uses data and analysis collected from RSAs and SMPs to identify locations as they relate to bicycle crashes to determine where to make improvements.
- New York City DOT uses a combination of criteria to select locations, including community requests, roadway geometry, network considerations, data analysis, ridership data and response to new opportunities.

Countermeasures

Respondents addressed a range of topics associated with the use of countermeasures (actions expected to result in a reduction of crashes), including:

- Tools, methods and procedures.
- Treatment of new bikeways.
- Limitations on bicycle use.
- Countermeasure successes.

- Countermeasure challenges.

Tools, Methods and Procedures

The following summarizes respondents' descriptions of the tools, methods and procedures their agencies use to select countermeasures:

- Georgia DOT conducts an RSA and/or prepares a Traffic Engineering Report. To determine the most appropriate countermeasures, the agency consults the Highway Safety Manual, Crash Modification Factors Clearinghouse and other FHWA publications. (See page 29 of this report for information about the Crash Modification Factors Clearinghouse and other publications related to countermeasures.)
- Michigan DOT uses Roadsoft and AASHTOWare's Safety Analyst to determine crash locations for further analysis (including locations with bicycle fatalities and serious injuries). After reviewing crash data, the agency selects countermeasures to improve safety based on the crash pattern, geometry of the roadway and other factors. Each countermeasure is specific to the location reviewed.

A new exposure model in development will include an overlay of crash data, geometric features, land use variables and other factors to determine high-risk areas for bicyclists and pedestrians. The new model is expected to focus efforts on implementing countermeasures with a robust range of information, not just crash data.

Related Resources:

AASHTOWare Safety Analyst: Safety Analyst Overview, American Association of State Highway and Transportation Officials, undated.

<http://www.safetyanalyst.org>

From the web site: Safety Analyst implements state-of-the-art analytical procedures for use in the decision-making process to identify and manage a systemwide program of site-specific improvements to enhance highway safety by cost-effective means.

Roadsoft: Roadway Asset Management, Center for Technology and Training, Michigan Technological University, undated.

<https://roadsoft.org>

From the web site: Roadsoft is a roadway asset management system for collecting, storing and analyzing data associated with transportation infrastructure. Built on an optimum combination of database engine and GIS [geographic information system] mapping tools, Roadsoft provides a quick, smooth user experience and almost unlimited data handling capabilities.

- Minnesota DOT is developing a new bicycle design manual that will include a facility selection tool based on bicycle level of service, speed and average daily traffic. Completion of the facility selection tool and the full bicycle design manual is expected by fall 2018.
- Nevada DOT does not use a formal tool to select countermeasures, instead relying on AASHTO and National Association of City Transportation Officials publications for guidance.

- Rather than using a tool, New York City DOT employs a process to select street improvement projects (see [Appendix D](#)). The first step of the process is to identify potential projects using data and analysis, requests from community sources and responses to new opportunities.

Treatment of New Bikeways

Respondents were asked about their processes to determine how countermeasures such as bike lanes or cycle tracks will function within the greater bicycle system. Georgia and Nevada DOT respondents noted that new bikeways must integrate or align with local and regional bicycle plans and networks (Georgia DOT also uses its complete streets policy as a guide). New York City DOT “looks at connections to existing and planned routes, important destinations such as park entrances and bridges, as well as local ridership data.”

Limitations on Bicycle Use

A possible countermeasure to address the safety of bicyclists is to prohibit the use of bicycles on certain roadways. Minnesota and New York City DOTs do not prohibit bicycle use on any roadway. Florida, Georgia, Michigan and Nevada DOTs prohibit bicycles on limited or control of access freeways or facilities.

Countermeasure Successes

The following summarizes the successes reported by respondents when using countermeasures to improve bicycle safety:

- Georgia DOT has worked with the city of Atlanta to leverage several resurfacing projects to include road diets. One project is an interim resurfacing project that eliminated two travel lanes and introduced striped bike lanes and a center turn lane. A future project will convert striped bike lanes to raised bike lanes and the center median to medianettes and turn lanes.
- Michigan DOT has installed bike lanes and more recently, separated bike lanes. The agency has also funded a major city’s bicycle education program about bicycle safety that has shown successful market message penetration. While the agency has identified significant decreases in fatal and serious injury crashes, it is not known if the decreases are directly related to the education program.
- Minnesota DOT’s successes have been at local level and include easing of crossings, increased yielding rates and increased separation of bicycles from traffic. The agency lacks significant before-and-after safety data, but crash numbers have been fairly stable over the last 10 years.
- Nevada DOT has completed numerous complete streets projects and site-specific accommodations.
- New York City DOT’s efforts in the last 10 years have resulted in a much safer bicycling environment for New York City cyclists. The respondent highlights protected bicycle lanes as one particularly successful countermeasure.

Countermeasure Challenges

Respondents were asked to identify any challenges they have encountered when using countermeasures to improve bicycle safety. The table below summarizes responses.

Challenges in Implementing Countermeasures		
Type of Challenge	Agency	Description
Agency policy	Georgia	Desire to prioritize motor vehicle traffic volumes and speeds.
Data	Georgia	Underreporting of bicycle crash data.
	Minnesota	Lack of ridership data.
	Minnesota	Lack of understanding of demand.
Impacts on facilities and users	Minnesota	Parking reduction challenges.
	Minnesota	Perceived “loss” of road space by motorized vehicle drivers.
	Nevada	Parking priorities.
	New York City	Balancing the needs of all road users within constrained geometries.
Maintenance and operations	Michigan	Difficulty in maintaining and operating facilities because of severe weather (including snow for many months of the year).
	Minnesota	Difficulty in maintaining facilities (snow presents a significant challenge).
	Minnesota	Poor infrastructure that prevents riding.
Public perception	Michigan	Pushback from the community on issues like road diets and bike lanes.
	Nevada	Local acceptance.
Right of way	Georgia	Limited existing right of way (ROW).
	Michigan	Limited ROW in the downtown areas where separated bicycle facilities would improve safety.
	Nevada	Inadequate ROW.

Other Practices

Respondents were asked to describe other agency practices related to their bicycle safety improvement programs, including:

- Incorporating context sensitive design.
- Participating in traffic safety investigations.
- Using multidisciplinary approaches to improve bicycle safety.

Incorporating Context Sensitive Design

Four agencies reported incorporating context sensitive design into their bicycle safety improvement programs:

- Michigan DOT incorporates context early and often as a standard practice in the agency’s design process. Bicycle facilities are incorporated into a design based on specific area needs.
- Minnesota DOT’s context sensitive design and complete streets policies address land use and needs. Bicyclists are included as an integral part of the transportation system, but they are prioritized differently in different contexts.
- Nevada DOT’s complete streets policy identifies facilities appropriate for adjoining land uses.
- New York City DOT’s bicycle-related designs are based on local conditions.

Participating in Traffic Safety Investigations

Respondents were asked to describe the stakeholder groups involved in traffic safety investigations associated with bicycle crashes. The table below summarizes survey responses.

Stakeholders Participating in Traffic Safety Investigations		
Stakeholder Group	Agency	Type of Participation
Local transit providers	Georgia	N/A
Members of the public and local advocates	Georgia, Michigan, Minnesota	N/A
Staff	Florida, Georgia, Nevada	State DOT staff members participate in RSAs and studies.
	Georgia, Michigan, Minnesota	Local staff members with engineering, public works and planning expertise participate in traffic safety investigations.
State offices or agencies	Florida	State highway safety offices identify crash locations and provide crash analysis and data integration.
	Florida	The state’s Department of Health provides information related to risk assessment and injury prevention.
	Florida	The state’s Department of Highway Safety and Motor Vehicles provides crash reports and data dissemination via FIRES. ¹
	Georgia, Minnesota, New York City	Law enforcement agencies provide crash reports.

¹ FIRES, or Florida’s Integrated Report Exchange System, is available at <https://www.firesportal.com/>. FIRES was “developed and maintained by LexisNexis, Inc. on behalf of the Florida Department of Highway Safety and Motor

Vehicles. It serves as a portal into the State of Florida's repository for traffic crash reports completed by Florida law enforcement agencies."

Using Multidisciplinary Approaches to Improve Bicycle Safety

Respondents were asked if their agencies use a multidisciplinary approach to improve bicycle safety. An example of such an approach is application of the "4 Es," defined by FHWA as engineering, enforcement, education and emergency services. The following summarizes survey responses:

- Florida DOT partners engineers with law enforcement personnel to conduct RSAs, which allows for a discussion of countermeasure selection based on roadway criteria and public behavior. The agency also combines paid and earned media with enforcement efforts.

The agency's High Visibility Enforcement program, which is described as a "traffic safety approach designed to create deterrence and change unlawful traffic behaviors," funds law enforcement activities that are designed to target unsafe behaviors of all road users, including motorists, pedestrians and bicyclists. Florida DOT intends these funds to serve as a crash mitigation tool.

Related Resource:

High Visibility Enforcement: High Visibility Enforcement for Pedestrian and Bicycle Safety, Florida Department of Transportation, 2016.

<http://www.alerttodayflorida.com/hve.html>

From the web site: Crashes involving pedestrians and bicyclists are more likely to result in fatal or serious injuries than any other types of crashes, and the financial impacts and suffering caused by these crashes are significant. As a result, the Florida Department of Transportation (FDOT) is looking to supplement ongoing educational campaigns with high visibility enforcement operations in the most needed locations. FDOT now has funding available for law enforcement agencies to conduct High Visibility Enforcement operations for pedestrian and bicyclist safety.

- Georgia DOT contracts with Georgia Bikes—a statewide bicycle advocacy organization—to provide bicycle education opportunities in Georgia. This includes educating engineers, citizens and police officers about bicycle safety.

Related Resource:

Georgia Bikes, undated.

<https://georgiabikes.org/>

The mission of this nonprofit organization is to "improve bicycling conditions and promote bicycling throughout the state of Georgia."

- Michigan DOT produces informational brochures, pamphlets and videos to help educate the public about facilities that the state constructs (bike facilities, roundabouts and diverging diamond interchanges). The agency has also partnered with law enforcement to conduct outreach and participates in the Toward Zero Deaths campaign.

Related Resource:

Toward Zero Deaths: Safety Fact Sheet, Michigan Department of Transportation, undated.

http://www.michigan.gov/documents/mdot/TZD_Safety_Fact_Sheet_495542_7.pdf

This fact sheet describes progress associated with Michigan DOT's statewide Toward Zero Deaths safety campaign.

- As a Toward Zero Deaths state, Minnesota DOT uses the 4 Es associated with that effort to inform all activities related to bicycle safety. The agency also provides engineering-related feedback and guidance to partners that include the departments of public safety and health and other law enforcement personnel. The agency's education campaign for bicyclists is currently being revamped.

Related Resources:

Toward Zero Deaths: Minnesota, Center for Transportation Studies, University of Minnesota, 2017.

<http://www.minnesotatzd.org>

From the web site: The Toward Zero Deaths approach is based on the belief that even one traffic-related death on our roads is unacceptable. This "zero deaths" idea was first adopted in Sweden in 1997 as "Vision Zero" and since then has evolved to several state DOTs, including Minnesota, that have identified zero deaths as a core objective in their Strategic Highway Safety Plans.

TZD uses a data-driven, interdisciplinary approach that targets areas for improvement and employs proven countermeasures, integrating application of education, enforcement, engineering, and emergency medical and trauma services (the "4Es"). A combination of strategies from different focus areas is often most effective for solving a particular problem.

Statewide Bicycle System Plan: MnDOT's Vision for Bicycling in Minnesota, Minnesota Department of Transportation, undated.

<https://www.dot.state.mn.us/bike/system-plan/pdfs/role-5es.pdf>

This two-page document describes Minnesota DOT's application and extension of the 4 E's with regard to bicycle safety. *From the document:*

MnDOT's role in Minnesota's bicycle system involves planning and the 5E's—engineering, education, evaluation, encouragement and enforcement. The goal is to bring the agency to a common vision for bicycling in Minnesota, and concurrently to an understanding within the agency and with external partners of its role in bicycling.

- Nevada DOT's efforts to improve bicycle safety include a state-funded education program, a complete streets policy and the Safe Routes to School program.

Related Resource:

BicycleNevada: Nevada's Source for Bicycling Information, Nevada Department of Transportation, undated.

<https://www.nevadadot.com/mobility/bicycle>

This web site provides information about education-related efforts associated with bicycling, including the agency's Bicycle and Pedestrian Education Program.

- New York City's bicycle program began in the mid-1990s and has expanded through the collaboration and commitment of the city's DOT and Department of Health and Mental Hygiene. Researchers, designers, engineers, law enforcement and local government contribute to the program's ongoing success.

Related Resources:

Protected Bicycle Lanes in NYC, New York City Department of Transportation, September 2014.

<http://www.nyc.gov/html/dot/downloads/pdf/2014-09-03-bicycle-path-data-analysis.pdf>

From the overview: Since 2007, the New York City Department of Transportation has installed over 30 miles of protected bicycle lanes throughout the city, including several parking protected bicycle lanes on various avenues in Manhattan. The following report contains an analysis of how some of these Manhattan routes have impacted safety, mobility and economic vitality. Routes were chosen for inclusion if they had at least three years of "after" safety data available.

Cycling in the City: Cycling Trends in NYC, New York City Department of Transportation, January 2017.

<http://www.nyc.gov/html/dot/downloads/pdf/cycling-in-the-city.pdf>

From the document: This Cycling in the City brief sees to answer two basic questions:

- How frequently are New Yorkers using cycling as a mode of transportation?
- How is that frequency changing over time?

Agencies Without Bicycle Safety Improvement Programs

Of the 15 agencies responding to the survey, nine state DOTs—Alabama, Delaware, Louisiana, Massachusetts, New Mexico, North Dakota, Rhode Island, South Dakota and Utah— have not developed a bicycle safety improvement program that includes criteria for data analysis and processes for selecting locations for traffic safety improvements.

Work is underway in three of these states to develop or implement a bicycle safety improvement plan or program:

- **Alabama.** The agency is developing the Vulnerable Road Users Guide to address safety issues related to bicyclists and other vulnerable road users. Once this guidance is completed, potential bicycle-related improvements will be eligible for Highway Safety Improvement Program (HSIP) funding.
- **Rhode Island.** The agency will include bicycle safety in the next edition of its state highway safety program.

- **Utah.** Work is underway to improve bicycle safety as part of the agency's active transportation efforts. State fatality numbers are higher for pedestrians than bicyclists, which has led the agency to focus more recently on pedestrian safety efforts.

Current Practices

The table below summarizes the current bicycle safety improvement practices of the six responding agencies that do not maintain a formalized bicycle safety improvement program.

Current Practices of Agencies Without Bicycle Safety Improvement Programs		
Type of Practice	State DOT	Description
Plans, policies and studies	Louisiana	In addition to implementing a complete streets policy, the agency is: <ul style="list-style-type: none"> • Reviewing policies and guidance related to signage and bicycle facility design. • Funding several bicycle and pedestrian master plans. • Working on feasibility studies for locations identified in the 2014 New Orleans Pedestrian Safety Action Plan, which includes bicycle-related components.¹
	Massachusetts	Updates to two agency plans are anticipated or underway: <ul style="list-style-type: none"> • The current statewide bicycle plan, which includes a section on safety. • The Strategic Highway Safety Plan (SHSP), which will include bicyclist safety as one of its emphasis areas. Work on this update began recently.
	New Mexico	Bicycle safety is included as part of the SHSP. Projects applying for HSIP funds are expected to address bicycle and pedestrian safety improvements as part of any safety-funded project.
Roadway projects	Delaware	Bicycle safety improvements are incorporated into all projects on an as-needed basis.
	Louisiana	The agency funds infrastructure improvements for data-driven bicycle and pedestrian projects through Safe Routes to Public Places, Safe Routes to Schools legacy projects and Local Road Safety Program projects; improvements associated with HSIP projects are included where appropriate.
	Massachusetts	The agency's 2013 Healthy Transportation Policy Directive ² requires integration of bicycle activity into all roadway projects.

Current Practices of Agencies Without Bicycle Safety Improvement Programs

Type of Practice	State DOT	Description
Comprehensive crash analysis	North Dakota	The crash analysis used to determine safety improvements must consider all road users, including pedestrians and bicycles.
Education and outreach	Massachusetts	The agency recently developed and released a bicyclist and pedestrian safety campaign, Scan the Street for Wheels and Feet. ³
	North Dakota	Funds have been designated for media campaigns for motorist and bicyclist awareness and bicycle safety training in local schools.
Legislation	South Dakota	A recent law requires vehicles to have at least 6 feet of separation from bicycles.
RSAs specific to bicyclist safety	Massachusetts	N/A

1 See the July 2014 City of New Orleans Pedestrian Safety Action Plan, Part 1: Engineering Strategies, available at <http://norpc.org/assets/pdf-documents/studies-and-plans/CNO%20PSAP%20-%20Final%20Report%20July%202014.pdf>.

2 See the September 2013 Massachusetts DOT Healthy Transportation Policy Directive, available at <https://www.massdot.state.ma.us/Portals/0/docs/GreenDOT/DirectiveHealthyTransportation.pdf>.

3 See details about the Scan the Street for Wheels and Feet campaign at <https://blog.mass.gov/transportation/massdot-highway/massdot-scan-the-street-for-wheels-and-feet-bicycle-and-pedestrian-safety-campaign/>.

Related Resources

The resources that follow are organized in these categories:

- State bicycle safety plans and programs.
- Decision support tools and models.
- Countermeasures.
- Ranking or prioritizing projects.
- Network screening.
- Planning and design.

State Bicycle Safety Plans and Programs

Arizona

ADOT Bicycle Safety Action Plan, Arizona Department of Transportation, September 2012.
http://apps.azdot.gov/ADOTLibrary/Multimodal_Planning_Division/Bicycle-Pedestrian/Bicycle_Safety_Action_Plan-1209.pdf

This action plan identified priority locations “that were analyzed in more detail to identify potential countermeasures that could be considered at each location. The FHWA BIKESAFE Bicycle Crash Countermeasure Selection System was used to assist in the identification of potential countermeasures.” Potential countermeasures for each priority location appear in Appendix B1, which begins on page 112 of the PDF.

Michigan

Michigan Pedestrian and Bicycle Safety Action Plan 2013-2016, Michigan Department of Transportation, September 2013.

http://www.michigan.gov/documents/msp/Ped_Bike_Action_Plan_September_2013_Reviewed_09232013_CK_440777_7.pdf

This is Michigan DOT’s current plan, which will be updated for 2018 in the coming months. A more significant update will occur in conjunction with the agency’s 2019-2022 SHSP update.

Minnesota

Statewide Bicycle System Plan: Executive Summary, Minnesota Department of Transportation, August 2016.

<https://www.dot.state.mn.us/bike/system-plan/pdfs/statewide-bicycle-system-plan.pdf>

This plan does not address in detail the screening methods or countermeasures used to examine or improve bicycle-related collision locations.

The introduction to Chapter 8, Measuring Performance (beginning on page 73 of the plan, page 87 of the PDF), notes that Minnesota DOT “uses performance measures to evaluate achievement toward agency goals. The 2012 Statewide Bicycle Planning Study (Study) recommended that the Statewide Bicycle System Plan identify measures that demonstrate the level of success achieved by implementing plans, programs and investments that support bicycling. The Study identified three key areas of performance that should be measured: ridership, safety and assets.”

Safety-related measures include:

- Annual bicycle-vehicle crashes (see page 77 of the plan, page 91 of the PDF).
- Projects that address bicycling needs (see page 79 of the plan, page 93 of the PDF).

Oregon

ODOT Pedestrian and Bicycle Safety Implementation Plan, Oregon Department of Transportation, February 2014.

<https://digital.osl.state.or.us/islandora/object/osl%3A41999/datastream/OBJ/download/Plan.pdf>

This document includes plans and appendices that address issues related to improving bicycle safety, including:

- Risk-based network screening (see page 69 of the plan, page 77 of the PDF).
- Segment prioritization and candidate project corridor identification (see page 73 of the plan, page 81 of the PDF).
- Crash frequency and severity network screening (see page 74 of the plan, page 82 of the PDF).
- Countermeasure options (see page 77 of the plan, page 85 of the PDF).
- Improving the plan (see page 84 of the plan, page 92 of the PDF).

Utah

State Bicycle Plan: Bicycle Facility Gap Analysis and Utah Collaborative Active Transportation Study, Utah Department of Transportation, 2014.

<https://www.udot.utah.gov/main/uconowner.gf?n=16746106523524233>

This plan “provides an overview of the Bicycle Facility Gap Analysis methodology used to identify gaps or road segments with insufficient conditions for bicycle travel.” The project selection process is addressed on page 11 of the plan (page 19 of the PDF).

Virginia

State Bicycle Policy Plan, Virginia Department of Transportation, September 2011.

http://www.virginiadot.org/programs/resources/bike/VDOT_Bicycle_Policy_Plan.pdf

From page 19 of the plan (page 20 of the PDF): VDOT’s Transportation and Mobility Planning Division has implemented the Strategically Targeted Affordable Roadway Solutions (STARS) program. STARS is a safety and operational analysis program that utilizes Road Safety Assessments (RSAs) to identify high crash locations and provide targeted engineering countermeasures. VDOT is using the RSA process in an effort to decrease the number of severe crashes by identifying existing and potential safety issues and providing recommended physical improvements. The RSA process can also be used to identify areas with high bicycle crash rates and to identify potential bicycle-specific countermeasures.

Related Resource:

STARS, Virginia Department of Transportation, February 2016.

<http://www.virginiadot.org/projects/resources/2016PlanningProgramming/STARS-handout-Feb2016-v5.pdf>

From the document: The objective of the STARS (Strategically Targeted Affordable Roadway Solutions) Program is to develop comprehensive and innovative transportation

solutions to relieve congestion bottlenecks and solve critical traffic and safety challenges throughout the Commonwealth.

The program, which is led by the VDOT Transportation and Mobility Planning Division, brings together planners, traffic engineers, safety engineers, roadway design engineers and maintenance specialists with local stakeholders to jointly identify cost-effective measures aimed at improving safety and reducing congestion. This multidisciplinary approach, from a project's inception through completion, helps to:

- Develop innovative, cost-effective solutions.
- Evaluate potential solutions more thoroughly.
- Identify potential project risks and costs.
- Build stakeholder consensus.
- Improve readiness for project implementation.

