Standardization of Crash Analysis in Florida

Final Report

Contract No. BDK80 977-10

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Prepared by:

Lehman Center for Transportation Research
Florida International University

In collaboration with:

Research Center
Florida Department of Transportation

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DISCLAIMER

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

METRIC CONVERSION CHART

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
SYMBOL	**WHEN YOU KNOW**	**MULTIPLY BY**	**TO FIND**	**SYMBOL**
AREA				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
SYMBOL	**WHEN YOU KNOW**	**MULTIPLY BY**	**TO FIND**	**SYMBOL**
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
NOTE: volumes greater than 1000 L shall be shown in m^3				

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Mr. Joseph Santos, P.E., of the Safety Office at the Florida Department of Transportation served as the project manager for this project.

16. Abstract

This project attempts to identify the existing crash analysis practices, problems, and needs in Florida in order to help move Florida in the direction of standardizing its crash analysis methods and tools. Standardization of crash analysis procedures in Florida would ensure that the crash analysis practices are up to the national standards and are applied consistently throughout the state. It would further permit other cost-saving opportunities, such as statewide training.

To reach the wide spectrum of transportation agencies in Florida, three online surveys were developed targeting the Florida Department of Transportation (FDOT) districts, local transportation agencies, and law enforcement agencies. On-site visits to agencies located in South Florida were first made to help in the development of the survey questions. The surveys targeting the FDOT districts and local transportation agencies included questions covering seven areas of interest: use of crash data; high crash locations; project selection, implementation, and evaluation; crash analysis software systems; crash analysis standardization; crash analysis documentation; and meetings and training. The survey questions targeting law enforcement agencies included questions covering four areas of interest: selection of enforcement locations, traffic violations and safety campaigns, crash reports, and working with transportation agencies. Results from the three surveys were summarized in detail in this report.

In addition to the surveys, three geographic information systems (GIS) currently in use in Florida for crash data retrieval and analysis, including the Web Crash Data Management System (WebCDMS), the Traffic Safety Analysis Tool (TSAT), and the Signal Four Analytics (S4), were reviewed to learn about their features and capabilities. Further, state-of-the-art crash analysis methods and tools, including the Highway Safety Manual (HSM), SafetyAnalyst, and Interactive Highway Safety Design Model (IHSDM), were also reviewed, and recommendations were provided.

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- Mr. Felix Delgado, Florida Department of Transportation District 4
- Mr. Rick Mitinger, Florida Department of Transportation District 4
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- Mr. Phani Allu, Florida Department of Transportation District 6
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- Mr. Andrew Sebo, Broward County Public Works Department
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- Ms. Diane Lynch, Miami-Dade Police Department

We would also like to thank the many individuals who either assisted in coordinating and/or participated in the demonstration and discussion of GIS crash analysis systems currently used in Florida, including WebCDMS (Web Crash Data Management System), TSAT (Traffic Safety Analysis Tool), and Signal Four Analytics (S4):

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- Mr. Jonathan Harris, Florida Department of Transportation District 3
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- Mr. Hunter Wei, Metric Engineering, Inc.
- Dr. Ilir Bejleri, University of Florida
- Mr. Nathaniel Wingfield, University of Florida
- Mr. Daniel Brown, University of Florida

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EXECUTIVE SUMMARY

The effectiveness of crash analysis depends on the proper analysis methods and the availability of up-to-date software tools and quality data. There is currently not a standard method and software tool for crash analysis in Florida. An increasing number of Florida Department of Transportation (FDOT) districts and local transportation agencies have either developed or adopted various software systems to meet their crash analysis needs. The current trend of developing individual systems at the local level is cost-ineffective and potentially unsustainable.