Wisconsin

Pedestrian and Bicycle Safety Program Assessment, State of Wisconsin, April 2016.

<http://wisconsindot.gov/Documents/safety/education/pedestrian/ped-bike-prog.pdf>

From the introduction:

This report reflects the information received from the State and testimonials of those interviewed in response to the Uniform Guidelines for State Highway Safety Programs, Highway Safety Program Guideline No. 14 Pedestrian and Bicycle Safety.

A discussion of highway and traffic engineering, which begins on page 23 of the report, examines crash data availability and analysis, engineering policy and design guidance, engineering challenges, traffic calming and RSAs. A series of recommendations is also provided.

Decision Support Tools and Models

National Guidance

Research in Progress: Pedestrian and Bicycle Safety Performance Functions for the Highway Safety Manual, NCHRP Project 17-84, start date: March 2017, expected completion date: March 2019.

Project description at <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4203>

From the project description: The objective of this research is to develop pedestrian and bicycle safety performance functions (SPFs) using risk-based or predictive methods, for transportation practitioners at all levels to better inform planning, design, and operations decisions. The results of the research will be used to update the Highway Safety Manual (HSM) and associated tools. The research to inform pedestrian and bicycle performance-based decisions can be independent from each other, but should recognize the intermodal relationships.

Research in Progress: Improved Prediction Models for Crash Types and Crash Severities, NCHRP Project 17-62, start date: July 2013, expected completion date: December 2017.

Project description at <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3420>

From the project description: The objectives of this research are to develop:

1. Crash severity and crash type SPFs or distributions or both that can be used in the estimation of the crash type and crash severity likely on the facility types contained or intended for use in the HSM [Highway Safety Manual];
2. Recommendations of how the research results can be incorporated into the HSM and associated tools, including the development of associated chapters or chapter content in AASHTO standard format for the HSM second edition and recommended procedures for consistent use of crash severity and crash type SPFs or distributions or both; and
3. A description of the statistical and practical advantages and disadvantages of the methodology developed in the research and potential barriers to implementation.

Systemic Safety Project Selection Tool, Howard Preston, Richard Storm, Jacqueline Dowds Bennett and Beth Wemple, Federal Highway Administration, July 2013.

<https://safety.fhwa.dot.gov/systemic/fhwasa13019/sspst.pdf>

From the abstract:

The Systemic Safety Project Selection Tool presents a process for incorporating systemic safety planning into traditional safety management processes. The Systemic Tool provides a step-by-step process for conducting systemic safety analysis; considerations for determining a reasonable distribution between the implementation of spot safety improvements and systemic safety improvements; and a mechanism for quantifying the benefits of safety improvements implemented through a systemic approach. The tool is intended for use by transportation safety practitioners in state, county and local government agencies to plan, implement and evaluate systemic safety improvement programs and projects that best meet their capabilities and needs.

See page 26 of this report for a December 2016 FHWA publication that applies the systemic safety project selection tool to bicycle and pedestrian crashes.

State and Local Research

Colorado

“Bicycle Safety Performance Functions for a U.S. City,” Kirsta Nordback, Wesley E. Marshall and Bruce N. Janson, *Accident Analysis and Prevention*, Vol. 65, pages 114-122, April 2014.

Citation at <http://www.sciencedirect.com/science/article/pii/S0001457513005137>

From the abstract: Efforts have intensified to apply a more evidence-based approach to traffic safety. One such effort is the Highway Safety Manual, which provides typical safety performance functions (SPFs) for common road types. SPFs model the mathematical relationship between frequency of crashes and the most significant causal factors.

Unfortunately, the manual provides no SPFs for bicyclists, despite disproportionately high fatalities among this group. In this paper, a method for creating city-specific, bicycle SPFs is presented and applied to Boulder, Colorado. This is the first time a bicycle SPF has been created for a U.S. city. Such functions provide a basis for both future investigations into safety treatment efficacy and for prioritizing intersections to better allocate scarce funds for bicycle

safety improvements. As expected, the SPFs show that intersections with higher bicyclist traffic and higher motorist traffic have higher motorist-cyclist collisions. The SPFs also demonstrate that intersections with more cyclists have fewer collisions per cyclist, illustrating that cyclists are safer in numbers. Intersections with fewer than 200 entering cyclists have substantially more collisions per cyclist.

Florida

“Joint Modeling of Pedestrian and Bicycle Crashes: Copula-Based Approach,” Tammam Nashad, Shamsunnahar Yasmin, Naveen Eluru, Jaeyoung Lee and Mohamed A. Abdel-Aty, *Transportation Research Record 2601*, pages 119-127, 2016.

Citation at <http://dx.doi.org/10.3141/2601-14>

From the abstract: The presented research developed a multivariate model by adopting a copula-based bivariate negative binomial model for pedestrian and bicycle crash frequency analysis. The proposed approach accommodates potential heterogeneity (across zones) in the dependency structure. The formulated models were estimated with pedestrian and bicycle crash count data at the statewide traffic analysis zone level for the state of Florida for 2010 through 2012. The statewide traffic analysis zone level variables considered in the analysis included exposure measures, socioeconomic characteristics, road network characteristics and land use attributes. A policy analysis was conducted—along with a representation of hot spot identification—to illustrate the applicability of the proposed model for planning purposes. The development of such spatial profiles allows planners to identify high-risk zones for screening and subsequent treatment identification.

Enhancing Non-Motorized Safety by Simulating Non-Motorized Exposure Using a Transportation Planning Approach, Naveen Eluru, Shamsunnahar Yasmin, Tanmoy Bhowmick and Moshir Rahman, Safety Research Using Simulation University Transportation Center, June 2016.

http://safersim.nads-sc.uiowa.edu/final_reports/UCF%201%20Y3_FinalReport.pdf

From the abstract: The current research effort is focused on developing a transportation planning simulation framework to generate exposure information for crash prediction models. Specifically, the research effort is focused on evaluating non-motorist exposure measures in terms of demand at a planning level. ... The proposed research approach recognizes that non-motorized safety is affected by vehicular volumes and non-motorized activity at a macro-level in the urban region. The vehicular and non-motorized exposure measures are generated to enhance the vulnerable road user crash prediction models. In identifying non-motorist exposure measures, the authors develop aggregate-level demand models to identify critical factors contributing to non-motorist generators and attractors at a zonal level. In evaluating non-motorist safety, the authors estimate four different aggregate level models: (1) zonal-level crash count model for examining pedestrian-motor vehicle crash occurrences, (2) zonal-level crash count model for examining bicycle-motor vehicle crash occurrences, (3) zonal-level crash severity model for examining pedestrian crash injury severity by proportions, and (4) zonal-level crash severity model for examining bicycle crash injury severity by proportions.

Michigan

Development of Safety Performance Functions and Other Decision Support Tools to Assess Pedestrian and Bicycle Safety, Timothy J. Gates, Peter T. Savolainen, Steven Stapleton, Trevor Kirsch and Santosh Miraskar, Transportation Research Center for Livable Communities, September 2016.

http://www.wmich.edu/sites/default/files/attachments/u883/2016/TRCLC_14_06_Report.pdf

From the recommendations (page vi of the report, page 9 of the PDF): The SPF models provided here give a general starting point for pedestrian and bicycle safety analyses. Perhaps the greatest limitation to prediction of pedestrian and bicyclist crashes, including those developed here, is the lack of reliable exposure data to represent the amount of pedestrian or bicyclist activity on a given segment or intersection. Future programs by transportation agencies or researchers should be aimed at collecting such exposure data for non-motorized users, in addition to motor vehicle traffic volumes.

Minnesota

Systemic Safety Project Selection Tool: Supplemental Case Studies, Federal Highway Administration, December 2016.

<https://safety.fhwa.dot.gov/systemic/pdf/fhwas17002.pdf>

This publication complements the July 2013 FHWA report Systemic Safety Project Selection Tool. (See page 24 of this report for the citation to the July 2013 report.) *From the introduction:* The purpose of this supplement is to demonstrate the application of the systemic safety planning process for these situations through two case studies. One case study demonstrates how State, county and local government agencies in Minnesota evaluated pedestrian and bicycle safety issues in urban areas and developed a program to address these issues based on the identification and assessment of risk factors. The second case study illustrates how North Dakota conducted systemic analysis with little supporting data available before the project was initiated.

Oregon

Risk Factors for Pedestrian and Bicycle Crashes, Chris Monsere, Haizhong Wang, Yi Wang and Chen Chen, Oregon Department of Transportation and Federal Highway Administration, May 2017.

http://www.oregon.gov/ODOT/Programs/ResearchDocuments/SPR779_BikePedRisk.pdf

From the abstract: The primary goal of this research was to develop a tool for the Oregon Department of Transportation (ODOT) to improve methods to identify and prioritize locations with increased or elevated risk for pedestrian and bicycle crashes. This report includes a comprehensive review of many scientific reports and papers about the pedestrian and bicycle crashes on road segments or intersections. To develop the risk model data were collected from 188 segments and 184 intersections randomly selected following the data collection plan. These samples included 213 bicycle and pedestrian crashes on the segments and 238 at intersections. Geometric, land use, volume, and crash data were collected from different databases, including Google Maps, EPA's [Environmental Protection Agency's] Smart Location Database and the ODOT crash database from 2009-2013. The research team developed logistic regression models for both crash occurrence (crash or not) and crash severity models. The models related to crash severity were not robust, most likely due to the few segments and intersections with severe crashes in the dataset. The crash occurrence models were used to create a risk-scoring tool. The risk-scoring tool was applied to safety projects identified in the 2015 All Roads Transportation Safety (ARTS) project lists from Oregon DOT's Region 1 and 2. The risk scores

for the case study applications aligned reasonably well with the project's benefit-costs estimates.

Related Resource:

Pedestrian and Bicycle Risk Scoring Tool, Chris Monsere, Yi Wang, Haizhong Wang and Chen Chen, Oregon Department of Transportation, undated.

http://www.oregon.gov/ODOT/Programs/ResearchDocuments/SPR779_Risk_Score_ODOT_v7.xlsx

From the introduction: The Pedestrian and Bicycle Risk Scoring Tool (PBRST) provides information about the relationship between geometric design, land use, traffic features and the probability of crash on segments and at intersections. It is based on the crash logistic models' results of ODOT SPR779: Risk Factors for Pedestrian and Bicycle Crashes. PBRST does not represent any design or legal requirements for roadway design.

Tennessee

Development of Decision Support Tools to Assess Pedestrian and Bicycle Safety: Focus on Population, Demographic and Socio-Economic Spectra, Deo Chimba and Abram Musinguzi, Transportation Research Center for Livable Communities, June 2016.

http://www.wmich.edu/sites/default/files/attachments/u883/2016/TRCLC_Final_Report_14_07.pdf

From the report's objectives: The main objective of this research project was to develop "decision support tools to assess pedestrian and bicycle safety" in Tennessee. The tool will help in the development of pedestrian and bicycle safety programs that could be adopted [to] assist not only Tennessee agencies but also nationally in better understanding of the causes of crashes and identifying appropriate operating strategies to [enhance] pedestrian and bicycle safety.

1. To conduct cluster analysis in GIS to verify any spatial clustering and identify high crash locations within the spectra of socioeconomic and demographics.
2. To develop Safety performance functions (SPFs) to examine relationships between bicycle/pedestrian crashes and associated factors.
3. To develop criteria for high crash location identification and a framework to prioritize funding of bicycle and pedestrian safety improvements.

Virginia

Framework for Selection and Evaluation of Bicycle and Pedestrian Safety Projects in Virginia, Shankar Natarajan, Michael J. Demetsky and Kenneth E. Lantz, Jr., Virginia Department of Transportation and Federal Highway Administration, January 2008.

http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-r8.pdf

From the abstract: The Virginia Department of Transportation's (VDOT) Bicycle and Pedestrian Safety (BPS) Program provides funds for implementing short-term, low-cost bicycle and pedestrian safety projects in Virginia. This initiative is administered by evaluating each project application on a case-by-case basis. The current evaluation process does not include a direct linkage between the selection criteria and conditions at the site that might be hazardous to nonmotorized travel. This significant limitation has resulted in the desire for a new methodology for project selection and evaluation.

This study developed a four-component framework for administering the BPS Program. In this framework, analysis procedures were identified for each component that can be used for identifying hazardous locations, determining causal factors, establishing performance measures, and determining potential countermeasures. The framework was then applied for selecting an appropriate safety treatment and for prioritizing a set of safety projects requested for funding.

Washington

“‘Ballpark’ Method for Estimating Pedestrian and Bicyclist Exposure in Seattle: A Potential Option for Resource-Constrained Cities in an Age of Big Data,” Rebecca L. Sanders, Alexandra Frackelton, Spencer Gardner, Robert Schneider and Michael Hintze, *TRB 96th Annual Meeting Compendium of Papers*, Paper #17-06409, January 2017.

<http://docs.trb.org/prp/17-06409.pdf>

From the abstract: This paper presents the results of an abbreviated exposure estimation process to develop “ballpark” pedestrian and bicycle estimates for the City of Seattle, conducted as part of a major Bicycle and Pedestrian Safety Analysis for Seattle’s Vision Zero effort. This paper contributes to existing research on exposure estimation and demonstrates a case study of practice-ready bicycle and pedestrian exposure models. Due to budget and time constrain[t]s, the exposure estimates used available data sources and were based on models from prior bicycle and pedestrian volume estimation studies. The pedestrian model (Pseudo R²=0.76) fit with other published models, but the bicycle model had a low Pseudo R² (0.41). After adding Strava data to the bicycle model, its explanatory power jumped to 64 percent. SDOT deemed the estimates robust enough to be used in the multivariate crash analysis and to support countermeasure identification and project prioritization. This type of abbreviated process may be appropriate for other cities seeking to estimate exposure but without the resources for a full-blown estimation effort.

Countermeasures

National Guidance

Research in Progress: Understanding and Communicating Reliability of Crash Prediction Models, NCHRP Project 17-78, start date: September 2016, expected completion date: March 2019.

Project description at <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4054>

From the project description: The objectives of this research are to develop guidance for: (1) the quantification of the reliability of crash prediction models including crash modification factors and/or functions (CMFs) and safety performance functions (SPFs) for practitioner use; (2) user interpretation of model reliability; and (3) the application of crash prediction models accounting for, but not limited to assumptions, data ranges, and intended and unintended uses.

Research in Progress: Update of Crash Modification Factors for the Highway Safety Manual, NCHRP Project 17-72, start date: August 2015; expected completion date: December 2017.

Project description at <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3875>

From the project description: The objectives of this research are to

- a. Assess the current criteria and existing process for evaluating and identifying the quality of CMFs for appropriate use with the HSM.
- b. Develop proposed revisions to the criteria and process, including how existing and new

CMFs may be incorporated in the HSM. Provide guidance for practitioner application of the revised process.

- c. Apply the evaluation criteria to identify and assess CMFs and develop a list of appropriate CMFs for the HSM.

CMFs to be studied are those listed in the FHWA CMF Clearinghouse. The research results are intended for possible inclusion in a future second edition of the HSM.

Research in Progress: Intersection Crash Prediction Methods for the Highway Safety Manual, NCHRP Project 17-68, start date: September 2014, expected completion date: October 2018.

Project description at <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3661>

From the project description: The objective of the research is to develop a set of crash predictive models consistent with existing methods that are comprehensive in their ability to address a wide range of intersection configurations and traffic control modes in rural and urban areas.

....

The predictive models developed in this research are to include safety performance functions (SPFs), crash modification factors (CMFs), and calibration factors in a format that is consistent with the predictive models in the existing HSM Part C. The predictive models should be sensitive to the traffic volumes on all intersecting roads and streets, design elements, and traffic control features considered by engineers and planners during the project development process.

Crash Modification Factors Clearinghouse, Federal Highway Administration, undated.

<http://www.cmfclearinghouse.org/>

From the FAQs: The Crash Modification Factors (CMF) Clearinghouse was established to provide transportation professionals:

- A regularly updated, online repository of CMFs,
- A mechanism for sharing newly developed CMFs, and
- Educational information on the proper application of CMFs.

The purpose of the CMF Clearinghouse is to compile all documented CMFs in a central location. The CMF Clearinghouse provides a searchable database that can be easily queried to identify CMFs to meet user's needs.

The CMF Clearinghouse will be updated on a regular basis to add recently developed and documented CMFs. New CMFs will be identified via a periodic review of published literature. In addition, the CMF Clearinghouse provides a mechanism for transportation professionals to submit documentation of new CMFs to be considered for inclusion.

Advancing Pedestrian and Bicyclist Safety: A Primer for Highway Safety Professionals, Kristen Brookshire, Laura Sandt, Carl Sundstrom, Libby Thomas and Richard Blomberg, National Highway Traffic Safety Administration, April 2016.

http://www.nhtsa.gov/staticfiles/nti/pdf/812258-Peds_Bike_Primer.pdf

From the abstract: The primer summarizes the most promising infrastructure treatments and behavioral programs available for addressing specific safety problems and highlights how these approaches can be combined and implemented. It identifies opportunities for various agencies to collaborate and combine their respective approaches and funding for a more comprehensive

program. It also offers real-world examples of what States and local jurisdictions are doing to address pedestrian and bicycle issues in a comprehensive manner.

Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices, Eighth Edition, Arthur Goodwin, Libby Thomas, Bevan Kirley, William Hall, Natalie O'Brien and Kate Hill, National Highway Traffic Safety Administration, November 2015.

<http://www.nhtsa.gov/staticfiles/nti/pdf/812202-CountermeasuresThatWork8th.pdf>

This guide includes countermeasures in a variety of traffic safety problem areas, including bicycles. *From the abstract:*

The guide:

- Describes major strategies and countermeasures that are relevant to SHSOs [state highway safety offices];
- Summarizes strategy/countermeasure use, effectiveness, costs and implementation time; and
- Provides references to the most important research summaries and individual studies.

Evaluation of Bicycle-Related Roadway Measures: A Summary of Available Research, Jill Mead, Ann McGrane, Charlie Zegeer and Libby Thomas, Federal Highway Administration, February 2014.

http://www.pedbikeinfo.org/cms/downloads/06%2013%202014%20BIKESAFE%20Lit%20Review_FINAL.pdf

From the introduction:

This document represents an effort to compile all known research on the effect of the bicycle safety countermeasures discussed in BIKESAFE. It is intended to serve as a companion document for the guide, providing a complementary overview of the researchers, research methods, and evaluation results that have guided the development and design of bicycle safety countermeasures.

Topics include shared roadway measures; on-road bike facilities; intersection treatments; maintenance; traffic calming; trails and shared-use paths; and markings, signs and signals.

Related Resource:

BIKESAFE: Bicycle Safety Guide and Countermeasure Selection System, Federal Highway Administration, undated.

<http://www.pedbikesafe.org/BIKESAFE>

From the web site: The Bicycle Safety Guide and Countermeasure Selection System is intended to provide practitioners with the latest information available for improving the safety and mobility of those who bike. The online tools provide the user with a list of possible engineering, education or enforcement treatments to improve bicycle safety and/or mobility based on user input about a specific location.

Ranking or Prioritizing Projects

“Using Highway Safety Manual Predictive Method to Prioritize Pedestrian and Bicycle Safety Projects,” Zahidu Siddique, Doug Bish and Amanda Salyer, *TRB 96th Annual Meeting Compendium of Papers*, Paper #17-00602, 2017.

Citation at <http://amonline.trb.org/17-00602-1.3399422?qr=1>

From the abstract: Oregon Department of Transportation (ODOT) administers the All Roads Transportation Safety (ARTS) Program to address safety on all public roads including non-state roadways. Approximately seven percent of the total safety funding is allocated to the pedestrian/bicycle emphasis area, which is one of the three emphasis areas of the systemic component of the ARTS Program. Traditionally ODOT has been using benefit-cost ratio, which is calculated using crash history of a given location, to justify and prioritize projects. Benefits are calculated by converting expected crash reduction due to the proposed improvement(s) in to economic values. However, since the number of reported vehicle-pedestrian and vehicle-bicycle crashes is low compared to vehicle-only crashes, using the benefit-cost ratio to prioritize projects in the pedestrian/bicycle emphasis area would exclude many potential locations from funding considerations. These locations might be susceptible to vehicle-pedestrian and vehicle-bicycle crashes but do not have the reported crashes required for traditional safety analysis. ODOT used the predictive method presented in the Part C of the Highway Safety Manual (HSM) to predict vehicle-pedestrian and vehicle-bicycle crashes and used predicted crashes to perform the cost-effectiveness analysis. Projects were prioritized based on the cost-effectiveness index (CEI). Although the HSM predictive method has some shortcomings, ODOT used it successfully to select projects in the pedestrian/bicycle emphasis area of the ARTS Program on both state highways and local agency roadways. It is anticipated that these projects will help achieve the goal of the program by reducing fatal and serious injury crashes on all roads of the state.

Network Screening

Statewide Analysis of Bicycle Crashes, Priyanka Alluri, Md Asif Raihan, Dibakar Saha, Wanyang Wu, Armana Huq, Sajidur Nafis and Albert Gan, Florida Department of Transportation, May 2017.

http://www.fdot.gov/research/Completed_Proj/Summary_SF/FDOT-BDV29-977-23-rpt.pdf

From the abstract:

In this study, an extensive literature review focusing on the methods to identify bicycle hot spots and findings on bicycle crash causes, crash contributing factors, and potential countermeasures was first conducted. A descriptive trend analysis was then conducted based on a total of 26,036 bicycle crashes that occurred during 2011-2014. The top five bicycle crash hot spots in each Florida Department of Transportation (FDOT) district were then identified using spatial analysis in ArcGIS. ... Macroscopic spatial analysis was conducted to model the relation between demographic, socio-economic, roadway, traffic, and bicycle activity data at the census block group level and bicycle crash frequencies in Florida. Finally, cross-sectional analysis was conducted to develop Florida-specific CMFs for bicycle crashes for different roadway segment and intersection facility types.

See page 11 of the report (page 31 of the PDF) for a discussion of network screening methods:

This section includes a review of literature on the existing network screening methods to identify and prioritize bicycle hot spots. GIS was found to be the most commonly used network screening tool. Furthermore, several studies have used a combination of different methods to rank bicycle high crash locations.

Two Level Approach to Safety Planning Incorporating the Highway Safety Manual (HSM) Network Screening, Mohamed A. Abdel-Aty, Pei-Fen Kuo, Ximiao Jiang, Jaeyoung Lee and Samer Al Amili, Florida Department of Transportation, April 2014.

http://www.fdot.gov/research/completed_proj/summary_sf/fdot-bdk78-977-13-rpt.pdf

From the executive summary: In summary, this study presents an integrated screening method that can be used to overcome the shortcomings of macro- and micro-level approaches. In particular, our results provide a comprehensive perspective on appropriate safety treatments by balancing the accuracy and efficiency of screening. Also, it is recommended that different strategies for each hot zone classification be developed because each category has distinctive traffic safety risks at each of the different levels.

Planning and Design

National Guidance

Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts, C. Porter, M. Danila, C. Fink, J. Toole, E. Mongelli and W. Schultheiss, Federal Highway Administration, August 2016.

https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_networks/fhwahep16055.pdf

From the abstract: This resource includes 24 design topics, organized into two themes. The 12 design topics in Part 1 focus on design flexibility. The 12 topics in Part 2 focus on measures to reduce conflicts between modes. Each design topic is four pages in length and includes relevant case studies and references to appropriate design guidelines.

This document covers a wide range of solutions to achieve multimodal transportation networks. It includes solutions for streets and intersections, and has information about shared use paths and other trails that can serve both transportation and recreation purposes. It includes information about crossing main streets, bridges and underpasses, and about interactions with freight and transit. This resource addresses common concerns and perceived barriers among planning and design professionals and provides specific information about flexible design treatments and approaches

State-Related Research

California

Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians, Caltrans, 2010.

https://nacto.org/docs/usdg/complete_intersections_caltrans.pdf

From the director's letter: The Complete Intersections Guide provides tools and techniques to improve bicycle and pedestrian transportation using basic guiding principles for common intersection types. The focus is on intersections and interchanges where transportation safety and mobility issues can be most challenging.

Related Resource:

“The Complete Intersections Guide,” Brian Alconcel, Workshop Presentation, Caltrans, October 2012.

http://www.dot.ca.gov/hq/tpp/offices/owd/academy_files/Oct_2012_Workshop/Wednesday/Complete_Intersections.pdf

This workshop presentation reviews the 12 guiding principles highlighted in the Complete Intersections Guide and prompts the reader to engage in question-and-answer sessions.

“Does Transit-Oriented Development Create a Bicycle and Pedestrian Safe Environment?” Dohyung Kim and Daniel Rojas, *TRB 94th Annual Meeting Compendium of Papers*, Paper #15-2202, 2015.

Citation at <http://amonline.trb.org/15-2202-1.1810436?qr=1>

From the abstract: Transit-oriented development (TOD) has been a popular planning tool within urban transportation and land use planning. TOD projects are often touted as being designed to promote bicycle and pedestrian trips and activities. However, bicycle and pedestrian friendly environments cannot be created without the guarantee of bicycle and pedestrian safety. There has been lack of research addressing whether TOD stations provide a safe environment for cyclists and pedestrians. The goal of this research is to determine whether or not the development of these TOD projects across Los Angeles County have had an effect on bike and pedestrian collisions. Applying a longitudinal regression approach, this research analyzes historical trends of bicycle and pedestrian collisions before and after TOD project implementation along LA Metro Rail, comparing bicycle and pedestrian collisions around non-TOD stations. The outputs of this study suggest that TOD implementation contributes to the increase of bicycle and pedestrian collisions, particularly bicycle collisions, rather than reducing bicycle and pedestrian collisions.

“The Influence of Bicycle Oriented Facilities on Bicycle Crashes within Crash Concentrated Areas,” Dohyung Kim and Kwangkoo Kim, *Traffic Injury Prevention*, Vol. 16, No. 1, pages 70-75, 2015.

Citation at <http://dx.doi.org/10.1080/15389588.2014.895924>

From the abstract:

- **Objective:** This study analyzes environmental features that influence bicycle crashes within crash concentrated areas. This study particularly provides a systemic approach to analyzing major bicycle oriented facilities contributing to bicycle crashes within crash concentrated areas.
- **Methods:** This study applies geographic information systems (GIS) to the identification of crash concentrated areas in Riverside County, California using five years of crash data as well as the development of environment feature data inventory. Based on the data inventory, a regression method was applied to discover whether there was a correlation between the presence of bicycle facilities and the occurrence of bicycle crashes.
- **Results:** This study identifies that longer distance between crosswalks and bus stops are positively associated with bicyclist crashes, while structured medians contribute to the reduction of bicycle crashes. This study also suggests that parking lot entrance ways and parking lots with no physical barrier from sidewalks cause bicycle crashes on sidewalks.
- **Conclusions:** This study presents guidelines for local transportation planners to analyze the patterns of bicyclist crashes in order to improve roadway safety. This research also

assists planners in effectively allocating scarce resources as they address issues of bicyclist safety.

Oregon

Towards Effective Design Treatment for Right Turns at Intersections with Bicycle Traffic, D.H. Hurwitz, C. Monsere, M. Jannat, J. Warner and A. Razmpa, Oregon Department of Transportation and Federal Highway Administration, November 2015.

http://www.oregon.gov/ODOT/Programs/ResearchDocuments/SPR767_FinalReport_070815.pdf

From the abstract: The overall goal of this research was to quantify the safety performance of alternative traffic control strategies to mitigate right-turning vehicle-bicycle crashes at signalized intersections in Oregon. The ultimate aim was to provide useful design guidance to potentially mitigate these collision types at the critical intersection configurations. This report includes a comprehensive review of more than 150 scientific and technical articles that relate to bicycle-motor vehicle crashes. A total of 504 right-hook crashes were identified from vehicle path information in the Oregon crash data from 2007-2011, mapped and reviewed in detail to identify the frequency and severity of crashes by intersection lane configuration and traffic control.

....

The resulting analysis of the driver performance indicators suggest that while we can measure the various driver performance metrics robustly, and all of the treatments had some positive effect on measured driver performance, it is not yet clear how to map the magnitudes of the differences to expected crash outcomes. Additional work is recommended to address the limitations of this study and to further consider the potential effects of the right-hook crash mitigation strategies from this research.

Evaluation of Bike Boxes at Signalized Intersections, Jennifer Dill, Christopher M. Monsere and Nathan McNeil, Oregon Transportation Research and Education Consortium, January 2011.

http://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1017&context=usp_fac

From the abstract: This report presents a before-after study of bike boxes at 10 signalized intersections in Portland, Oregon. The bike boxes, also known as advanced stop lines or advanced stop boxes, were installed to increase visibility of cyclists and reduce conflicts between motor vehicle[s] and cyclists, particularly in potential “right-hook” situations. ... Both the observations and survey of motorists found a high rate of compliance and understanding of the markings. Overall, 73% of the stopping motor vehicles did not encroach at all into the bike box. Both motor vehicle and bicycle encroachment in the pedestrian crosswalk fell significantly at the bike box locations compared to the control intersections. The bike boxes had mixed effects on the motorists’ encroachment in the bicycle lane. The number of observed conflicts at the bike box locations decreased, while the total number of cyclists and motor vehicles turning right increased. Negative-binomial models based upon the data predict fewer conflicts with the boxes, particularly as right-turning motor vehicle volumes increase. Observations of yielding behavior at two bike box and one control intersection found an improvement in motorists yielding to cyclists at the bike box locations. Differences in the traffic volumes and location contexts make firm conclusions about the effects of green coloring of the boxes difficult.

Appendix A: Survey Questions

The following survey was presented to members of the AASHTO Subcommittee on Safety and representatives of selected metropolitan planning organizations expected to have experience with bicycle safety improvement programs.

Introductory Question

Responses to the following question determined how respondents completed the survey:

Has your agency developed a bicycle safety improvement program that includes criteria for data analysis and processes for selecting locations for traffic safety improvements?

- Respondents who answered “yes” completed the remainder of the survey.
 - Respondents who answered “no” responded to the following two questions:
 1. Please describe your agency’s current efforts to improve bicycle safety.
 2. Does your agency have plans to implement a bicycle safety improvement program in the future? If yes, please describe.
-

Project Screening and Selection

1. What network screening methods does your agency use to identify locations for potential bicycle-related safety improvements? Select all that apply.
 - We don’t use network screening methods.
 - Continuous risk profile.
 - Peak searching.
 - Simple ranking.
 - Sliding window.
 - Other.
2. If applicable, please describe the segmentation criteria your agency uses in connection with network screening.
3. Does your agency use systemic safety tools or methodologies to address bicycle safety? If yes, please describe.
4. Please describe your agency’s process to rank or prioritize and then select bicycle-related collision locations for traffic safety improvements.

Countermeasures

5. Please describe the tool, method or procedure your agency uses to identify and select countermeasures to improve bicycle safety.
6. Does your agency prohibit the use of bicycles on certain roadways as a countermeasure?
7. When bicycle facilities such as bike lanes or cycle tracks are selected as the appropriate countermeasure to improve safety, please describe the process to determine if the bikeway will function within the greater context of the bicycle transportation network (for example, existing and proposed bicycle route network maps).

8. Please describe any successes your agency has experienced when using countermeasures to improve bicycle safety.
9. Please describe any challenges your agency has encountered when using countermeasures to improve bicycle safety.

Other Practices

10. Does your agency incorporate context sensitive design in your bicycle safety improvement program? If yes, please describe.
11. Please describe the stakeholder groups involved in the traffic safety investigation process for bicycle crashes.
12. Does your bicycle safety improvement program use a multidisciplinary approach (for example, the 4 E's—education, engineering, enforcement and encouragement) to improve safety? If yes, please describe.

Wrap-Up

13. If available, please provide a copy of documents related to your bicycle safety improvement program.
14. Please use this space to provide comments or additional information about any of your answers above.

Appendix B: Survey Results

The full text of each survey response is provided below. For reference, we have included an abbreviated version of each question before the response. The full question text appears in [Appendix A](#). Responses have been edited for clarity. When a respondent skipped a section of the survey, those questions have been omitted.

Agencies with Bicycle Safety Improvement Plans

The following survey responses are from agencies whose representatives indicated they do maintain a bicycle safety improvement program.

Florida

Contact: Trenda McPherson, State Bicycle/Pedestrian Safety Program Manager, Florida Department of Transportation, 850-414-4025, trenda.mcpherson@dot.state.fl.us.

Countermeasures

5. **Tool, method or procedure used to select countermeasures:** [No response.]
6. **Prohibit use of bicycles on certain roadways?** Florida Statute 316.091:
Except as provided herein, no person shall operate upon a limited access facility any bicycle, motor-driven cycle, animal-drawn vehicle, or any other vehicle which by its design or condition is incompatible with the safe and expedient movement of traffic.
7. **How agency determines function of new bikeway within network:** [No response.]
8. **Successes using countermeasures:** [No response.]
9. **Challenges using countermeasures:** [No response.]

Other Practices

10. **Incorporate context sensitive design?** [No response.]
11. **Stakeholder groups involved in traffic safety investigations:** Engineers are involved through road safety audits and studies; enforcement [is] involved through road safety audits and crash investigations; the SHSO [state highway safety office] is involved through crash location, crash analysis and data integration; the Department of Health is involved through risk assessment and injury prevention; and DHSMV [Department of Highway Safety and Motor Vehicles] is involved through crash report collection and data dissemination via the FIRES portal. [FIRES, or Florida's Integrated Report Exchange System, is available at <https://www.firesportal.com/>. FIRES was "developed and maintained by LexisNexis, Inc. on behalf of the Florida Department of Highway Safety and Motor Vehicles. It serves as a portal into the State of Florida's repository for traffic crash reports completed by Florida law enforcement agencies."]
12. **Multidisciplinary approach to improve safety?** Yes. Education, enforcement, engineering, and emergency services are critical components in reducing crashes and improving safety for pedestrians and bicyclists. In Florida, we overlap the "E's" in countermeasure application to ensure the greatest opportunity to effectively increase awareness, improve compliance with traffic laws and improve behaviors that result in traffic crashes involving bicyclists. Examples include partnering engineers with [law] enforcement during road safety audits. This provides the opportunity to discuss countermeasure

selection based on roadway criteria as well as public behavior in the area. [We] combin[e] paid and earned media with enforcement efforts. Our High Visibility Enforcement program is geared towards education [see **Documents** below.]

Wrap-Up

13. Documents:

High Visibility Enforcement: High Visibility Enforcement for Pedestrian and Bicycle Safety, Florida Department of Transportation, 2016.

<http://www.alerttodayflorida.com/hve.html>

From the web site: HVE [high visibility enforcement] is a traffic safety approach designed to create deterrence and change unlawful traffic behaviors. Crashes involving pedestrians and bicyclists are more likely to result in fatal or serious injuries than any other types of crashes, and the financial impacts and suffering caused by these crashes are significant. As a result, the Florida Department of Transportation (FDOT) is looking to supplement ongoing educational campaigns with high visibility enforcement operations in the most needed locations. FDOT now has funding available for law enforcement agencies to conduct High Visibility Enforcement operations for pedestrian and bicyclist safety.

High visibility enforcement funds are intended as a crash mitigation tool. These enforcement activities are designed to target unsafe behaviors of all road users, including motorists, pedestrians and bicyclists.

Georgia

Contact: Scott Zehngraft, Assistant State Traffic Engineer, Traffic Operations, Georgia Department of Transportation, 404-635-2848, szehngraft@dot.ga.gov.

Note: Georgia Department of Transportation is currently developing a bicycle and pedestrian safety action plan. A draft of the plan in progress is provided as [Appendix C](#).

Project Screening and Selection

1. **Network screening methods:** Don't use.
2. **Use segmentation criteria?** No.
3. **Use systemic safety tools or methodologies?** Statewide crash data (all crashes and bike crashes) is being used to develop the Bicycle Safety Action Plan. Hot spot corridors and predominant crash types are being identified.
4. **Process to rank, prioritize and select collision locations:** Corridors are being prioritized based on the gross numbers of bicycle crashes. This simplistic method is being used because of the current lack of bicyclist traffic volume data.

Countermeasures

5. **Tool, method or procedure used to select countermeasures:** In assessing specific corridors or intersection, GDOT conducts a road safety audit and/or prepares a traffic engineering report. GDOT references the Highway Safety Manual, CMF [Crash Modification Factors] Clearinghouse and other FHWA [Federal Highway Administration] publications in order to determine the most appropriate countermeasures.
6. **Prohibit use of bicycles on certain roadways?** People are prohibited from biking on

limited access freeways in Georgia.

7. **How agency determines function of new bikeway within network:** Per GDOT's complete streets policy, all GDOT projects are assessed to determine how they align with local and regional bicycle plans.
8. **Successes using countermeasures:** GDOT has worked with the city of Atlanta to leverage several resurfacing projects to include road diets. One of these projects is an interim resurfacing project that eliminated two travel lanes and introduced striped bike lanes and a center turn lane. Within a few years a capital safety-funded project will convert the striped bike lanes to raised bike lanes and the center median to medianettes and turn lanes (for example, S[tate] R[oute] 154 in the Little Five Points shopping district).
9. **Challenges using countermeasures:** Underreporting of bicycle crash data; limited existing ROW [right of way]; and desire to prioritize motor vehicle traffic volumes and speeds.

Other Practices

10. **Incorporate context sensitive design?** No.
11. **Stakeholder groups involved in traffic safety investigations:** Road safety audits [RSAs] include GDOT staff, local city engineering and public works staff, local law enforcement, local advocates, local transit providers, local planning staff and others as interested.
12. **Multidisciplinary approach to improve safety?** GDOT contracts with Georgia Bikes—a statewide bicycle advocacy organization—to provide bicycle education opportunities in Georgia. This includes educating engineers, citizens and police officers on relevant information to promote bike safety.

Wrap-Up

13. **Documents:**
Georgia Bike Sense: A Guide for Bicyclists, Georgia Department of Transportation, 2016.
<http://www.dot.ga.gov/drivesmart/travel/Documents/English-fullversion.pdf>
From the introduction: This guide covers the situations and conditions you'll likely encounter while cycling here, emphasizing safe and legal riding. Whether you're a beginner or an experienced rider, this guide provides an overview of how you can ride more safely and effectively.

Georgia Bicycle and Pedestrian Safety Action Plan, Draft, Georgia Department of Transportation, undated.

See [Appendix C](#).

This draft plan in progress includes policy and nonengineering recommendations (see page 31), statewide engineering recommendations (see page 37), and site-specific recommendations for high-crash areas (see page 38).

Georgia Bikes, undated.

<https://georgiabikes.org/>

The mission of this nonprofit organization is to “improve bicycling conditions and promote bicycling throughout the state of Georgia.”

Michigan

Contact: Carissa McQuiston, Nonmotorized Safety Engineering Specialist, Safety Programs Unit, Michigan Department of Transportation, 517-335-2834, mcquistonc@mi.gov.

Project Screening and Selection

1. **Network screening methods:** Simple ranking. We look at crash locations and we are developing a bicycle risk tool that maps exposure, crashes and many layers of data, including geometric features, land uses, etc. This will help MDOT locate areas of risk across the state for bicyclists.
2. **Use segmentation criteria?** No.
3. **Use systemic safety tools or methodologies?** Yes. We are developing a risk assessment tool to determine high-risk areas across the state. We also use Safety Analyst and Roadsoft to determine crash locations for further analysis/review.
4. **Process to rank, prioritize and select collision locations:** All high-risk locations based on crash statistics are determined and ranked based on fatalities and serious injury occurrence. Bicycle high-risk locations are included in this ranking, and those that have fatalities and serious injuries are considered for countermeasure implementation.

Countermeasures

5. **Tool, method or procedure used to select countermeasures:** We identify locations with high crashes using Roadsoft. This includes locations with bicycle fatalities and serious injuries. After review of the circumstances involved in those crashes we selected countermeasures to improve safety based on the crash pattern, geometry of the roadway, etc. Each countermeasure is particular to the location being reviewed. We are also currently developing a tool that models risk. We have developed an exposure model and are overlaying that with crash data, geometric features, land use variables, etc. to determine areas with high levels of risk to bicyclists and pedestrians. This tool will help us determine locations that we can focus our efforts on to implement countermeasures with additional information—not just based on the crash data.
6. **Prohibit use of bicycles on certain roadways?** Yes. Bicycles are not allowed on our limited access freeways for safety reasons.
7. **How agency determines function of new bikeway within network:** We typically add bike facilities when we are doing road projects. We have done restriping projects solely for bicycle infrastructure inclusion, but typically we are putting in our facilities as a roadway is being maintained or reconstructed. When we are putting in bicycle facilities, they are meeting a need in the community [that] the state trunk line is running through. We do like to see a non-motorized plan or a master plan showing what features the communities would like on state roadways. Sometimes nonconnected segments go in during roadway construction, but there needs to be future proposed connections that these facilities would eventually connect to.
8. **Successes using countermeasures:** We have installed bike lanes and recently, separated bike lanes. We have funded a major city's bicycle education program that has shown successful market message penetration about bicycle safety and the crash data has seen significant decreases in fatal and serious injury crashes (though this might not be directly due to the campaign, the reduction is worth highlighting).
9. **Challenges using countermeasures:** Right of way [ROW]—there is only so much ROW in the downtown areas where bike facilities (separated) would improve safety. There are

many modes of travel wanting to be in the limited amount of space. In our urban areas we have the most pedestrians, transit users, bicyclists and motorists. And also consideration for state-owned roadways where commercial traffic is typically the highest moving goods. These factors all are considered in the design and function of the roadway. We also have severe weather (snow for many months of the year), which is a factor in maintenance and operations. Some countermeasures are more challenging to implement because of these considerations. We also try to accommodate the needs of the community [the] state roadway passes through, and sometimes there is pushback from the community on issues like road diets and bike lanes.

Other Practices

10. **Incorporate context sensitive design?** Yes. This is incorporated early and often and is standard practice in our design process. Whether bike facilities are ultimately incorporated in a design is based on the needs of that particular segment.
11. **Stakeholder groups involved in traffic safety investigations:** When project development is being discussed, all stakeholders are invited to be in the process at some point in the design—typically the public at public involvement meetings, the city or county early on in design, etc.
12. **Multidisciplinary approach to improve safety?** We produce informational brochures, pamphlets, videos, etc., to help educate the public on all the facilities the state constructs (bike facilities, roundabouts, DDIs [diverging diamond interchanges], etc.). We have done outreach, including law enforcement.

Wrap-Up

13. Documents:

Bicycle and Pedestrian Terminology, Michigan Department of Transportation, March 2014.

https://www.michigan.gov/documents/mdot/MDOT_BicycleandPedestrianTerminologyBooklet_445994_7.pdf

This publication provides images and definitions of terms associated with bicycles and pedestrians in Michigan.

What Every Michigan Driver Should Know About Bicycle Lanes, Michigan Department of Transportation, January 2017

http://www.michigan.gov/documents/mdot/MDOT_Bicycle_Lane_Brochure_402819_7.pdf

This brochure provides images and descriptions of Michigan DOT's treatment of bicycle lanes.

Toward Zero Deaths: Safety Fact Sheet, Michigan Department of Transportation, undated.

http://www.michigan.gov/documents/mdot/TZD_Safety_Fact_Sheet_495542_7.pdf

This fact sheet describes progress associated with Michigan DOT's statewide Toward Zero Deaths safety campaign.

14. **Comments or additional information:** Michigan's goal is Toward Zero Deaths, and this includes all our users.

Minnesota

Contact: Melissa Barnes, Pedestrian and Bicycle Safety Engineer, Office of Traffic, Safety and Technology, Minnesota Department of Transportation, 651-234-7376, melissa.barnes@state.mn.us.

Project Screening and Selection

1. **Network screening methods:** We use a risk-based analysis.
2. **Use segmentation criteria?** No.
3. **Use systemic safety tools or methodologies?** Yes. Characteristics vs. crash-based.
4. **Process to rank, prioritize and select collision locations:** Analyze intersections and network for characteristics, determine which characteristics had high levels of crashes compared to percent presence on the system, rank intersections based on five to six high-risk characteristics (more characteristics, higher rating). We do not use a weighted method, although [we] may in the future. To further fine-tune, we plan on overlaying this with a needs-based analysis.