Standardization of crash analysis procedures in Florida would ensure that the crash analysis practices are up to the national standards and are applied consistently throughout the state. It would further permit other cost-saving opportunities, such as statewide training. However, to succeed in the transition to standardized crash analysis procedures, it is important to ensure that no stakeholder will be made to feel short-changed by the process and that their needs will not only continue to be met after the transition, but also more efficiently and effectively. It is also expected that some useful district systems may be adopted for statewide application, benefiting other agencies and avoiding the duplication of efforts.

This project aims to identify the existing crash analysis practices, problems, and needs in Florida in order to help move Florida in the direction of standardizing its crash analysis methods and tools. The existing crash analysis methods and the needs of the various local agencies play a significant role in standardizing the crash analysis procedures. To reach the wide spectrum of transportation-related agencies in Florida, three comprehensive online surveys were designed targeting the FDOT districts, local transportation agencies, and law enforcement agencies. The on-site visits to FDOT District 4 and District 6 and to Miami Dade County and Broward County Public Works Departments helped in designing the survey questions.

An online survey was sent to all the eight districts. Responses were received from six districts. The following are the key findings from the survey:

- Most districts use the annual 5-percent transparency report to identify high crash locations.
- All districts responded that cost information of safety studies should be shared among the FDOT District Offices.
- All districts use the benefit-cost (B/C) ratio to select safety improvement projects.
- Most districts responded that the Strategic Highway Safety Plan (SHSP) has well-served their traffic safety needs.
- The districts prioritize projects in the following order of SHSP's four emphasis areas: Intersection Crashes, Lane Departure Crashes, Vulnerable Road Users, and Aggressive Driving.
- All districts desired to replace the CAR system with a web-based system.
- All districts responded that a standardized crash analysis method and procedure should be followed across the state.
- Most of the districts are still not confident in implementing the Highway Safety Manual (HSM) and SafetyAnalyst due to their extensive data requirements and the necessary statistical/software expertise. All districts responded that a standard web-based

geographic information system (GIS) should be adopted for crash analysis across the state.

- The majority of the districts would like to update the Highway Safety Improvement Program Guideline (HSIPG).
- Half of the responding districts preferred to have face-to-face statewide meetings semiannually and the other half preferred to meet only once a year.
- Quarterly web meetings with the Safety Office received support from most districts.
- The majority of the districts responded that FDOT should provide statewide training on crash analysis.
- Face-to-face meetings are the preferred mode of providing training on crash analysis.
- The districts are interested in FHWA-NHI courses that focus on intersection safety, pedestrian safety, roadway safety audits/assessment, and safety effects of roadway design features.

Similar responses were received from the 37 local transportation agencies that had responded to the survey. The following are the key findings from the survey:

- The majority of local agencies use three years of crash data for performing safety studies.
- The majority of local agencies indicated that in-house staff investigated high crash locations.
- Crashes due to speeding, distracted driving, and at intersections were the safety issues of greatest concern to most local agencies.
- The majority of local agencies desired standardization of the crash analysis method and procedure across the state.
- The majority of responding local agencies use the B/C ratio to select safety improvement projects.
- Funding is often considered as a deciding factor in selecting and prioritizing safety projects.
- Some agencies prefer to consider the HSM as a standard, while some agencies prefer to have the HSM only as a guide as the HSM analysis is considered to be too cumbersome for most local agencies.
- Local agencies are interested in adopting SafetyAnalyst. For extensive adoption, the responding agencies wish the software to be provided free of charge along with low cost training tools.
- The majority of local agencies responded that a statewide standard web-based GIS system should be adopted for crash analysis.
- The majority of local agencies responded ‘strongly agree’ that FDOT should provide statewide training on crash analysis.
- Similar to the opinions of the FDOT districts, face-to-face meetings are by far the preferred mode of providing training on crash analysis.
- The majority of local agencies work with the FDOT District Office only when a situation arises.
- The majority of local agencies work closely with the FDOT District Office to improve traffic safety.

- More funding to local agencies, more communication and coordination, more training courses, and training of law enforcement officers to correctly fill in the crash forms are the most important requirements of the local agencies from the FDOT.