Countermeasures

5. **Tool, method or procedure used to select countermeasures:** Our upcoming bicycle design manual will have a facility selection tool based on bicycle level of service, speed and ADT [average daily traffic].
6. **Prohibit use of bicycles on certain roadways?** No.
7. **How agency determines function of new bikeway within network:** We do discuss ensuring that the facility makes sense and creates logical connections, either at a local or regional scale.
8. **Successes using countermeasures:** Our successes have been at a fairly localized level, with ease of crossings, increased yielding rates and increased separation from traffic. We do not have a lot of before-and-after safety data, and our crash numbers have been fairly stable over the last 10 years.
9. **Challenges using countermeasures:** Lack of ridership number data, lack of understanding of demand [and] poor infrastructure prevents riding, parking reduction challenges, perceived “loss” of road space, difficulties with maintaining facilities (snow in particular).

Other Practices

10. **Incorporate context sensitive design?** Yes. We have context sensitive design/complete streets policies that address land use and needs. Bicyclists are addressed as an integral part of the transportation system but are prioritized differently in different contexts.
11. **Stakeholder groups involved in traffic safety investigations:** Law enforcement, families, engineers, general public, Department of Public Safety.
12. **Multidisciplinary approach to improve safety?** Yes. Everything we do incorporates the 4 E’s as we are a Toward Zero Deaths state and use that lens in all [of] our work. We provide an education campaign for bicyclists (currently being revamped), work with the Department of Public Safety and law enforcement, and very closely with Health. We are the engineering “E.” We get and provide input on the other E’s through relationships.

Wrap-Up

13. Documents:

Statewide Bicycle System Plan, Minnesota Department of Transportation, August 2016.

<http://www.dot.state.mn.us/bike/system-plan/pdfs/statewide-bicycle-system-plan-final.pdf>

This state bicycle system plan does not address in detail the screening methods or countermeasures used to examine or improve bicycle-related collision locations. It does provide safety-related performance measures associated with bicyclists.

MnDOT Bikeway Facility Design Manual, Minnesota Department of Transportation, March 2007. (This manual is currently being updated.)

<http://www.dot.state.mn.us/bike/pdfs/manual/manual.pdf>

Minnesota DOT is revising this manual to include a facility selection tool based on bicycle level of service, speed and ADT.

Toward Zero Deaths: Minnesota, Center for Transportation Studies, University of Minnesota, 2015.

<http://www.minnesotatzd.org>

From the web site: The Toward Zero Deaths (TZD) approach is based on the belief that even one traffic-related death on our roads is unacceptable. This “zero deaths” idea was first adopted in Sweden in 1997 as “Vision Zero” and since then has evolved to several state DOTs [departments of transportation], including Minnesota, that have identified zero deaths as a core objective in their Strategic Highway Safety Plans.

TZD uses a data-driven, interdisciplinary approach that targets areas for improvement and employs proven countermeasures, integrating application of education, enforcement, engineering, and emergency medical and trauma services (the “4 E’s”). A combination of strategies from different focus areas is often most effective for solving a particular problem.

Nevada

Contact: Jamie Borino, Bicycle and Pedestrian Program Manager, Nevada Department of Transportation, 775-888-7433, jborino@dot.nv.gov.

Project Screening and Selection

1. **Network screening methods:** NDOT [Nevada DOT] uses the road safety assessment [RSA] and safety management plan [SMP] to identify sections of roadway to help mitigate bicycle crashes.
2. **Use segmentation criteria?** No.
3. **Use systemic safety tools or methodologies?** No.
4. **Process to rank, prioritize and select collision locations:** NDOT uses data and analysis collected from RSAs and SMPs to identify locations as they relate to bicycle crashes and make improvements.

Countermeasures

5. **Tool, method or procedure used to select countermeasures:** NDOT uses AASHTO and National Association of City Transportation Officials publications for guidance.

6. **Prohibit use of bicycles on certain roadways?** Yes. Only control of access of facilities (freeways) where other comparable/safer alternatives exist.
7. **How agency determines function of new bikeway within network:** Integration with local bicycle plans and networks help[s] NDOT set priorities as they relate [to] bicycles.
8. **Successes using countermeasures:** Numerous complete streets projects and site-specific accommodation as necessary.
9. **Challenges using countermeasures:** Inadequate right of way, parking priorities and local acceptance.

Other Practices

10. **Incorporate context sensitive design?** Yes. Complete streets, facilities appropriate for adjoining land use.
11. **Stakeholder groups involved in traffic safety investigations:** NDOT has part in RSA, SMP and the Strategic Highway Safety Plan (SHSP). These [allow] all stakeholders that relate to a project to provide input.
12. **Multidisciplinary approach to improve safety?** Yes. NDOT has a state-funded education program, a complete streets policy and a Safe Routes to School Program (SRTS).

Wrap-Up

13. **Documents:** [No response.]
14. **Comments or additional information:** The Nevada Department of Transportation has a robust cyclist and driver education program. NDOT's bicycle and pedestrian program also offers direct bicycle training and has a substantial outreach program that has educational literature as well as safety items. NDOT also [uses] RSAs and SMPs to analyze specific segments of Nevada's roads. NDOT also has a complete streets policy for guidance. Injury and fatality metrics are low in comparison to other road users.

New York City

Contact: Alice Friedman, Bicycle and Greenway Program Acting Deputy Director, New York City Department of Transportation, 212-839-7242, afriedman@dot.nyc.gov.

Project Screening and Selection

1. **Network screening methods:** Don't use.
2. **Use segmentation criteria?** No.
3. **Use systemic safety tools or methodologies?** No.
4. **Process to rank, prioritize and select collision locations:** We use a combination of criteria to select locations, including community requests, roadway geometry, network considerations, data analysis, ridership data and response to new opportunities.

Countermeasures

5. **Tool, method or procedure used to select countermeasures:** See [Appendix D](#).
6. **Prohibit use of bicycles on certain roadways?** No.
7. **How agency determines function of new bikeway within network:** We look at

connections to existing and planned routes, important destinations such as park entrances and bridges, as well as local ridership data.

8. **Successes using countermeasures:** See protected bike lane study from 2014 and Cycling in the City report [see **Documents** below].
9. **Challenges using countermeasures:** The DOT Bicycle Program is charged with the safe and efficient movement of people and goods, with a focus on cyclists. We need to balance the needs of all road users within constrained geometries, which can be challenging.

Other Practices

10. **Incorporate context sensitive design?** Yes. All of our designs are based on local conditions.
11. **Stakeholder groups involved in traffic safety investigations:** DOT analyzes crash reports as collected by NYPD [New York Police Department].
12. **Multidisciplinary approach to improve safety?** Yes. Described in Cycling in the City report [see **Documents** below].

Wrap-Up

13. **Documents:**

Street Improvement Projects: Process, New York City Department of Transportation, undated.

See [Appendix D](#).

This flowchart illustrates the agency's street improvement project development process.

Protected Bicycle Lanes in NYC, New York City Department of Transportation, September 2014.

<http://www.nyc.gov/html/dot/downloads/pdf/2014-09-03-bicycle-path-data-analysis.pdf>

From the overview: Since 2007, the New York City Department of Transportation has installed over 30 miles of protected bicycle lanes throughout the city, including several parking protected bicycle lanes on various avenues in Manhattan. The following report contains an analysis of how some of these Manhattan routes have impacted safety, mobility, and economic vitality. Routes were chosen for inclusion if they had at least three years of "after" safety data available.

Cycling in the City: Cycling Trends in NYC, New York City Department of Transportation, January 2017.

<http://www.nyc.gov/html/dot/downloads/pdf/cycling-in-the-city.pdf>

From the document: This Cycling in the City brief see[k]s to answer two basic questions:

- How frequently are New Yorkers using cycling as a mode of transportation?
- How is that frequency changing over time?

Agencies Without Bicycle Safety Improvement Plans

The following survey responses are from agencies whose representatives indicated they do not maintain a bicycle safety improvement program.

Alabama

Contact: Tim Barnett, State Safety Operations Engineer, Traffic and Safety Operations Section, Alabama Department of Transportation, 334-242-6123, barnettt@dot.state.al.us.

1. **Current efforts to improve bicycle safety:** Vulnerable Road Users Guide is under development to address bicycle safety along with other vulnerable road users.
2. **Plans to implement bicycle safety program?** Yes. Bicycle safety is considered along with other vulnerable road user safety, and improvements are eligible for Highway Safety Improvement Program funding.

Delaware

Contact: Adam Weiser, Safety Programs Manager, Delaware Department of Transportation, 302-659-4073, adam.weiser@state.de.us.

1. **Current efforts to improve bicycle safety:** Bicycle safety improvements are incorporated into all projects on an as-needed basis.
2. **Plans to implement bicycle safety program?** No.

Louisiana

Contact: Jessica De Ville, Bicycle and Pedestrian Coordinator, Highway Safety Section, Louisiana Department of Transportation and Development, 225-379-1844, jessica.deville@la.gov.

1. **Current efforts to improve bicycle safety:** Implementing our complete streets policy, reviewing policies and guidance related to signing and design of bike facilities, funding several bicycle and pedestrian master plans, working on feasibility studies for locations identified in New Orleans Pedestrian Safety Action Plan, which includes bike components, funding infrastructure improvements for data-driven bike/pedestrian projects through Safe Routes to Public Places, Safe Routes to Schools legacy projects and Local Road Safety Projects as well as including improvements on traditional HSIP [Highway Safety Improvement Program] projects where appropriate.
2. **Plans to implement bicycle safety program?** No.

Massachusetts

Contact: Bonnie Polin, Manager Safety Programs, Massachusetts Department of Transportation, 857-368-9636, bonnie.polin@state.ma.us.

1. **Current efforts to improve bicycle safety:** We have a Healthy Transportation Policy and must integrate bicycle activity into all roadway projects.
 1. Have RSAs specific to bicyclist safety.

2. Already have (but will be updating) a Statewide Bicycle Plan (with a section on safety).
 3. Developed and released a bicyclist (and pedestrian) safety campaign, "Scan the Street for Wheels and Feet."
 4. Bicyclist safety is one of the emphasis areas of our SHSP and the update is just kicking off, to name a few things.
2. **Plans to implement bicycle safety program?** No.

New Mexico

Contact: Wade Patterson, Active Transportation Programs Supervisor, Planning Division, New Mexico Department of Transportation, 505-827-5508, wade.patterson@state.nm.us.

1. **Current efforts to improve bicycle safety:** Bicycle safety is included as part of the SHSP manual. Projects applying for HSIP funds are expected to address bicycle and pedestrian safety improvements as part of any safety-funded project. As the Active Transportation Programs Supervisor and BP [bicycle/pedestrian] Coordinator, I sit on the review committee for SHIP [Statewide Highway Improvement Program] funding review to ensure bike safety issues are adequately addressed.
2. **Plans to implement bicycle safety program?** No.

Comments or additional information: New Mexico is in the midst of drafting a statewide bicycle plan that will result in design guidelines to be used for identified roadway tiers. State-owned and [state-] maintained roadways that are slated to incorporate bicycle facilities will develop them as part of regularly scheduled maintenance and reconstruction. Safety is a key element of the design guidelines. All other bike safety issues are addressed as part of the SHSP manual and HSIP project funding review. Lastly, we have hired two on-call firms to draft Regional Safety Plans for parts of the state with high fatality rates. These plans will be conducted based on task orders, and I serve on the committee that determines the plans to be drafted and approves the resulting document. My role is specifically to ensure bike/pedestrian issues are properly addressed.

North Dakota

Contact: Donovan Slag, Transportation Engineer, Planning and Asset Management Division, North Dakota Department of Transportation, 701-328-4398, doslag@nd.gov.

1. **Current efforts to improve bicycle safety:** Funds have been designated towards media campaigns for motorist and bicyclist awareness and bicycle safety training in local schools. Crash analysis used to determine safety improvements must consider all road users (pedestrians, bicycles, etc.).
2. **Plans to implement bicycle safety program?** No.

Comments or additional information: Future plans for bicycle safety may be included in the development of our next SHSP; however, I am not aware of plans for a specific bicycle program at this time.

Rhode Island

Contact: Mark Felag, Managing Engineer, Planning and Program Development Division, Rhode Island Department of Transportation, 401-222-2524, ext. 4130, mark.felag@dot.ri.gov.

1. **Current efforts to improve bicycle safety:** We have included bicycle safety in our next edition of our State Highway Safety Program.
2. **Plans to implement bicycle safety program?** Yes. [See the response above.]

South Dakota

Contact: Andy Vandel, Highway Safety Engineer, Division of Planning and Engineering, South Dakota Department of Transportation, 605-773-4421, vandel@state.sd.us.

1. **Current efforts to improve bicycle safety:** Recent law was adopted requiring vehicles to have at least 6 feet of separation from bicycles.
2. **Plans to implement bicycle safety program?** No.

Utah

Contact: Robert Miles, Traffic and Safety Director, Utah Department of Transportation, 801-910-2070, robertmiles@utah.gov.

1. **Current efforts to improve bicycle safety:** We currently work in this area as part of our active transportation efforts. Our fatality numbers are higher in pedestrians than [in bicyclists]; therefore, we are putting more emphasis on developing pedestrian safety efforts lately.
2. **Plans to implement bicycle safety program?** Yes. As part of a larger active transportation safety initiative.

Georgia Bicycle and Pedestrian Safety Action Plan



Table of Contents

I.	INTRODUCTION & PLANNING PROCESS	3
II.	GOALS & OBJECTIVES.....	5
III.	EXISTING CONDITIONS REPORT	6
1.	Bicycle and Pedestrian Laws	6
2.	Bicycle and Pedestrian Funding Sources	8
3.	Bicycle and Pedestrian Facilities	13
4.	Engineering, Planning and Design Policies	15
5.	Georgia Bicycle and Pedestrian Crash Analysis Report.....	19
IV.	POLICY & NON-ENGINEERING RECOMMENDATIONS.....	31
V.	SYSTEMWIDE ENGINEERING RECOMMENDATIONS	Error! Bookmark not defined.
VI.	SITE-SPECIFIC RECOMMENDATIONS FOR HIGH CRASH AREAS	Error! Bookmark not defined.

I. INTRODUCTION & PLANNING PROCESS

Purpose

Passed in 2005, the federal transportation act, SAFETEA-LU, requires every state to develop Strategic Highway Safety Plans (SHSP) in order to continue to receive certain federal transportation funds. Georgia's SHSP was completed and adopted by Governor Perdue in October 2006, and updated again in October 2007. The plan identifies ten "key emphasis areas" and calls for the development of individual Safety Action Plans for each key emphasis area. Non-motorized transportation – or bicyclists and pedestrians – was one of these areas. A bicycle and pedestrian task team was convened, headed by Georgia Department of Transportation's State Bicycle and Pedestrian Coordinator, to develop the Bicycle and Pedestrian Safety Action Plan.

The purpose of the Safety Action Plans is to identify current conditions, safety problems and needs, and to determine future funding and programs. The Safety Action Plans must be comprehensive in scope and should address education, enforcement, engineering, emergency response, and evaluation. The bicycle and pedestrian plan will also address encouragement (i.e. programs that encourage more biking and walking). A multi-disciplinary team is working together to develop each of the plans. Once completed, the plans will be adopted by the SHSP Leadership Committee, comprised of high level management and leadership of various state agencies, who will use the plans to prioritize funding and programs.

In addition to this process, in 2005, the Federal Highway Administration (FHWA) identified Georgia as one of ten pedestrian "focus states". All states with more than 150 annual pedestrian fatalities were included in the multi-year focus state initiative which provides technical assistance to state DOTs to develop Pedestrian Safety Action Plans. Through this effort, FHWA has provided GDOT with four training workshops, monthly conference calls, a "How To" guide on developing Safety Action Plans, and technical reviews of crash data and draft planning documents.

Planning Process

The Georgia Department of Transportation (GDOT) formed a Bicycle and Pedestrian Task Team in December 2006 and began the development of the Georgia Bicycle and Pedestrian Safety Action Plan (GBPSAP).

The task team consists of members from 25 agencies and organizations involved in safety, transportation, public health, and biking and walking. The member organizations are listed below. The task team developed the vision, goals, objectives, recommendations and countermeasures, and will play in integral role in implementing the plan.

Georgia Bicycle and Pedestrian Task Team member organizations:

Agency/Organization		Agency/Organization	
1	Association County Commissioners of Georgia	18	GDOT, Office of Consultant Design
2	Atlanta Bicycle Campaign	19	GDOT, Office of Maintenance
3	Atlanta Regional Commission	20	GDOT, Office of Road Design
4	Center for Quality Growth & Reg'l Development (GA Tech)	21	GDOT, Office of Traffic Safety & Design
5	Chatham Co-Savannah Metro Planning Commission	22	GDOT, Office of Urban Design
6	City of Atlanta, Bureau of Planning	23	Georgia Bikes

7	City of Decatur	24	Georgia Department of Driver Services, Cust. Srvc, Licensing & Records Division
8	Clean Air Campaign	25	Georgia Environmental Protection Division
9	Dept. of Community Affairs, Office of Planning & Quality Growth	26	Georgia Municipal Association
10	Department of Education, Office of Pupil Transportation	27	Georgia Regional Transportation Authority
11	Dept. of Human Resources (DHR), Div. of Public Health (DPH), Office of EMS/Trauma	28	Governor's Office of Highway Safety (Law Enforcement & Planning Offices)
12	DHR, DPH, Office of Injury Prevention	29	Institute of Transportation Engineers/GA Section
13	DHR, DPH, Office of Chronic Disease (Physical Activity/Obesity initiative)	30	MARTA
14	FHWA - GA Division	31	North Georgia Regional Development Center
15	GA Tech - School of Civil & Environmental Engineering	32	PATH foundation
16	GDOT (Dept. of Transportation), Office of Planning (Bike/Ped/SRTS Programs)	33	PEDS
17	GDOT, District 7, Traffic Operations	34	Perimeter Transportation Coalition

Next Steps:

Once completed, the plan will be adopted by the Strategic Highway Safety Plan Leadership Committee and the Governor. The Leadership Committee will use this plan to prioritize the expenditure of federal safety funds. The Task Team will also seek to have the plan adopted by the State Transportation Board and thereby guiding future GDOT transportation decisions.

Following the completion of the plan, the Task Team will continue to meet to advise on plan implementation, and to advise the Department of Transportation on other bicycle and pedestrian related matters (policies, plans, accessibility or maintenance issues, maps and publications, etc).

II. GOALS & OBJECTIVES

The goal of the Georgia Strategic Highway Safety Plan is to “Strive for Zero Deaths”. All of the goals and objectives below reflect this overarching goal.

Vision

A safe and accessible environment that supports and encourages increased levels of bicycling and walking. All state, local, and regional transportation agencies provide a transportation system where walking and bicycling are viable transportation choices, and residents and visitors are able to walk and bike safely and conveniently to accomplish their daily activities while maintaining active and healthy lifestyles.

Goal 1: Improve Bicycle and Pedestrian Safety:

Objectives:

- Reduce pedestrian fatalities by 33% by 2013.
Statewide, the average number of annual pedestrian fatalities is 164 (2004 – 2006); a 33% reduction would result in about 110 fatalities per year by 2012.
- Reduce all pedestrian crashes and injuries by 20% by end of calendar year 2013.
Statewide, the average number of annual pedestrian crashes (2004-2006) was 2,582; a 20% reduction would result in 2,066 pedestrian crashes per year by 2012.
- Overall 20% reduction in bicycle crashes and injuries by the end of calendar year 2013.
Statewide, the average number of annual bicycle crashes (2004-2006) was 939; a 20% reduction would result in approximately 750 annual crashes.

Goal 2: Increase Trips Made by Bicycle and On Foot (including those using wheelchairs or other mobility assistance device):

Objectives:

- Increase bicycle and walking trips to school statewide by 20% by 2013. (Measured through the Georgia Safe Routes to School Program “before and after” parent surveys).
- Develop educational and promotional programs to encourage biking and walking.

Goal 3: Increase Funding for Bicycle and Pedestrian Programs and Infrastructure Improvements:

Objective:

- Base the percentage of total safety funds spent on bicycle/pedestrian safety projects on the percentage of bicycle/pedestrian fatalities statewide.
- Include bicycle and pedestrian facilities in all GDOT projects and all road projects with federal participation.

Goal 4: Improve Bicycle and Pedestrian Related Data Collection:

Objectives:

- Conduct inventory of sidewalk, bike lane, trail and shoulder mileage.
- Develop a data collection method for bicycle and pedestrian traffic counts, so that biking/walking rates can be measured.

III. EXISTING CONDITIONS REPORT

1. Bicycle and Pedestrian Laws

Georgia’s bicycle and pedestrian laws are found in the Georgia State Code. Below is a summary of key laws related to bicycles, pedestrians, and traffic safety, and a brief discussion of some emerging issues related to these laws. All traffic laws that impact bicycles and pedestrians can be found in the Appendix.



Figure 1: A cyclist riding legally in Athens, Georgia

Bicycle Laws:

Bicyclists are considered vehicles under Georgia Code, and therefore have the same rights and responsibilities as motor vehicles. Bicyclists can ride in the middle or left part of a lane if the lane is too narrow to share with a motor vehicle. Georgia Code does not include a specific provision prohibiting bicycles from operating on the sidewalk, however based on the definition of “vehicle,” it is illegal to operate a bicycle on the sidewalk regardless of the location or age of the bicyclist. All bikes operating at nighttime must use a front light and a rear red reflector. Any bicyclist under the age of 16 must wear a bicycle helmet.

The Georgia Code does not address operation or right-of-way assignment for bicycle lanes or multi-use paths. However it does allow for a local governing authority to require bicycles to use a path if it is adjacent to the roadway, regulated for the *exclusive* use of bicycles *and* designed according to American Association of State Highway Transportation Officials (AASHTO). Currently there are no paths in Georgia that meet all three of these requirements, therefore, bicyclists cannot be required to use a multi-use path adjacent to the roadway unless such paths are restricted for bicycle traffic only (i.e. no pedestrians, dog-walkers, joggers, etc) and upgraded to meet AASHTO standards.

Pedestrian Laws:

A crosswalk is legally defined as the part of an intersection that connects the sidewalks on either side of the street – whether marked with painted white stripes or not. Therefore, all laws that require drivers to stop for pedestrians in crosswalks apply to both those crosswalks marked with painted lines as well as to

“unmarked” crosswalks. Crosswalks must be marked at 3-way “T-intersections” and at mid-block locations in order for them to be considered “crosswalks” (the interpretation on T-intersections was established in Griffin v. Odum, Court of Appeals of Georgia, 1963).

The term “jay-walking” is misleading. Pedestrians can legally cross a road between intersections unless both adjacent intersections are signalized (generally only found in downtown areas). Pedestrians have the right of way when crossing unsignalized intersections even if the crosswalk is unmarked (except at T-intersections). Pedestrians can legally cross the street at a signalized T-intersection when the signal facing the pedestrian is green. However, pedestrians must yield to motor vehicles when crossing at an unmarked crosswalk at an unsignalized T-intersection, and when crossing between intersections at a non-crosswalk location. (See Figure 2).

Vehicles must stop and stay stopped for pedestrians in crosswalks. Georgia law requires turning cars to stop for pedestrians, even on green lights, if the pedestrian is approaching or within one lane of the half of the road onto which the driver will be turning. Drivers are allowed to turn right on red at most intersections, but pedestrians in crosswalks (marked or unmarked) still have right of way. Pedestrians can cross with the green light, except if there’s a walk/don’t walk symbol; then they can only start crossing during the walk phase, or finish walking during the flashing don’t walk phase.

(INSERT FIGURE21 – Diagram of legal pedestrian crossings)

Traffic Code Enforcement and Safety Laws:

Speeding is a major factor in pedestrian fatalities. The difference of 10 mph in vehicle speed is significant in increasing or decreasing the chances of the pedestrian’s survival in a pedestrian-vehicle crash. Currently police officers can only ticket drivers who exceed the speed limit by more than 10 mph (except in school zones one hour before, during, and after school hours, in marked historic districts, and in marked residential zones. Roads with speed limits of 35 mph + are not considered residential). However, urban districts cannot have a speed limit posted higher than 30mph – which few local governments seem to be aware of. Reducing the posted speed limit in these areas would remove some barriers to law enforcement, as well as open up additional areas to certain engineering treatments that are typically reserved for roads with a speed limit of 30mph or less (such as in-street crosswalk signs or speed humps). There is a need to define “urban district” and “marked residential zone” in the Georgia Code in order to help communities set proper speed limit and allow traffic enforcement.

2. Bicycle and Pedestrian Funding Sources

A. Transportation Enhancement:

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) established the Transportation Enhancement (TE) program, which was further refined under the Transportation Equity Act for the 21st Century (TEA-21) in 1998 and reauthorized under the Safe, Equitable, Transportation Efficiency Act – A Legacy for Users (SAFETEA-LU) in 2005. The TE program provides funds for non-traditional transportation projects such as sidewalks, multi-use trails, bicycle facilities, railroad depot and lighthouse renovations, and streetscape improvements.

<http://www.dot.ga.gov/localgovernment/FundingPrograms/TransportationEnhancement/>

B. Congressional Earmarks:

Congressional earmarks are funds inserted into legislation for specific projects, locations, or institutions that do not go through the normal budgetary review process. Access to these funds is generally obtained through lobbying a Congressman. There are 89 bicycle and pedestrian projects in the SAFETEA-LU authorization for Georgia. www.fas.org/sfp/crs/misc/m012606.pdf

C. CMAQ:

The Congestion Mitigation and Air Quality Improvement (CMAQ) program was created as part of ISTEA to support local efforts to meet the new federal guidelines set by the Clean Air Act Amendments (CAAA) of 1990 and provides funding assistance to regions designated as non-attainment areas by the EPA (i.e. areas in non-attainment of air quality standards established by the Clean Air Act). Areas failing to meet the National Ambient Air Quality Standards (NAAQS) receive funds to invest in projects that decrease transportation related air pollutants by reducing highway travel, encouraging more efficient use of existing facilities, and reducing vehicle emissions at the source. Eligible projects include ridesharing programs, intelligent transportation systems, and bicycle/pedestrian facilities.

In Georgia, projects are selected by the State Air Quality Partners: Georgia Department of Transportation, Georgia Division of Environmental Protection and the Georgia Regional Transportation Authority. The Atlanta Regional Commission (ARC) participates in project selection in the metropolitan Atlanta region. SAFTEA-LU appropriated \$50,115,972 to Georgia for FY05-FY09. <http://www.dot.ga.gov/DOT/plan-prog/planning/aq/CMAQ/index.shtml>. Historically, many of these funds were used for bicycle/pedestrian projects, however, since 2007, Georgia has focused these funds on projects that reduce Particulate Matter 2 – primarily diesel retrofits of bus and vehicle fleets.

D. Recreational Trails Program:

The Recreational Trails Program (RTP) was established under ISTEA. The RTP funds come from the Federal Highway Trust Fund, and represent a portion of the motor fuel excise tax collected from non-highway recreational fuel (i.e. tax on all-terrain vehicle fuel). Eligible projects include developing and maintaining recreational trails and trail-related facilities for both non-motorized and motorized recreational trail uses.

RTP funds are distributed to the States by legislative formula: half of the funds are distributed equally among all States, and half are distributed in proportion to the estimated amount of non-highway recreational fuel use in each State and a portion of these funds must be dedicated to motorized ATV trails projects. Georgia receives approximately \$2 Million annually and the funds are administered by the

E. Safe Routes to School:

Safe Routes to School (SRTS) is a new program created by SAFETEA-LU which provides Georgia with approximately \$16 Million for fiscal years 2005-2009. The Program's goal is to increase the number of children in grades K-8 bicycling and walking to school. The Program makes funding available for a wide variety of programs and projects, from building safer street crossings to establishing programs that encourage children and their parents to walk and bicycle to school. Benefits of the Program include: reduced congestion and increased safety near participating schools; reduced air pollution in route to and near participating schools; and increased physical activity of children. In Georgia, the program is administered by the Georgia Department of Transportation and the first round of funding is expected in 2009. <http://www.dot.ga.gov/srts/>

F. Safety Education (Sections 402 & 157):

The Governor's Office of Highway Safety administers funding for safety-related educational programs. Funding comes from the State and Community Highway Safety Grant Program (Section 402 of SAFETEA-LU) and some funding from the Safety Incentive Program (Section 157). Project selection is directed towards "National Priority Program areas" (i.e. program areas most effective in reducing crashes, injuries and fatalities) which include the Pedestrian and Bicycle Safety Program and the Community Traffic Safety Program (CTSP). Agencies at the state, county, city and private/non-profit levels are eligible to apply. State grants are available for up to three years with the first year of funding at 100% (no local match), the second year requiring a 20% local match, and the third year requiring a 40% local match. Funds are generally prioritized by crash frequency from the previous year's crash data. Examples of funded bicycle and pedestrian projects include a "Share the Road" awareness campaign and a bilingual pedestrian safety education initiative. (<http://www.gohs.state.ga.us/>).

G. Surface Transportation Program:

The Surface Transportation Program (STP) is funded by the Federal Highway Trust Fund, which is funded through gas taxes. The STP is the largest "pot" of money available for non-interstate highway construction, including bicycle and pedestrian facilities. Much of the bicycle and pedestrian facility network is constructed through this program as part of road widening and construction projects. In some instances, the Georgia DOT has used these general surface transportation funds to pay for pedestrian facilities as "stand alone" projects. Also, the larger MPOs with a population over 200,000 receive "attributable" funds which are a portion of STP that the MPO may program themselves, without the approval of GDOT. The Atlanta Regional Commission chooses to spend much of these "attributable" funds on bicycle and pedestrian projects (see Table 1). However, even MPOs which do not receive "attributable" funds can choose to fund bicycle and pedestrian projects through the STP – they just require GDOT approval. The Athens MPO (MACORTS) has funded a couple of bike lane projects, with the approval of GDOT, in this way. (www.fhwa.dot.gov/safetealu/factsheets/stp.htm).

H. Funding Amounts:

The following tables indicate the average amount of funding dedicated to bicycle and pedestrian programs and construction projects throughout the state. This tally does not include those facilities constructed as part of a road widening or new construction project, as those costs are not broken out separately in the project budget.

Table 1. Historic Bike/Ped Program Funding for Georgia

Program/Fund	Data Source	Years	Total amount	Per Year Average
Transportation Enhancement (TE)	Projects awarded for FY04-FY 07 (GDOT)	2004-2007	\$ 107,864,836	\$ 26,966,209
Congestion Mitigation Air Quality (CMAQ)	Projects approved FY05-FY10 (GDOT)	2005-2010	\$ 32,051,460	\$ 5,341,910
Safe Routes to School	GDOT – SAFETEA-LU	2005 - 2009	\$ 16,000,000	\$ 3,200,000
High Priority Projects	Projects listed in SAFETEA-LU	2005-2009	\$ 70,054,000	\$ 14,010,800
ARC Programmed Projects (Q23)	ARC Transp. Improv. Program FY03-FY05	2003-2005	\$ 48,823,200	\$ 16,274,400
Other Federal Funds (Q20, Q24, Fed'l Safety, bond)	GDOT - Transportation Explorer Database	2003-2006	\$ 9,431,105	\$ 2,357,776
DNR - Recreational Trails Program	Awarded project FY04 (DNR)	2004	\$ 1,441,722	\$ 1,441,722
DNR - Land & Water Conservation Program	Awarded project FY03-05 (DNR)	2003-2005	\$ 3,305,487	\$ 1,101,829
Governor's Office of Highway Safety - Safety/Education	Provided by GOHS (Section 402 & 157 funds)	2004-2006	\$ 498,704	\$ 166,235
			TOTAL	\$ 67,660,881

Table 2. Projected Bike/Ped Funding*

Program/Fund	Data Source	Years	Total amount	Per Year Average
Transportation Enhancement (TE)	Projects awarded for FY04-FY 07 (GDOT)	2004-2007	\$ 107,864,836	\$ 26,966,209
ARC Programmed Projects (L230)	ARC 2008 – 2013 TIP	2008 - 2013	\$ 103,170,517	\$ 17,195,086
Other Federal Funds (L200, L240, Fed'l Safety)	ARC 2008 – 2013 TIP	2008 - 2013	\$ 18,656,400	\$ 3,109,400
State Bonds (GRTA)	ARC 2008 – 2013 TIP	2008 - 2013	\$ 7,715,053	\$ 1,285,842
DNR - Recreational Trails Program	Awarded project FY04 (DNR)	2004	\$ 1,441,722	\$ 1,441,722
DNR - Land & Water Conservation Program	Awarded project FY03-05 (DNR)	2003-2005	\$ 3,305,487	\$ 1,101,829
Governor's Office of Highway Safety - Safety/Education	Provided by GOHS (Section 402 & 157 funds)	2004-2006	\$ 498,704	\$ 166,235
			TOTAL	\$ 51,266,323

*Projections for SRTS and HPP to be determined. No CMAQ funds are expected in the next funding cycle.

Transportation Enhancement Program:

The largest proportion of bicycle and pedestrian projects are funded through the TE program (See Figure 3). Of these projects, less than one-percent were spent on on-street bicycle facilities, and approximately 10% were spent on new sidewalks (where none had previously existed) and on pedestrian safety improvements (such as pedestrian overpasses or refuge islands). The majority of the funds went to multi-use trail facilities, and streetscape projects which generally include sidewalk upgrades, street furniture, new lighting, and landscaping (See Figure 4).

Figure 3.

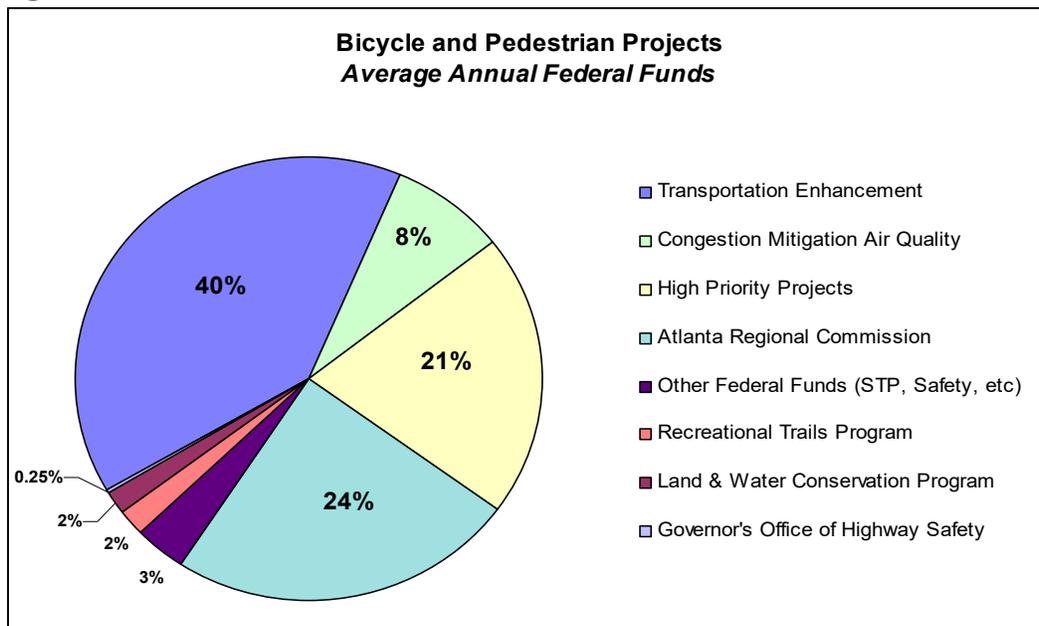
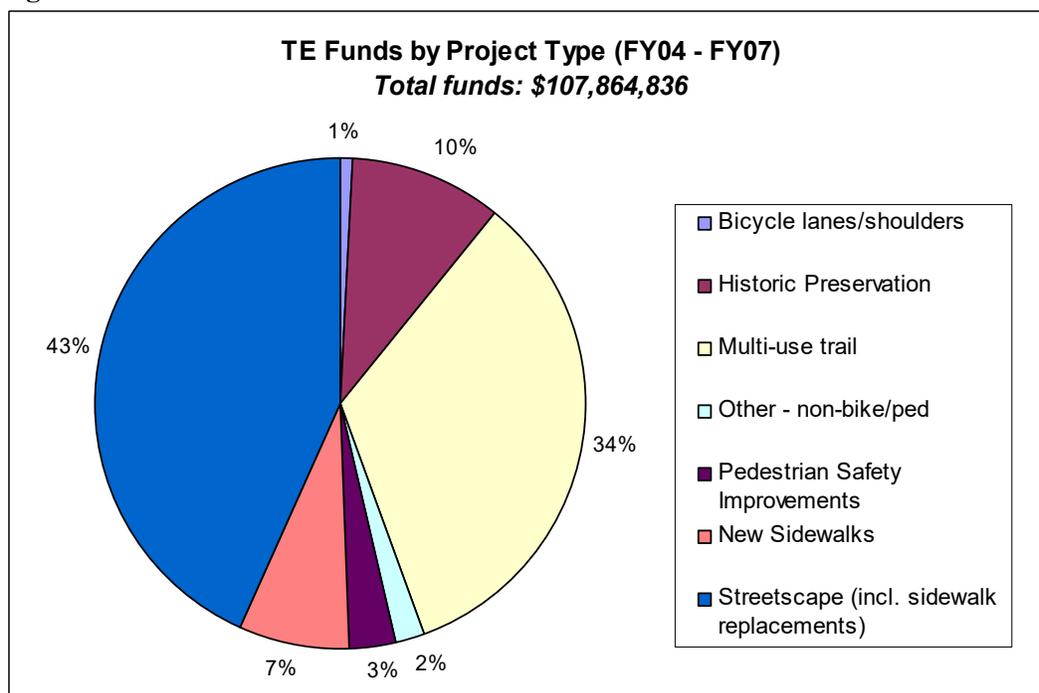


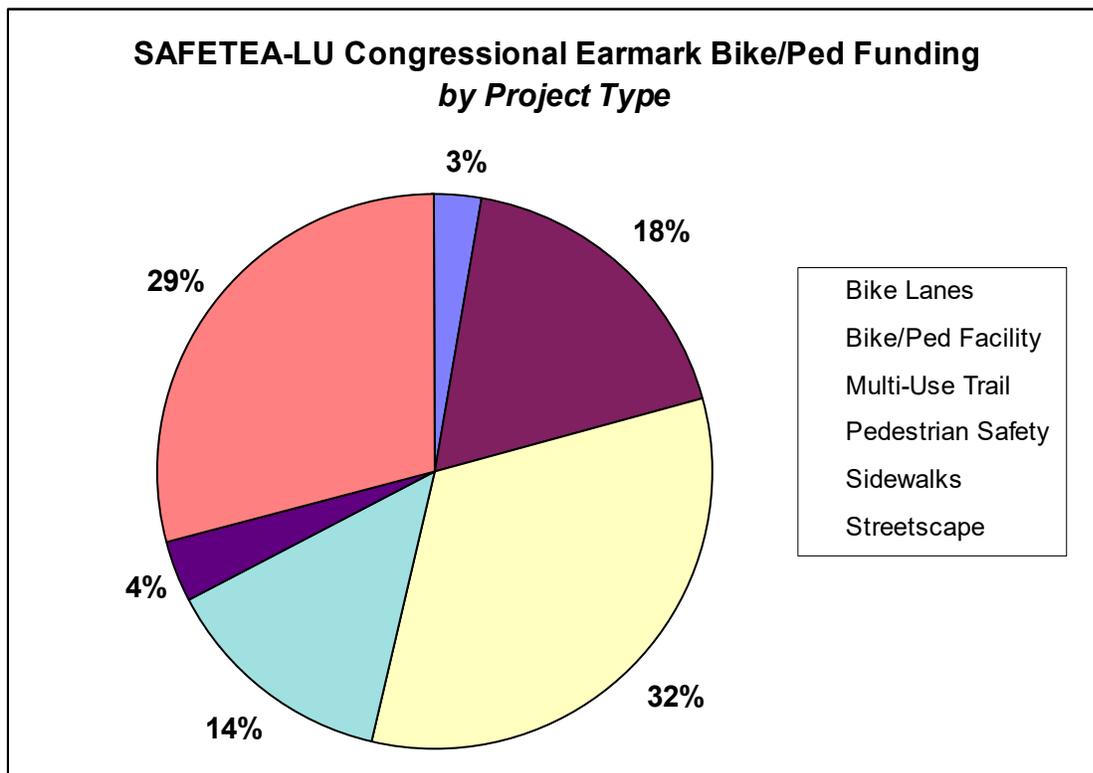
Figure 4.



Congressional Earmarks:

In addition to Transportation Enhancements, a large percentage of bicycle and pedestrian funding (21%) came from Congressional earmarks in the SAFETEA-LU legislation. Congressional earmarks, also referred to as “high priority projects”, are projects inserted into authorization bills by U.S. Senators and House Representatives for a particular project in their state. SAFETEA-LU dedicates over \$70 Million to bicycle and pedestrian projects in Georgia for the period of the authorization – FY2005-FY2009. Of these projects, like the Transportation Enhancement (TE) Program, most are streetscape and trail projects. However, a higher proportion of these funds are dedicated to pedestrian safety projects (such as median refuge islands), sidewalk construction, and bike lanes. (See Figure 5).

Figure 5.



Metropolitan Planning Organizations:

The Atlanta Regional Commission is the Metropolitan Planning Organization (MPO) that serves the Atlanta Region. There are 15 MPOs in Georgia which are charged with programming the federal transportation funds for their respective metropolitan regions. MPOs receive funds based on their population, and the larger MPOs with populations over 200,000 receive additional funding which can be spent at the discretion of the MPO (known as Q23 or LU230 or “attributable” funds). Most MPOs spend these funds on road projects, but the ARC spends much of its money on bicycle and pedestrian projects. Much of the ARC bike/ped projects are part of the Livable Centers Initiative which is a program aimed at coordinating land use and transportation, and developing compact, mixed-use developments that promote transit, bicycle and pedestrian access. The LCI Program funds both plans and construction projects. Most of the remaining ARC bike/ped projects are transportation or safety oriented, with fewer streetscape projects than TE or Congressional Earmarks.

3. Bicycle and Pedestrian Facilities

Sidewalks:

According to the Georgia Department of Transportation’s Road Characteristics (RC) database, there are a total of 7,754.44 miles of public roads that have sidewalks on one or both sides of the road. Of the 7,754.44 miles, 3,880.48 miles have sidewalks on both sides of the road. There are approximately 1,485.31 miles of state highway with sidewalks on at least one side of the road, of which, 944.66 miles have sidewalk on both sides and 550.65 miles have sidewalk on just one side.

Paved shoulders:

The RC database indicates that there are approximately 2,382 miles of public roads that have at the least one paved shoulder with a width greater than, or equal to 4 feet. Of these, 2141 miles are state highways.

All Public Roads		
	Miles	Percentage
All Public Roads (excluding interstates)	114,758	
Sidewalks (on at least one side of the road)	7,754	7%
Paved Shoulder \geq 4' (on at least one side of the road)	2,382	2%

State Highways		
	Miles	Percentage
State Highways (excluding interstates)	15,702	
Sidewalks (on at least one side of the road)	1,495	10%
Paved Shoulder \geq 4' (on at least one side of the road)	2,141	14%

Source: GDOT, Office of Transportation Data 2008



Figure 6: A Cyclist Riding on the Shoulder in Chamblee.

Georgia State Bicycle Route Signage:

In 1997, the Georgia Department of Transportation designated 14 state bicycle routes, and to date, has installed signage on four of these designated routes. Information on the four signed routes can be found in Table 3 below. In addition to the four state bicycle routes that are signed, there are many other local roads and some state highways that have bicycle signage, but there is no current inventory of these signed routes at this time.

Table 3. Signed State Bicycle Routes

State Bicycle Route (SBR) Name	Counties	Mileage
Southern Crossing (SBR 10)	Seminole, Decatur, Grady, Thomas, Brooks, Lowndes, Lanier, Clinch, Ware, Brantely, Glynn	246.3
Coastal Route (SBR 95)	Rabun, Habersham, Stephens, Franklin, Hart, Elbert, Wilkes, McDuffie, Warren, Jefferson, Burke, Jenkins, Screven, Effingham, Chatham	168.6
Savannah River Run (SBR 85)	Effingham, Chatham, Bryan, Liberty, McIntosh, Clynn, Camden	314.3
Augusta Link (SBR 50)	McDuffie, Columbia, Richmond	38.5
<i>Total</i>		<i>767.7</i>

The signs along the state bicycle routes include various signs from the Manual on Uniform Traffic Control Devices (MUTCD). They are: the bicycle warning sign with the “Share the Road” placard (W11-1, W16-1), bicycle route markers (D11-1, M1-8), “right turn yield to bikes” regulatory sign (R4-4) and a variation of a warning sign which reads “watch for bicyclists on bridge”. The signs are installed in 5 mile intervals and at every intersection where the bike route makes a turn.