Compared to the districts and local transportation agencies, the law enforcement agencies are considered to be quite different in their objectives, problems, and needs. This is mainly because the law enforcement officials are geared toward improving safety and mobility through enforcement. Therefore, a different set of questions was designed to address these officials. The following are the key findings from the survey of 46 law enforcement agencies:

- Most agencies regularly focused on specific locations for enforcement of traffic violations.
- Location selection for enforcement was commonly based on the analyzed crash records and citizen complaints.
- The majority of agencies would like to receive crash location maps from the previous year or previous quarter from FDOT.
- Speeding, failing to use safety belts, and failing to properly restrain a child were the most common causes of violation enforcement.
- Blocking traffic, failing to move over, and parking illegally were the least common causes of violation enforcement.
- Enforcement of driving under influence, speeding, and running red lights were most often selected as ‘extremely effective’ to improve traffic safety.
- Enforcement of illegal parking, traffic blockage, and following too closely were most often selected as least effective.
- Most agencies follow up with an evaluation to assess the effectiveness of the implemented safety campaigns.
- The majority of agencies use both electronic and hard copy crash report forms.
- The majority of agencies responded that the new police report form that became effective on January 1, 2011 has been an improvement over the previous form.
- A few officials considered filling out additional data in the new crash forms to be time consuming and recommended simplified crash reports. Further, additional training on filling out the crash reports was requested.
- The majority of agencies were proactive in holding regular meetings with local transportation agencies for coordination of efforts.
- The majority of agencies stated the need to organize more meetings with transportation agencies and to get more assistance from them.

Supplementing the three online surveys, three GIS systems, including the Web Crash Data Management System (WebCDMS), the Traffic Safety Analysis Tool (TSAT), and the Signal Four Analytics (S4), were reviewed in order to learn about the capabilities of the existing GIS systems currently being used by agencies in Florida for crash data retrieval and analysis. Based on the evaluation, the following capabilities are considered as the most desirable crash analysis features: query crashes, spatially locate crashes, identify high crash locations, generate output reports and plots, and draw collision diagrams.

From the surveys, it was found that districts and agencies currently identify high crash locations by crash frequency, crash rate, and critical rate. These methods are common; however, they are fraught with issues. More specifically, these basic methods do not account for the well-known regression-to-the-mean (RTM) phenomenon. The issues and limitations of traditional site selection methods are addressed by the advanced methods like the empirical Bayes (EB) analysis. The HSM and SafetyAnalyst are two of the many safety analysis tools developed and funded by the federal government. Use of these tools is encouraged as they incorporate the EB method in various steps of the roadway safety management process. However, for their complete implementation, these advanced tools require a wide range of data in comparison to the basic methods. These intense data requirements often deter states from early adoption. However, states can adopt these tools in phases while simultaneously ramping up the tedious process of data acquisition.

While SafetyAnalyst has been touted as the software complement to the Highway Safety Manual, there are a few fundamental differences that must be understood. The two tools supplement each other and have their own advantages. Therefore, adoption of both the tools would be highly beneficial to the state. SafetyAnalyst could be used for more system-wide analysis, while the HSM could be geared more toward site-specific analysis. Moreover, the detailed discussion of several network screening methods in the HSM would help in the transition from traditional to advanced methods. Therefore, adoption of both the HSM and SafetyAnalyst is recommended as, together, they help in conducting a comprehensive roadway safety management process. Further, inclusion of spatial/GIS functionalities of crash analysis would be beneficial as they are currently unavailable with the two tools. Therefore, in addition to the HSM and SafetyAnalyst, a standardized GIS applications tool for Florida is recommended.