Figure 7: Bicycle Signage



4. Engineering, Planning and Design Policies

Design and Accommodation Policies

Georgia Department of Transportation Policies:

Pedestrian Signals:

Pedestrian countdown heads are being used on new traffic signal permits for new signals and signal upgrades.

Sidewalks:

From the *GDOT Design Policy Manual*: Sidewalks will be provided wherever curb and gutter is utilized along the outside edges of pavement of the mainline roadway, i.e., urban sections. Sidewalk may be omitted on side road tie-ins where there is no existing sidewalk and the additional widening of shoulders for sidewalk would result in excessive impacts as determined by the design team on a case by case basis. Sidewalk will not be required in rural areas where curb and gutter is placed at the back of the useable shoulder for the purpose of reducing construction limits. Refer to GDOT Construction Standards and Details and *GDOT Pedestrian and Streetscape Guide*. Sidewalks are to be placed 2' behind the curb (Typical), 6' behind the curb (Desirable). A 16' shoulder is recommended when there is sufficient space for the use of a 6' grass strip. (*GDOT Design Policy Manual, Chapter 6.6*).

Figure 8: Typical Sidewalk Placement Behind Curb



Crosswalks:

Pedestrian signals, crosswalks, landings, and curb ramps must be provided on all approaches to a signalized intersection except those exempted by the Office of Traffic Safety and Design (usually for safety reasons). (*Traffic Signal and Design Guidelines*)

Islands:

Islands should be considered for roads too wide for pedestrians to cross all at once. They must be large enough for drivers to see, cannot get in the way of turns, and should not make the intersection larger. (GDOT Design Policy Manual, Chapter 7)

Bicycle Facilities:

Bicycle lanes and related improvements shall be incorporated into all widening and reconstruction projects when there is an existing bikeway or if the project is on an approved Bicycle Route. The term “Bicycle Route” is defined as “any roadway where there is an existing bikeway or any location where a bicycle facility is identified for such roadway in a state, regional or local transportation plan” (GDOT Design Policy Manual, Chapter 6.12 and Glossary).

Medians at Pedestrian Crossings:

Locations where a significant number of pedestrians are likely to be crossing the roadway at mid-block, may warrant positive separation of opposing traffic using a median for pedestrian refuge. Signals are not typically warranted at these locations. Two phase pedestrian crossings may be required when the roadway width requires excessive pedestrian crossing time (i.e. 6-lane section with dual lefts and a right turn lane, etc). In the case of a two phase pedestrian crossing, the median must be wide enough to provide an ADA compliant pedestrian refuge area. (GDOT Design Policy Manual, Chapter 6.9.4)

Lane Widths:

The standard lane width is 12 feet. In Type A urban areas (characterized by speed limits of 35 or less, curbs and sidewalks, CBDs or historic districts, building face to curb generally 10 feet or less, low truck volumes) lane widths can be reduced to 11 feet. (GDOT Design Policy Manual, Chapter 6.2.1)

Bike Lane signs:

GDOT follows the FHWA Manual on Uniform Traffic Control Devices (MUTCD: mutcd.fhwa.dot.gov/pdfs/2003/Ch9.pdf). The “bike lane” sign must be used together with marked bicycle lanes. Sign spacing should be determined by engineering judgment based on prevailing speed of bicycle and other traffic, block length, distances from adjacent intersections, and other considerations. The “ahead” sign should be mounted directly below a bike lane sign in advance of the beginning of a marked bicycle lane. The “ends” sign should be mounted directly below a bike lane sign at the end of a marked bicycle lane. Where motor vehicles entering an exclusive right-turn lane must weave across bicycle traffic in bicycle lanes, the “begin right turn lane yield to bikes” sign may be used to inform both the motorist and the bicyclist of this weaving maneuver.

Figure 9: Marked bicycle lane near Georgia Tech in Atlanta



Share the Road signs:

GDOT’s guidelines state they should be placed on roads without bike lanes; within 500 feet of transitions between bike lanes or paved shoulders to shared roadways; in areas where the road curves continuously (at intervals of 5 miles in rural areas and 2 miles in urban areas or as needed); and along two-lane roads with paved shoulders less than 2 feet wide (same intervals as above). In practice, signs are typically installed at the request of a local government or concerned citizens. Often installation is done by the local government, even on state facilities. (*GDOT Signing and Marking Guidelines*)

Speed limits:

Georgia Code Article 9, beginning with Section 40-6-180 sets the basic standard of a “reasonable” speed limit. Transportation Online Policy & Procedure System (TOPPS) 6780-4 (www.dot.ga.gov/topps/op/tsd/6780-4.htm) states that “the speed limit will be set as a maximum speed limit under the best conditions...”.

Roundabouts:

GDOT requires approval by the Division Director of Preconstruction, the Division Director of Operations, and the Chief Engineer. To be eligible for roundabouts, roads must have single-lane approaches with ADT counts not to exceed 16,000.

Accel /Deceleration lanes:

Acceleration lanes are usually not built on low speed roads. They are required by GDOT as needed based on grade, sight distance and traffic. According to the Driveway Manual, at speeds over 55 mph, full-width acceleration lanes should be considered, and on driveways that include a deceleration lane, a tapered acceleration lane should be considered. Deceleration Lanes are considered to always be helpful and are required when projected traffic exceeds certain minimum standards.

From the Regulations for Driveway & Encroachment Control Driveway Manual used by site developers:

“4I-1 When Deceleration Lanes Are Required: The provisions of this section shall generally apply to auxiliary lanes installed on the approach to an intersection that provide for deceleration and storage of vehicles waiting to turn right or left. Such lanes are always beneficial and will be required in conjunction with commercial driveway permits when projected traffic volumes exceed minimum levels as provided in the sections below.

4I-1-1 Minimum Requirements for Right Turn Deceleration Lanes:

Right turn deceleration lanes must be constructed at no cost to the Department (Georgia Department of Transportation) if the daily site generated Right Turn Volumes (RTV) based on ITE Trip Generation (assuming a reasonable distribution of entry volumes) meet or exceed the values shown in <table below>. Passing lane sections fall under the criteria for two or more lanes.”

Table 4. GDOT Minimum Requirements for Deceleration Lanes

Posted Speed	2 Lane Routes		More than 2 Lanes on Main Road	
	AADT	AADT	AADT	AADT
	<6000	≥6000	<10,000	≥10,000
35mph or less	200 RTV/day	100 RTV/day	200 RTV/day	100 RTV/day
40 to 50 mph	150 RTV/day	75 RTV/day	150 RTV/day	75 RTV/day
55 to 60 mph	100 RTV/day	50RTV/day	100 RTV/day	50 RTV/day
≥ 65 mph	Always	Always	Always	Always

Multiple left turn lanes:

Dual left turn lanes are used on high traffic volume roads based on a capacity analysis (300 vehicles or more turning left per hour). Off-peak periods should be considered as dual left turn lanes usually do not allow turning at will. (*Regulations for Driveway and Encroachment Control*)

Design Speed:

AASHTO defines the design speed as "...the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern."

GDOT policy, according to GDOT Design Policy Manual, is to set design speeds such that they are consistent with the speed drivers are traveling. The manual further notes that on country roads or city streets, engineers should work with local jurisdictions to set speed limits and design speeds in order to encourage the local jurisdiction to post a speed less than or equal to the design speed. "It is desirable to select a design speed as high as practical to attain a desired degree of safety, mobility, and efficiency within the constraints of environmental quality, economics, aesthetics, and other social or political effects." (*GDOT Design Policy Manual, Chapter 3*).

Design vehicles are selected types of vehicles, with representative weight, dimensions, and operating characteristics used to set highway design controls (passenger cars, buses, trucks, and recreational vehicles). The Design Manual notes that the bicycle should be considered a design vehicle where it may be used on a road.

Sources:

- GDOT Design Guidance Policy Memo, January 7, 2003 from Frank Danchetz, Chief Engineer
- Repository for Online Access to Documentation and Standards (ROADS): www.dot.ga.gov/dot/preconstruction/R-O-A-D-S/index.shtml
- GDOT Design Policy Manual: www.dot.ga.gov/dot/preconstruction/R-O-A-D-S/DesignPolicies/index.shtml
- GDOT Transportation Online Policies and Procedures System (TOPPS): www.dot.ga.gov/topps
- Regulations for Driveway & Encroachment Control Driveway Manual: www.dot.ga.gov/dot/preconstruction/r-o-a-d-s/DesignPolicies/documents/pdf/DrivewayFull.pdf
- Office of Traffic Safety and Design: www.dot.ga.gov/dot/operations/traffic-safety-design/index.shtml
- Office of Road Design: www.dot.ga.gov/dot/preconstruction/roaddesign
- Traffic Signal and Design Guidelines: www.dot.ga.gov/dot/operations/traffic-safety-design/Documents/PDF/Traffic%20Signal%20Design%20Guidelines.pdf

5. Georgia Bicycle and Pedestrian Crash Analysis Report

The data used in this crash report is from the Georgia Department of Transportation crash database which is compiled from police crash reports. The Crash Analysis Reporting Environment (CARE) tool was also used.

Introduction

Bicycles and pedestrians comprise 10.5% of all fatalities in Georgia – more than other crash types and users (e.g. heavy trucks, motorcycles, train/car, work zone and run-off-the-road crashes).

Table 5: Percentage of Fatalities by User and Crash Type*

Alcohol related	31.5%
Bicycles	1.5%
Fatigue/Inattentive	3%
Head-on	15%
Heavy Trucks	9%
Intersections	46%
Motorcycles	7%
Not using seatbelt (passenger vehicles)	73%
Older drivers (over 64)	16%
Pedestrians	9%
Run-off the road	9%
Speeding & tailgating	21%
Vehicle/train	<1%
Work zones	1%
Young drivers (under 21)	19%

**Based on 1,023,293 crashes, and 4995 traffic fatalities between 2003-2005*

Bicycle Crashes

Bicycle crashes in Georgia comprise less than a quarter of 1% of the overall traffic related crashes, yet represent more than 5 times that percentage of the overall traffic fatalities. This points to the vulnerability of a bicyclist in a crash compared with motor vehicle drivers/passengers. Nationally, Georgia ranks 8th among the states with the most bicycle fatalities. This is somewhat alarming considering that, based on the 2000 Census journey to work data (the only exposure data available on bicycling), the Atlanta Metropolitan Statistical Area (MSA) has among the lowest rates of bicycling in the country.

Table 6: Bicycle and Traffic Crashes in Georgia, 2000 - 2006

Year	All Traffic Crashes	All Bicycle Crashes	% of All Traffic Crashes that are Bicycles	All Traffic Fatalities	All Bicycle Fatalities	% of all Traffic Fatalities that are Bicycles
2000	310,122	803	0.26%	1,404	12	0.85%
2001	317,851	711	0.22%	1,475	21	1.42%
2002	327,710	788	0.24%	1,367	11	0.80%
2003	332,321	723	0.22%	1,469	15	1.02%
2004	342,307	718	0.21%	1,466	16	1.09%
2005	348,041	755	0.22%	1,595	20	1.25%
2006	342,158	932	0.27%	1,703	16	0.94%

Of all reported bicycle crashes from 2000 – 2005, 2.1% were fatalities, 76.5% were injury crashes, and 21.3% were non-injury or property damage only (PDO) crashes.

While the number of bicycle fatalities seems relatively low per year (generally under 20), they are on the rise in Georgia. The year 2001 stands out as a bit of an anomaly with highest number of fatalities in the 7 year period, while at the same time having the lowest number of crashes and injuries for the same period. The general trend line however shows a steady increase of fatalities since 2002.

Figure 10.



Shortfalls of Data

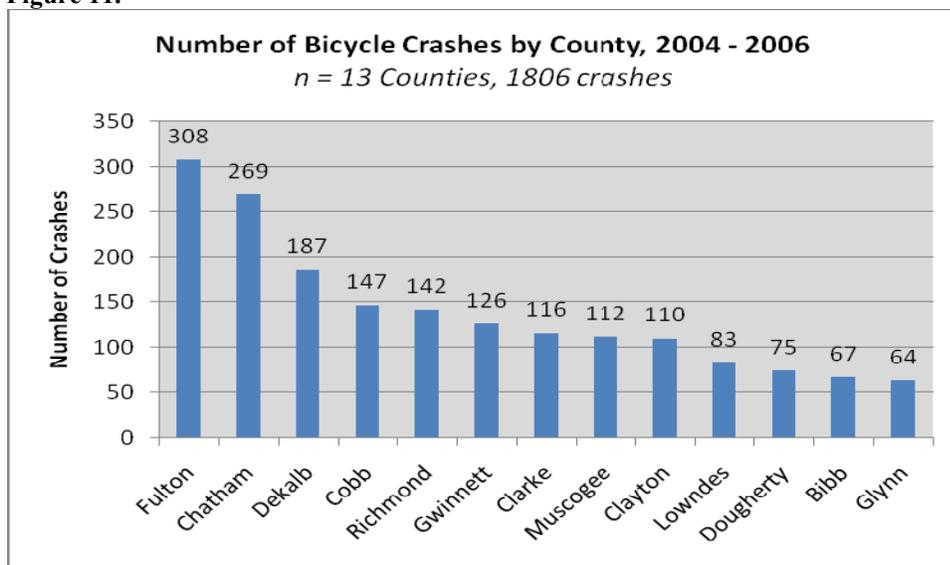
The biggest obstacle to analyzing bicycle crash data is the lack of “exposure” data. Unlike with motor-vehicles, we do not have traffic counts or bicycle-miles-traveled data. Therefore, while we know there is a moderate increase in bicycle fatalities, we do not know if the fatality rate for bicyclists is going up, down, or staying flat.

The crash database also does not include some critical information, such as the bicycle’s direction of travel (riding with or against traffic), the bicycle maneuver (was the bicyclist traveling straight or turning left or right?), the presence of a bike facility, and helmet use data is incomplete. In addition to analyzing the crash database, 198 police crash report forms where a bicyclist was injured or killed were reviewed. None of these reports indicated whether the bicyclist was using headlights or rear reflectors/lights, the helmet data was spotty, and nearly half of the reports did not indicate where the bicyclist was riding (i.e. with traffic, against the flow of traffic, in a bike lane, on a sidewalk, etc). This lack of data makes it difficult to understand the root causes of certain crashes.

Geographic Distribution of Crashes

The majority of bicycle crashes occur in a relatively small geographic area. There were 2,819 bicycle crashes from 2004 – 2006. Of these, 1,806 crashes (64% of the state’s total) occurred in just 13 counties. The remaining 1,013 crashes were spread among the remaining 146 counties, averaging about 7 crashes per county over the 3 year period.

Figure 11.



Characteristics of Bicycle Crashes

Beyond this clustering of crashes in metropolitan areas, there is no statistically significant pattern of bicycle crashes occurring along the same roadway or intersection. Therefore, it will be more fruitful to look at roadway type and crash characteristics to find trends or commonalities among the crashes. Countermeasures will be generally applicable to similar types of roadways or crashes across the state.

Bicycle Crashes by Speed Limit:

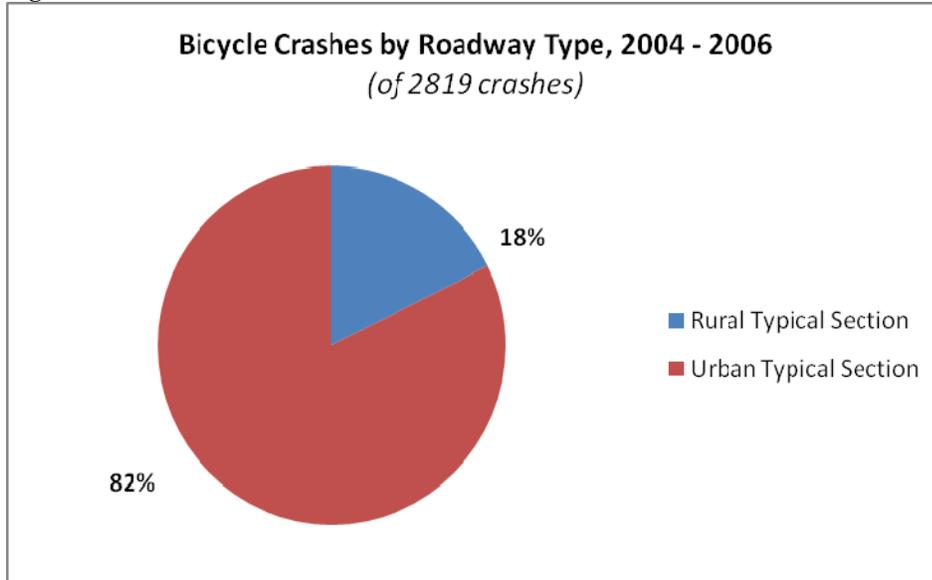
Nearly twice as many bicycle crashes occur on local streets with a posted speed limit of 35mph or less than on higher speed roads. However, the opposite is true for fatalities: from 2004 through 2006, 17 fatalities occurred on roads with a speed limit of 35mph or less, and 40 fatalities on roads with a 40mph speed limit or greater. This is not surprising – the roads with higher speed limits tend to be rural state highways or multi-lane suburban arterials which attract fewer bicyclists than lower speed streets in urban areas. However, when crashes do occur at these higher speeds, they are more likely to be fatalities.

Table 7: Bicycle Crashes and Fatalities by Speed Limit, 2004-2006

Speed Limit	Crashes	Fatalities	% of Crashes that are fatalities
Null	199	0	0.00%
15	6	0	0.00%
20	9	0	0.00%
25	415	2	0.48%
30	587	5	0.85%
35	690	10	1.45%
40	194	3	1.55%
45	477	19	3.98%
50	30	1	3.33%
55	192	16	8.33%
60	2	0	0.00%
65	15	1	6.67%
70	3	0	0.00%
Total	2819	57	2.02%

The following pie chart reiterates this pattern – that most bicycle crashes occur in urban areas on urban roadway types. These are generally roadways with a speed limit of 35mph or less (sometimes up to 45mph), have curb and gutter and usually sidewalks. There are generally more driveways and intersections on urban roadways than on rural typical sections.

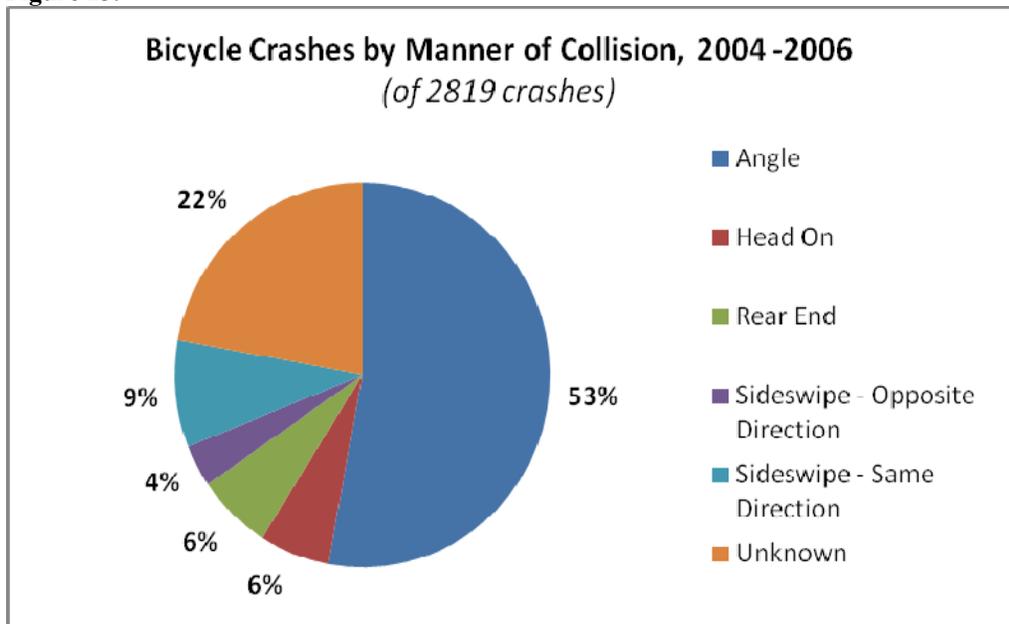
Figure 12.



Manner of Collision:

As shown in the chart below, approximately half of all bicycle crashes are at an angle, which indicates turning movements (possibly motor vehicles turning right or left in front of the bicyclist).

Figure 13.



Use of Bicycle Helmets:

Georgia's bicycle crash statistics from 2000 to 2006 (taken from GDOT's crash database) reveal that only 12 percent of bicyclists involved in crashes wore helmets. National statistics from the Insurance Institute for Highway Safety show that just 8.5 percent of bicyclists killed in crashes from 2000 to 2006 wore helmets. This may reflect the low usage of helmets, or may portray the effectiveness of helmet usage in preventing death.

Age is a significant factor affecting helmet use. Of the bicycle crash victims in Georgia, those aged 30 and older had a helmet use rate of 22 percent. This is more than three times greater than the helmet use rate among bicycle crash victims under 30 years old. This may explain why bicyclists under 18 years old comprise 30% of Georgia's bicycle fatalities (of these fatalities, only 11 percent wore helmets).

Figure 14.

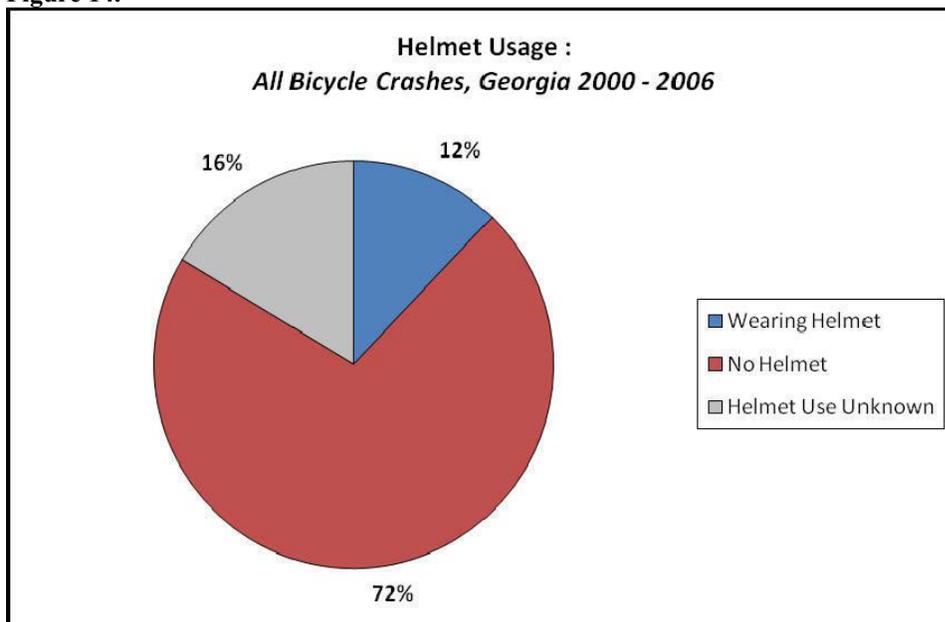
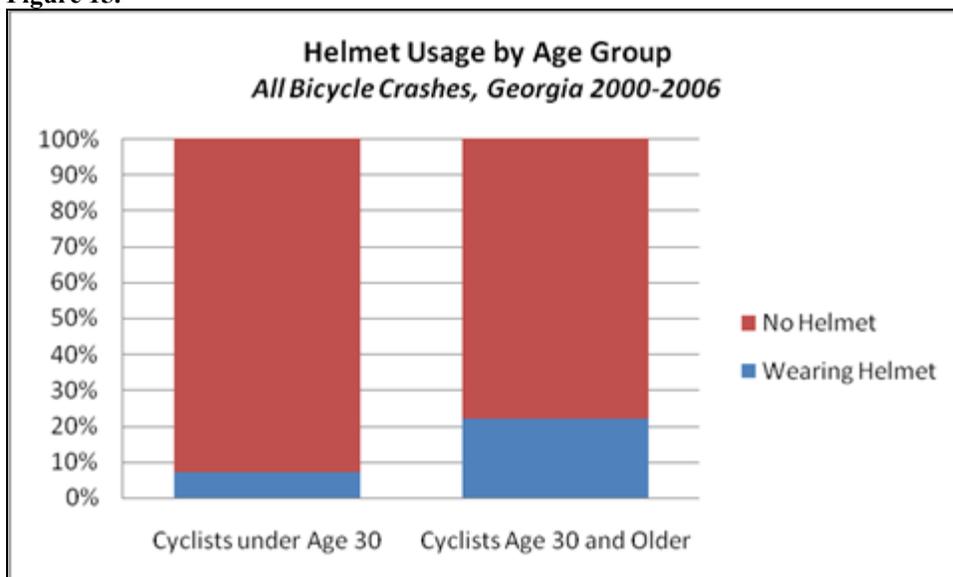


Figure 15.



High Bicycle Crash Locations:

While the majority of bicycle crashes are spread out randomly among a dozen counties, there are some corridors where crashes tend to cluster, and further evaluation of the crash reports for these areas may be warranted. The high crash corridors were determined by all 2 mile roadway segments with at least 4 crashes from 2004 – 2006.

Intersections were also analyzed, and no pattern was discovered in these crash locations. Over the 3-year period, *no intersection* in the entire state had more than 3 bicycle crashes recorded. During this same time period. Only 25 intersections in the state had 2 bicycle crashes occur at them, and only 4 intersections experienced 3 bicycle crashes (none of which were fatalities). Therefore, the intersection data will not be used in project prioritization, but the corridors will be (which are inclusive of intersection crashes as well).

Table 8: High Bicycle Crash Corridors, 2004 - 2006

County	Name	Start Point	End Point	Total Crashes	Fatal Crashes
Fulton	PONCE DE LEON AVE	8.41	9.9	11	
Fulton	HIGHLAND AVE	1.59	3.51	11	
Clarke	PRINCE AVE	3.09	4.25	9	1
Chatham	MONTGOMERY CROSS RD	0.3	1.22	8	
Clarke	BAXTER ST	0.17	1.81	8	
Fulton	NORTH AVE	7.49	8.04	7	
Richmond	WALTON WAY	0.27	1.27	7	
Chatham	DERENNE AVE	0.16	0.43	6	
Richmond	GREENE ST	3.91	4.63	6	
Richmond	LANEY WALKER BLVD	0.23	1.04	6	
Chatham	40TH ST	0.14	1.16	6	
Liberty	ELMAG MILES PKWY	17.92	18.97	6	
Lowndes	PATTERSON ST	15.24	16.49	6	1
Clarke	W BROAD ST	7.57	8.09	5	
Chatham	HENRY ST	0.9	1.79	5	
Clarke	OCONEE ST	8.79	8.96	4	
Bulloch	FAIR RD	18.49	18.91	4	
Clarke	BROAD ST	6.3	6.76	4	
Chatham	LINCOLN ST	1.08	1.57	4	
Cobb	S COBB DR	4.87	5.56	4	1
Fulton	MEMORIAL DR	31.8	32.56	4	
Clayton	UPPER RIVERDALE RD	0.49	1.49	4	
Dougherty	SLAPPEY BLVD	1.65	2.68	4	
Glynn	GLYNN AVE	13.53	14.59	4	1
Lowndes	N PATTERSON ST	0.08	1.24	4	
Houston	GREEN ST	0.89	2.51	4	
Richmond	FAIRINGTON DR	0.01	1.75	4	
Douglas	FAIRBURN RD	8.32	10.23	4	

Pedestrian Crashes

Introduction

As shown in the table below, pedestrians are over-represented in traffic fatality data, comprising of over 10% of all motor-vehicle related fatalities yet making up less than 1% of all crashes.

Table 9: Pedestrian and Traffic Crashes in Georgia, 2000 - 2006

Year	All Traffic Crashes	All Pedestrian Crashes	% of All Traffic Crashes that are Pedestrians	All Traffic Fatalities	All Pedestrian Fatalities	% of all Traffic Fatalities that are Pedestrians
2000	310,122	2490	0.80%	1,404	141	10.04%
2001	317,851	2552	0.80%	1,475	158	10.71%
2002	327,710	2561	0.78%	1,367	166	12.14%
2003	332,321	2530	0.76%	1,469	161	10.96%
2004	342,307	2435	0.71%	1,466	156	10.64%
2005	348,041	2574	0.74%	1,595	151	9.47%
2006	342,158	2738	0.80%	1,703	185	10.86%

Summary of Injuries and Fatalities

Pedestrian crashes, injuries and fatalities have generally remained level for the six year time period, however crashes are decreasing or leveling off in the City of Atlanta (down 3% from 2003 to 2006), but increasing in the suburban Atlanta – up over 30% in Gwinnett and Clayton Counties, and up 10% in Dekalb County over the same time period. This may indicate that as Atlanta is becoming more walkable and densely developed, crashes are going down, while suburban Atlanta has seen increased traffic and an influx in transit-dependent residents in recent years. The 10 counties below comprise almost 70% of all pedestrian crashes in the state.

Table 10: Counties with a Minimum 50 Annual Pedestrian Crashes, 2003 - 2006

County	2003	2004	2005	2006	Total
Fulton	587	555	551	569	2262
Dekalb	306	329	342	337	1314
Cobb	144	120	163	152	579
Chatham	138	146	142	160	586
Gwinnett	121	133	148	160	562
Clayton	102	107	113	139	461
Richmond	86	80	76	84	326
Bibb	94	76	67	104	341
Muscogee	72	73	87	78	310
Clarke	74	50	64	56	244

Pedestrian Crashes by Speed Limit

As with bicycle crashes, most pedestrian crashes occur on lower speed roads (25mph – 35mph), while most fatalities occur on roads with a 45mph speed limit. Fatalities are more likely to occur on higher speed roadways because reaction time and stopping distances are decreased. However, there are fewer

pedestrians on these high speed roadways (generally principal arterials and multi-lane suburban corridors), which would explain why fewer overall crashes occur on these roads than on local roads.

Figure 16.

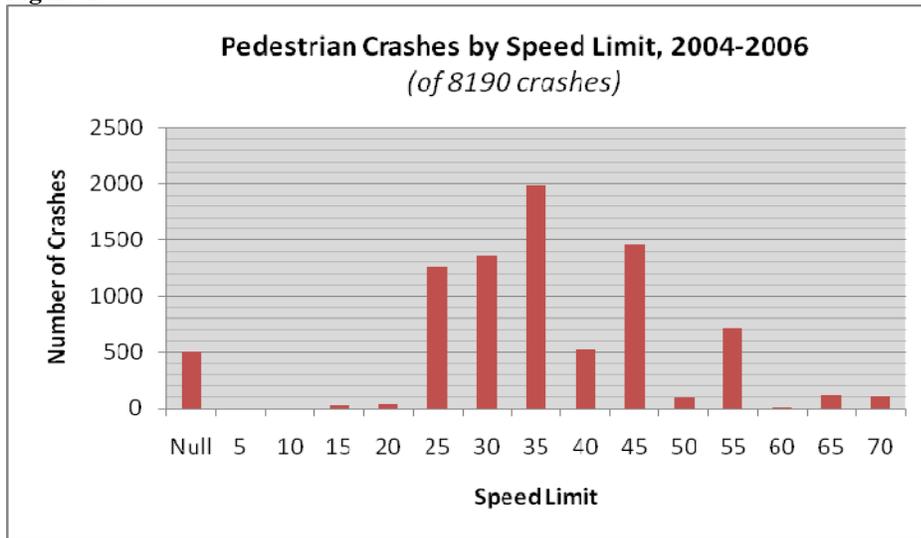
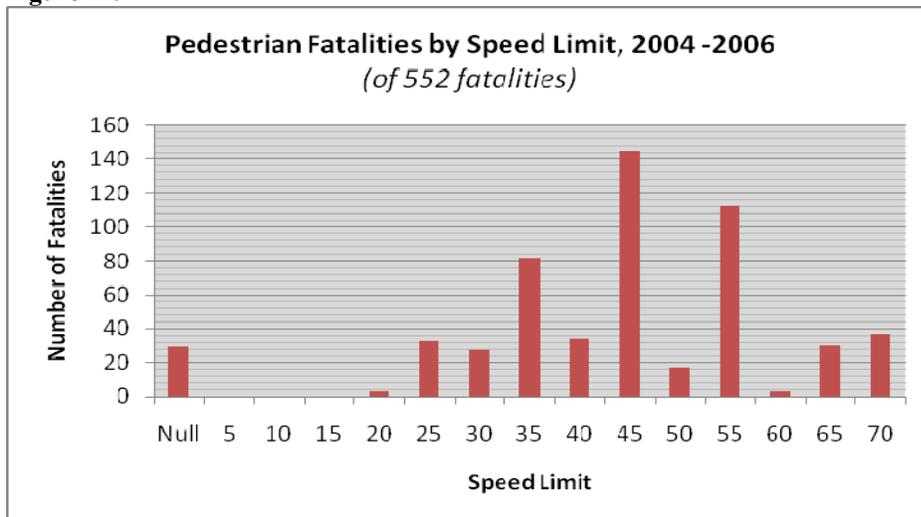


Figure 17.



Characteristics of the Pedestrian

There is a common misconception that the majority of pedestrian crashes are caused by a drunk or impaired pedestrian. The data indicates otherwise: only 3.4% of pedestrians involved in crashes in Georgia from 2004 – 2006 were listed as having been under the influence of drugs or alcohol.

Table 11: Condition of Pedestrians Involved in Crashes, 2004 - 2006

Pedestrian Condition	Not Injured	Injured	Fatal	Total
Not Drinking	855	5363	398	6616
Not Known if U.I.	167	934	123	1224
Drinking, not Impaired	7	45	1	53
U.I. Alcohol and/or Drugs	33	218	29	280

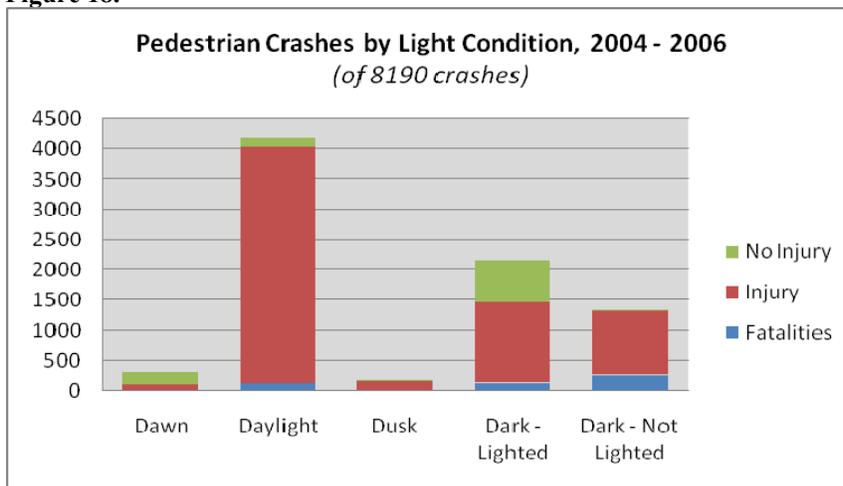
Physical Impairment	3	12	1	16
Apparently Fell Asleep	1	0	0	1

Source: 2004 – 2006 CARE database

Pedestrian Crashes by Light Condition

The vast majority of crashes occur during daylight hours; however three times as many fatalities occur at night (dark conditions) than during the day. This could indicate the need for better lighting; it also may suggest that motorists are travelling at greater speeds at night when there is less traffic (resulting in decreased reaction time and stopping distance).

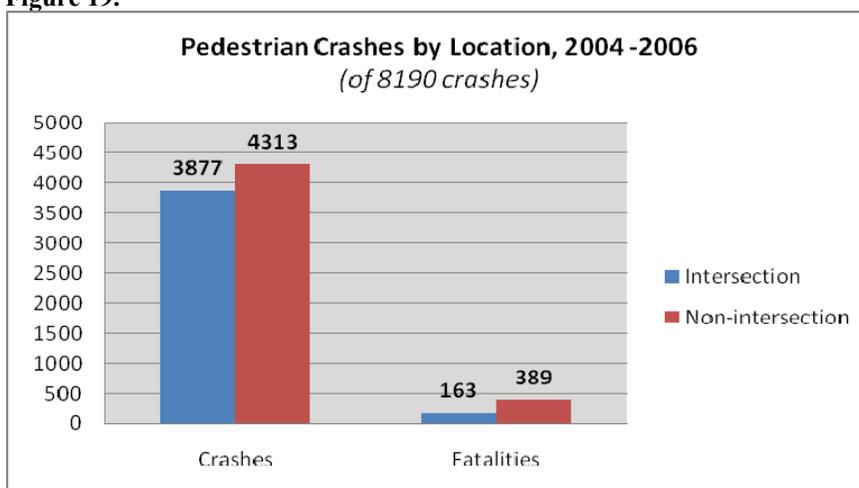
Figure 18.



Pedestrian Crash Location

There is a fairly even split between pedestrian crashes occurring at intersections and “mid-block”. However, more than twice as many fatalities happen at mid-block locations than at intersections. This is likely due to the higher speeds at mid-block where motorists are not slowing down to make a turn, and also because drivers are less likely to expect pedestrians at non-intersection locations.

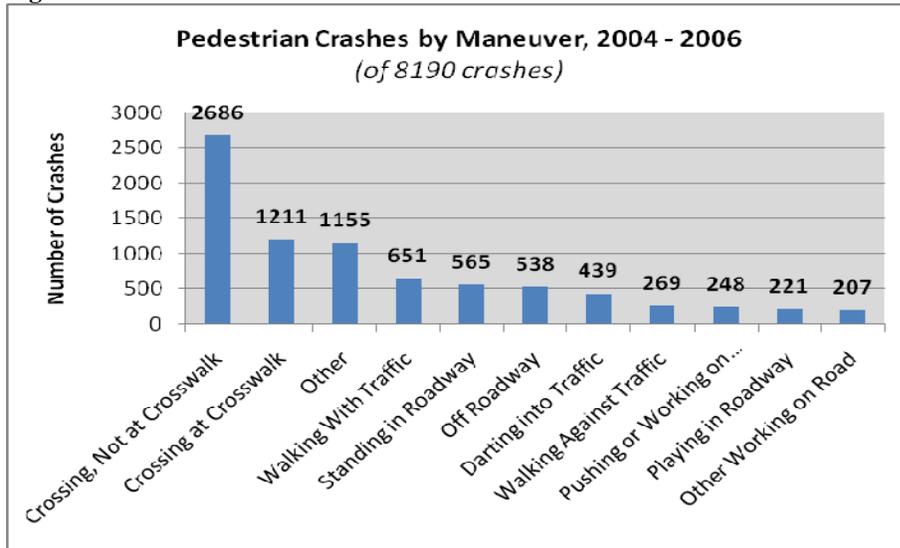
Figure 19.



Pedestrian Crashes by Maneuver

Almost half of all pedestrian crashes and fatalities occur while crossing the roadway. Only about 12% occur while walking along the roadway. For these types of crashes, twice as many crashes occur when walking on the right side of the road (i.e. with your back to traffic) rather than on the left side of the road facing oncoming traffic. These statistics reinforce the state law requiring pedestrians to walk on the left side of the road when walking in the street (when no sidewalk or shoulder is present). It is safer to walk facing traffic because the pedestrian can see a car coming and can get out of the way if necessary. Interestingly, it is the opposite for bicycles. Due to speed differentials and driver expectation, bicycles are safest riding with traffic on the right side of the road (which is also required by law).

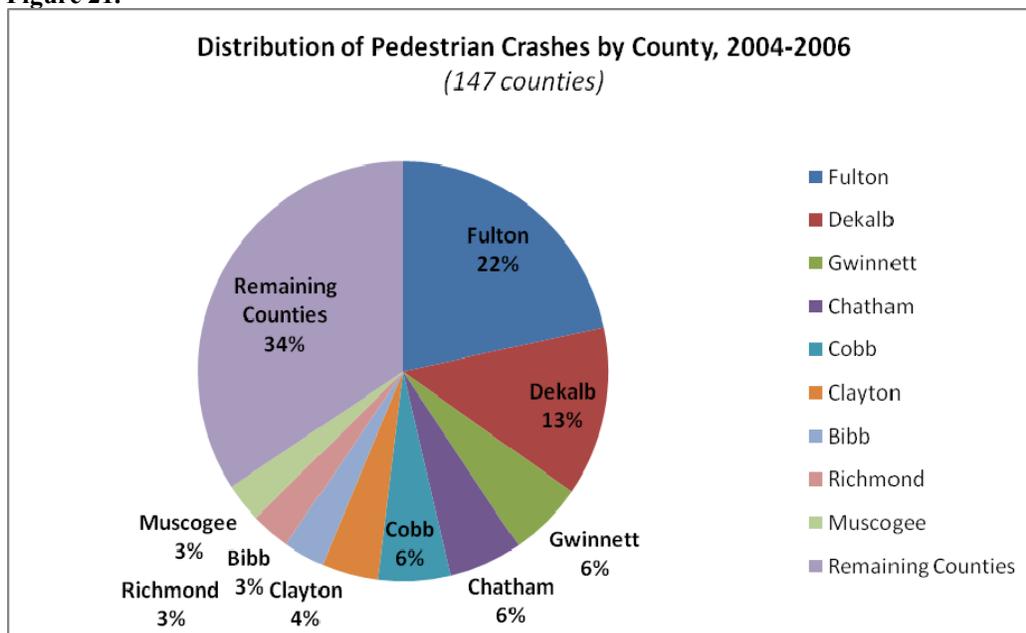
Figure 20.



High Crash Locations

Most pedestrian crashes (83% in Georgia) occur in areas defined as urban and suburban rather than rural. This is also reflected in the distribution of pedestrian crashes by county (see pie chart below). Nearly 65% of all pedestrian crashes happened in just 9 counties. All of these counties are predominantly urban or suburban and include the five core metro-Atlanta counties and the next five largest metropolitan areas in the state (Savannah, Augusta, Macon, Columbus and Athens). These same counties are also the only counties in the state that had at least 50 pedestrian crashes annually from 2004 to 2006.

Figure 21.



Corridors with the Highest Pedestrian Crashes:

The high crash corridors were determined by all 1 mile roadway segments with at least 5 crashes. This resulted in 199 segments. Where these 1 mile segments were contiguous on the same roadway, they were aggregated into one corridor. For example, there were three 1-mile contiguous segments on Ponce de Leon with approximately 20 crashes each. These were combined to create a three-mile corridor with 58 crashes). This process yielded 141 corridors which were further filtered by selecting only those with 15 or more crashes. This resulted in 28 “high pedestrian crash corridors”.

Table 12: High Pedestrian Crash Corridors, 2004-2006

County	Name	From	To	Total Crashes	Fatal Crashes
Fulton	ROSWELL RD	LAKELAND DR	DALRYMPLE RD	55	1
Dekalb	BUFORD HWY		SHALLOWFORD RD	42	2
Fulton	PONCE DE LEON AVE	DURANT PL		41	2
Fulton	PEACHTREE ST			39	1
Fulton	BANKHEAD HWY	MAYNARD CT	PIERCE AVE	38	0
Dekalb	GLENWOOD AVE	BROWNWOOD AVE	CLARKE LN	37	3
Dekalb	COVINGTON HWY	MOUNTAIN DR	GREENBRIAR WAY	34	3
Dekalb	CANDLER RD	FLAT SHOALS RD	GLENWOOD RD	33	0
Fulton	PEACHTREE RD	28TH ST	E ANDREWS DR	33	0
Clayton	RIVERDALE RD	WALKER RD	ON TO I-285 S	29	3
Dekalb	MORELAND AVE	GRACEWOOD AVE	ST LOUIS PL	29	0
Fulton	STEWART AVE	MORELAND WAY	CHRISTMAN ST	27	2
Fulton	BOULEVARD			27	0
Fulton	NORTH AVE	FOWLER ST	DURANT PL	24	0

Chatham	VICTORY DR	HOPKINS ST	SHUPTRINE AVE	23	1
Clayton	TARA BLVD	SOUTH AVE	MT. ZION RD	20	4
Fulton	MARTIN LUTHER KING JR DR	BARFIELD AVE	OLD GORDON RD	20	1
Fulton	Fulton SR 883			20	0
Fulton	NORTHSIDE DR	RALPH D ABERNATHY BLVD	NORTHSIDE CIR	19	1
Fulton	SIMPSON RD			19	0
Fulton	OLD NATIONAL HWY	FLAT SHOALS RD	GODBY RD	18	2
Clarke	BROAD ST	SYCAMORE DR	JACKSON ST	18	0
Chatham	ABERCORN ST	MIDDLEGROUND RD	MONTGOMERY CROSS RD	17	2
Dekalb	MEMORIAL DR	WYMAN ST		16	2
Fulton	CASCADE AVE			16	0
Gwinnett	BUFORD HWY	HILSIDE DR	CAMBRIDGE ST	15	2
Muscogee	VETERANS PKWY	14TH ST	35TH ST	15	2
Dekalb	CLAIRMONT RD	CLAIRMONT RUN	CENTURY PL	15	1

High Pedestrian Crash Intersections:

The following intersections were selected based on having at least 5 pedestrian crashes from 2004-2006. They are ranked according to the crash severity index which assigns weighted scores to crashes for fatalities, serious injuries, etc.

Table 13: High Pedestrian Crash Intersections, 2004- 2006

County	Route	Description	Total	Fatal	Injury	Severity	AADT
Fulton	Fulton SR 3	Stewart Ave @ Cleveland Ave	10	0	9	30	15628
Clayton	Clayton SR 139	Riverdale Rd at Garden Walk Blvd	7	1	5	37.14	35680
Dekalb	Dekalb SR 260	Glenwood Rd at Columbia Drive	6	0	6	33.33	22210
Fulton	Fulton CS 904-03	Martin Luther King Dr at Fulton CS 2003-03	6	0	6	26.67	21846
Fulton	Fulton CS 661-03	Peachtree St at Fulton CS 1828-03	6	0	6	23.33	18156
Fulton	Fulton CS 2001-03	International Blvd at Fulton CS 3695-03	6	0	4	20	10398
Fulton	Fulton SR 8	North Ave at W. Peachtree St	6	0	4	16.67	29345
Dekalb	Dekalb CS 693-05	Chamblee Dunwoody Rd at Cumberland Dr	5	1	4	60	11728
Dekalb	Dekalb SR 260	Glenwood Rd at E. Lake Blvd	5	0	5	36	18442
Fulton	Fulton SR 42-SP	McDonough Blvd at Henry Thomas Dr	5	0	5	36	13236
Fulton	Fulton CS 904-03	Martin Luther King Dr at Fulton CS 1868-03	5	0	5	28	21616
Dekalb	Dekalb SR 13	Buford Hwy at N. Cliff Valley Way	5	0	5	28	25234
Fulton	Fulton SR 883	Fulton SR 883 at Fulton CS 2051-03	5	0	4	32	11600
Fulton	Fulton SR 8	Ponce de Leon Ave at Kennesaw Ave	5	0	4	28	33390
Fulton	Fulton SR 8	Ponce de Leon Ave at Seminole Ave	5	0	4	28	36180
Fulton	Fulton SR 8	North Ave at Peachtree St	5	0	4	24	30590
Clarke	Clarke SR 10	Broad St at College Ave	5	0	4	24	30224

Figure 22: Woman and child attempting to cross Buford Highway



IV. POLICY & NON-ENGINEERING RECOMMENDATIONS

Acronym Directory:

GDOT	Georgia Department of Transportation
GOHS	Governor's Office of Highway Safety
DDS	(Georgia) Department of Driver Services
GDEC	Georgia Department of Economic Development
DCA	(Georgia) Department of Community Affairs
GDPH	Georgia Division of Public Health
DOE	(Georgia) Department of Education
MPOs	Metropolitan Planning Organizations
RDCs	Regional Development Centers
TMA	Transportation Management Associations
MARTA	Metropolitan Atlanta Regional Transit Authority
GRTA	Georgia Regional Transportation Authority
ARC	Atlanta Regional Commission
GMA	Georgia Municipal Association
ACCG	Association County Commissioners of Georgia
ABC	Atlanta Bicycle Campaign (non-profit/advocacy org.)
PEDS	Pedestrians Educating Drivers on Safety (non-profit/advocacy org.)
GA Bikes	Georgia Bikes! (non-profit/advocacy org.)

Education			
Priority	Task	Description	Responsible Agencies
1	State-wide public education campaign	<p>Modeled after GOHS's successful "Click it or Ticket" and "Zero Tolerance" programs. Messages should be tailored for each target audience (motorists, pedestrians & cyclists). Campaign to include the following:</p> <ul style="list-style-type: none"> • Drive-time radio PSAs, including some Spanish language messages • Messages placed inside transit vehicles, stations and stops, to reach cyclists and pedestrians; and on bus-backs and bus "wraps" to reach motorists. • Use new communication tools such as Facebook, Podcasts, etc • Below are some general concepts for safety messages: <ul style="list-style-type: none"> ○ Motorist oriented: Cyclists belong on road, pass with care, look for bike/peds at intersections, peds have right of way in crosswalk, don't speed, etc. ○ Cyclist oriented: wear helmet, use lights, ride with traffic, make eye contact/watch for cars at intersections, obey traffic rules ○ Pedestrian: Cross with signal not against it, look for turning cars even when you have the right-of-way, etc. 	GOHS, MARTA, GRTA, PEDS, GA Bikes, ABC, Community Improvement Districts, TMAs
2	Educate drivers on how to share the road with bikes/peds	Develop curriculum to be included in driver's education trainings, conduct bus driver's education trainings for transit agencies, and produce materials for schools, transit agencies, and Department of Driver Services.	Department of Driver Services, GOHS, PEDS, ABC, GA Bikes, MARTA, GRTA, ARC's Transit Operators Subcommittee, and other transit agencies
3	Educate transportation professionals and civil engineering students on bike/pedestrian design and safety throughout the state.	<ul style="list-style-type: none"> • Partner with professional organizations to develop and host trainings (such as ITE, GPA, ASCE, WTS, MPOs, TMAs, etc). • Educate GDOT staff through GDOT Trainee program, incorporate this into Plan Development Process (possibly part of ADA Compliance Officers duties...). • Incorporate bike/ped design into curricula of State engineering and planning schools (GA Tech, GA Southern, Southern Polytech , Savannah State, etc) 	GDOT, Planning and Engineering Professional Organizations, ARC, PEDS, Universities

4	Develop and Distribute Bicycle Safety Materials	<ul style="list-style-type: none"> Expand GOHS Bike Helmet Giveaway Program, distribute bicycle lights, and reflective gear. Update, print and distribute Georgia Bike Sense Guide, and develop additional educational materials as needed. Work with GOHS, Regional Development Centers (RDCs) and DDS to distribute. Translate Bike Sense into Spanish and distribute with assistance from the RDCs, Latin American Association, churches, etc. Continue to distribute Bike Sense guides and other educational materials to all bike shops, driver license and tag registration centers, state parks, visitor centers. Translate into Spanish. 	GDOT, GOHS, DDS, RDCs, Georgia Bikes, Atlanta Bicycle Campaign
5	Conduct Bicycle Safety Training	Work with colleges and universities, get bicycle police officers to assist with trainings, make trainings more accessible, mainstream to reach more riders, or potential riders.	ABC, GA Bikes, GOHS, TMAs, Universities, law enforcement
6	Continue “share the road” license plate program	Use this bike/ped task team to develop plan and identify educational programs to be funded with license plate revenue.	GOHS
7	Update the Driver’s Manual	Include more information about the rules of the road related to bicyclists. Provide materials for new drivers.	DDS, GDOT, PEDS
8	Educate elected and appointed officials on laws, innovative techniques and the needs of bicycles and pedestrians	Conduct regular trainings for elected officials in Atlanta and other parts of state. Present to State Transportation Board to encourage the allocation of more resources to bicycle and pedestrian facilities and safety programs. Incorporate into Georgia Municipal Association and Association County Commissioners training and the University of Georgia’s training for officials and judges.	GDOT, GOHS, ARC, GMA, ACCG, Universities
9	Research effectiveness on bike & ped educational programs	Conduct longitudinal studies on the effectiveness of Safe Routes to School (SRTS) program on driving habits, commute habits, etc.	GDPH, Universities, GDOT
10	Put bike/ped safety messages on Georgia Navigator signs	Messages could be posted on non-interstate signs, and interstate signs if permissible. This could be done for a targeted awareness campaign, for bike month (May), or walk to school day/week (October), etc.	GDOT, GOHS
11	Create PowerPoint presentation on bike/safety issues.	Put presentation on GDOT website, and distribute to neighborhood associations, professional associations (e.g. ITE, GPA, ASE, WTS, etc).	GDOT

Encouragement			
Priority	Task	Description	Responsible Agencies
1	Encourage Georgia's congressional members to support bike/ped	Agency leadership and advocacy organizations work with state legislators and Georgia's U.S. Congressional delegations to join bike/ped caucus and support bike/ped funding.	GDOT, DDS, GOHS, ABC, PEDS, GA Bikes
2	Encourage bicycle & pedestrian friendly development.	Develop handbook of bicycle and pedestrian friendly land use regulations for use by local government planning offices and neighborhood groups. Work with cities and counties to enact land use regulations that: require showers and secure bike parking for employees or create incentives for businesses that provide them; require bike and ped facilities as part of new developments and subdivisions; require pedestrian-oriented urban design (ped scale, parking in rear, etc); and driveway consolidation and access management.	GDOT, DCA, local city planning offices and planning boards, GA Tech (planning school and/or Center for Quality Growth)
3	Install secure, covered bicycle parking at MARTA and park & ride lots.	Also, evaluate possibility for a "bike station" pilot project (similar to Chicago's Millennium Park bike station).	MARTA, GRTA, CCT, C-trans, other transit agencies, ABC, GA Bikes
4	Create statewide Transportation Alternatives Campaign	Model after Clean Air Campaign's Commuter Awards program to expand statewide. Host an annual event and conduct year-round activities to encourage people to bike and walk to work/school, etc.	GDOT, GOHS, MPOs, RDCs, TMAs
5	Expand Safe Routes to School	Partner with other organizations or agencies to expand SRTS to more schools. Continue GDOT contracts with RDCs to develop SRTS plans.	GDOT, RDCs, MPOs, DOE, GOHS, bike/ped organizations,
6	Sunday/Holiday road closings	Fully or partially close roads to motor vehicle traffic on a Sunday and/or Holiday to encourage biking and walking and other activities, such as skating or jogging.	GDOT, Local City jurisdiction, GDED, GDPH, TMAs

Enforcement			
Priority	Task	Description	Responsible Agencies
1	Conduct Speed and crosswalk enforcement at pedestrian safety hot spots	Provide funding for sting operations and enforcement efforts	Georgia State Patrol, University police, GOHS
2	Train law enforcement officers in pedestrian and bicycle laws, crash reporting, and safety	Work through law enforcement training center and GOHS' monthly law enforcement meetings. Trainings will help improve crash reporting, driver/rider/walker behavior and	GOHS, State Law Enforcement Training Center in Forsyth, GA, PEDS

	issues	help prevent injuries.	
3	Improve the reporting of bicycle and pedestrian crashes	Revise state police crash reports form to include more information on bike/ped crashes.	GDOT, GOHS, law enforcement agencies.

Task	Description	Responsible Agencies	Priority (<i>not assigned yet</i>)
Pass new law to allow use of speed cameras in school zones	Pass new legislation to allow speed camera enforcement in school zones and construction zones. Revenue from fines, after operating costs, go to GDOT Georgia Safe Routes to School program and GOHS traffic/pedestrian/bicycle safety programs	GDOT, GOHS, DOE Agency leadership	
Pass “Stop for Bus” law and post signs on backs of buses	Pass new law requiring that motorists stop for buses that are loading/unloading passengers (like the stop for school buses law).	MARTA, GRTA, GOHS Agency leadership	
Change law (§40-14-8) to permit law enforcement to ticket motorists speeding within 10 mph over the speed limit.	This would allow for more enforcement in neighborhoods and on non-interstate locations. The difference of 5 or 10 mph in a bike or ped crash can mean the difference between surviving the crash or not.	GOHS and law enforcement Agency Leadership	
Change Super Speeder Law to include lower speed roads where bikes/peds are more prevalent.	Change law to include anyone driving more than 20 mph over speed limit on roads with 45mph speed limit or less.	GOHS and law enforcement Agency Leadership	
Define or refine definitions in the Georgia Code	Change “bicycle” to be a “vehicle”, not a “device”, including multi-wheeled bicycles, and bicycles with a wheel ≤ 13 ” in diameter. Include definitions for skaters, skateboards, etc. Change law to make it legal to ride a bicycle on the sidewalk under certain conditions, such as bicyclists under the age of 16. Change definition of Bicycle Path to “Shared use Path” (since paths are never exclusive to bicycle use)	DDS, GOHS Agency Leadership	
Delete sidepath law (§40-6-294 c and d)	Delete law replace with a law that prohibits jurisdictions from requiring bicyclists to use sidepaths. This law conflicts with other laws giving bicycles the same rights and responsibilities as motor vehicles.	DDS, GOHS Agency Leadership	

Change §40-6-21 meaning of the flashing don't walk signal	Change meaning of the flashing don't walk signal when displayed with a countdown timer to mean that pedestrians can start walking across the crosswalk at anytime during the countdown phase, as long as they are out of the crosswalk by the time the countdown gets to zero.	DDS, GOHS Agency Leadership	
Increase fines and penalties for injuring a person in hit and run crashes	Change §40-6-270(b) to read "If such accident is the proximate cause of death or a injury, any person knowingly failing to stop and comply with the requirements of subsection (a) of this Code section shall be guilty of a felony and, upon conviction thereof, shall be punished by imprisonment for not less than one nor more than five years." Change §40-6-270(c)(1) to read "If such accident resulted in damage to vehicle which is driven or attended by any person, any person knowingly failing to stop or comply with the requirements of this Code section shall be guilty of a misdemeanor..."	DDS, GOHS Agency Leadership	
Change law regarding requirement to use overcrossing or undercrossing (§40-6-92(b))	Include exceptions to law for ADA accessibility, personal security, or excessive walking distance to reach the over/underpass	DDS, GOHS Agency Leadership	
Develop new standard for bicycle brakes	Change law from current obsolete and confusing law (§40-6-296(b)) which measures brakes on skidding distance. Develop new standard for bicycle brakes.	DDS, GOHS Agency Leadership	
Remove §40-6-92(c) (pedestrian crossing between adjacent signalized intersections can only cross at crosswalks)	This law is very confusing and difficult to enforce, and does not necessarily improve safety or access. Eliminate this provision and replace it with one that prohibits crossing within 150 feet of a traffic signal unless using a marked crosswalk.	DDS, GOHS Agency Leadership	
Broaden definition of crosswalk to include unmarked crosswalks at T intersections	Currently pedestrians do not have the right-of-way or legal protection at unmarked crosswalks at T-intersections.	DDS, GOHS Agency Leadership	
Change law requiring that bikes be equipped with rear red reflectors (§40-6-296(a)) to allowing red lights instead of red reflector	Provision should be included to require that light functions as a reflector when the battery is dead.	DDS, GOHS Agency Leadership	
Remove or create exception to law requiring that all bikes sold be equipped with reflectors on pedals. (§40-6-297)	Many bicycles are designed with "clipless pedals" which requires that the cyclist clips his/her shoe into the clip. There are no pedals on these bicycles – the reflectors are on the shoes and other parts of the bicycle.	DDS, GOHS Agency Leadership	
Remove or make exception to law requiring that pedals	Changing this law would make recumbent bicycles street legal.	DDS, GOHS Agency	

to be no more than 12” off the ground (§40-6-296(d)).		Leadership	
Increase fines for excessive speeding in <35mph areas	Change §40-6-1 to increase fines for driving >5 to 10mph above the speed limit on streets with limits <35mph. The current fine of \$35 is not sufficient penalty to discourage the action.	DDS, GOHS Agency Leadership	

I. SYSTEMWIDE ENGINEERING RECOMMENDATIONS

Engineering Countermeasures

- **Integrate bicycle and pedestrian facility needs into all planning, design, construction and maintenance activities** of the Department of Transportation, local governments and other transportation providers (such as sidewalks, shoulders, crossing enhancements, pedestrian signals, etc.).
- **Create policy to fund crosswalk and curb ramp improvements as part of GDOT resurfacing projects.**
- **On federally-funded and state-funded projects, require counties and cities to meet or exceed GDOT standards** for medians, channelization islands, crosswalks, pedestrian signals, etc.
- **Expand the staff of state pedestrian and bicycle program** to include a planner or engineer whose primary role is to conduct project reviews of GDOT and state/federally funded projects for inclusion of bicycle and pedestrian safety and accessibility features.
- **Develop policy and criteria for using Leading Pedestrian Intervals.** Possible locations include T-intersections and intersections with significant right turn movements and pedestrians.
- **GDOT adopt policy to consider narrowing travel lanes as part of resurfacing projects to accommodate a bikeable shoulder.** Develop guidelines for travel lane widths according to speed, truck percentages, etc...
- **Develop a “safety audit” process** for all road improvement projects in the State Transportation Improvement Program and prioritize projects based on outcomes.
- **Identify high bicycle and pedestrian crash locations and develop countermeasures to improve safety.** Construct projects with federal Safety funds as well as opportunities to piggy-back these projects with other road improvement projects. Countermeasures that might be built through this program include but are not limited to:
 - Raised medians and crossing islands
 - Countdown pedestrian signals at intersections
 - Pedestrian signals at pedestrian crossings
 - Pedestrian beacon (HAWK) at pedestrian crossings
 - Protected only left turns
 - Flashing yellow arrow for protected-permissive phasing (GDOT needs to accept this first).
 - Leading Pedestrian Intervals
 - Changes to signal timing (cycle lengths, phasing)
- **Require access management plans as part of GDOT and local projects.**

- **Encourage land use policies that promote bikeable/walkable streets**, community design that promotes walking, biking and transit use, driveway consolidation/access management, and lower speeds.
- **Develop a program to review urban streets for opportunities for road diets.**
- **Evaluate GDOT driveway policy for possible improvements to pedestrian safety:**
 - Evaluate the possibility of increasing the warrants (i.e. minimum number of turning vehicles per hour) for a driveway deceleration/acceleration lane in urban areas, residential areas, school zones, and roads with speeds of 35 mph or less.
 - Develop new design standards for driveways and sidewalks through driveways to encourage slow speed turns and yielding to pedestrians.
- **Develop criteria for use of the Florida right turn slip lane design standard under certain conditions and include in GDOT design policy manual.**
- **Develop a policy to set pedestrian signals to automatically display the WALK signal whenever the concurrent traffic signal is circular green.**
- **GDOT adopt policy that when bridges are closed due to structural deficiency, they remain open for bicycle and pedestrian traffic if bridge conditions safely allow.** This could encourage bicycle and pedestrian traffic and allow a transportation facility to remain partially useful to the public.

II. SITE-SPECIFIC RECOMMENDATIONS FOR HIGH CRASH AREAS

Bicycle Safety Projects:

1. **Priority Area One:** Midtown/Poncey-Highland Area of Atlanta (North Ave., Ponce de Leon, N. Highland, and vicinity)

- a. Mark bike lanes on Virginia Ave as possible alternate route to Ponce
- b. Add “sharrows” (shared lane markings) to N. Highland due to not enough space for bike lanes and to encourage bicycles to stay out of the door zone
- c. Add bicycle signage to North Ave., Ponce de Leon, N. Highland, Virginia Avenues
- d. Do a road diet on North Ave west of Freedom Parkway and add bike lanes. This portion of North has excess capacity, and the bike lanes would also help to improve sight distance for vehicles entering from side streets, shorten the crossing distance and reduce speeds.
- e. Work with Ponce de Leon Pedestrian Safety Project to incorporate bicycle safety elements where possible

2. **Priority Area Two:** Athens/UGA area (Prince St., Baxter St., Broad St., Oconee St.):

- a. Evaluate the possibility of marking bike lanes or shoulders on Prince, Baxter, Broad, and Oconee Streets.
- b. Identify and mark alternative routes where necessary
- c. Use sharrows and signage where roads are too narrow for bike lanes

3. **Priority Area Three:** Savannah (Montgomery Cross Rd, Derenne Ave., 40th St., Henry St., Lincoln St.,)
 - a. Evaluate the possibility of marking bike lanes or shoulders on Montgomery Cross Rd., Derenne Ave., 40th Street, Henry St., Lincoln Street and surrounding principal streets.
 - b. Identify and mark alternative routes where necessary
 - c. Use sharrows and signage where roads are too narrow for bike lanes

4. Continue to review crash data and analysis crash reports to identify bicycle crash “hot spots” and develop safety projects.

Pedestrian Safety Projects:

1. **Priority Area One: Metropolitan Ave @ Cleveland Ave (intersection project)**
 - b. Restripe crosswalks and add accessible curb ramps and signals

2. Study turning movements and add protected left turn or eliminate right turns on red if needed
3. Evaluate signal timing and make adjustments as needed – is wait time for the walk light too long? Is walk phase too short? Does this intersection have many red light runners (can we add a camera here)?
4. Evaluate need for a Leading Pedestrian Interval
5. Evaluate need for medians
6. Tighten curb radii and create concrete raised crossing islands if warranted

Evaluate crash reports for the following to determine countermeasures (may include median refuge islands, signal improvements, signing and marking, etc):

1. **Priority Area Two:** Roswell Rd, Fulton County
2. **Priority Area Three:** Peachtree Street & Peachtree Rd, Fulton County
3. **Priority Area Four:** Bankhead Hwy, Fulton County
4. **Priority Area Five:** Glenwood Ave, Dekalb County
5. **Priority Area Six:** Covington Hwy, Dekalb County
6. **Priority Area Seven:** Candler Rd. Dekalb County
7. **Priority Area Eight:** Riverdale Rd., Clayton County
8. **Priority Area Nine:** Moreland Ave., Dekalb County
9. **Priority Area Ten:** Boulevard Dr., Fulton

10. Continue to review crash data and analysis crash reports to identify pedestrian crash “hot spots” and develop safety projects

Appendix D: New York City DOT Street Improvement Process