The HSM and SafetyAnalyst are still in their preliminary stage of implementation. Stepping up the implementation of both the HSM and SafetyAnalyst in addition to standardizing the GIS applications of crash analysis is likely to yield better results. Further, the implementation strategy must involve districts and local transportation agencies to result in extensive adoption of the newer tools. Although the cost and budget constraints could be an issue, adequate training on how to make use of these tools is likely to yield better and quick results.

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LIST OF ACRONYMS/ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADA	Americans with Disabilities Act
AIMS	Accident Information Management System
ARS	Accident Reporting System
B/C	Benefit to Cost Ratio
CAR	Crash Analysis Reporting
CDMS	Crash Data Management System
CFR	Code of Federal Regulations
CIOT	Click It or Ticket
CRASH	Crash Reduction Analysis System Hub
CTST	Community Traffic Safety Team
DHSMV	Department of Highway Safety and Motor Vehicles
DUI	Driving under the Influence
EB	Empirical Bayes
EMS	Emergency Medical Services
EPDO	Equivalent Property Damage Only
FAQs	Frequently Asked Questions
FB	Full Bayes
FDOT	Florida Department of Transportation
FGB	Florida Green Book
FHP	Florida Highway Patrol
FHWA	Federal Highway Administration
FIU	Florida International University
FSUTMS	Florida Standard Urban Transportation Model Structure
GIS	Geographic Information System
HCM	Highway Capacity Manual
HRRR	High Risk Rural Roads
HSA	Highway Safety Analysis
HSIPG	Highway Safety Improvement Program Guideline
HSM	Highway Safety Manual
HSP	Highway Safety Program
ITE	Institute of Transportation Engineers
LOS	Level of Service
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
MUTS	Manual on Uniform Traffic Studies
MVMT	Million Vehicle Miles Traveled
NB	Negative Binomial
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NPV	Net Present Value
OOCEA	Orlando-Orange County Expressway Authority
PD&E	Project Development and Environment
PDO	Property Damage Only

PSI	Potential for Safety Improvement
RCI	Roadway Characteristics Inventory
RSA	Road Safety Audit
S4	Signal Four Analytics
SHSP	Strategic Highway Safety Plan
SPF	Safety Performance Function
SR	State Road
SRTS	Safe Routes to School
TEM	Traffic Engineering Manual
TOA	Tindale-Oliver & Associates
TPO	Transportation Planning Organization
TSAT	Traffic Safety Analysis Tool
TSIMS	Traffic Safety Information Management System
TSSMS	Traffic Safety Study Management System
UF	University of Florida
WebCDMS	Web Crash Data Management System

CHAPTER 1
INTRODUCTION

1.1 Problem Statement

Crash analysis is performed by traffic safety engineers on a daily basis. The effectiveness of such analysis depends not only on the professional knowledge of the engineers, but also on the proper analysis methods and the availability of up-to-date software tools and quality data. The Crash Analysis Reporting (CAR) system was developed to serve the crash data retrieval and analysis needs of the Florida Department of Transportation (FDOT). While this IBM mainframe program has served its intended purposes well for FDOT for over a decade, it is increasingly becoming obsolete when compared with what today's computer technology can offer. To a large extent, the CAR system is being used to retrieve crash records, leaving FDOT without an up-to-date tool for crash analysis. At FDOT District 6, for example, crash records are downloaded from CAR and then imported into a spreadsheet application for crash analysis.

Several FDOT districts have developed software applications to meet their crash analysis needs. For example, District 7 has long used the Crash Data Management System (CDMS) developed by Tindale-Oliver & Associates, and District 3 has used the Traffic Safety Analysis Tool (TSAT) developed by ATEC, Inc. In addition, an increasing number of county agencies are using several other systems, including a web-based version of CDMS (or WebCDMS), the Accident Information Management System (AIMS) system marketed by JMW Engineering, and a web-based geographic information system (GIS) developed at the University of Florida. While these different systems clearly fulfill a need of Florida's traffic safety community, their continued development and use may not be in the long-term interests of the state.

To appreciate the problem with developing and maintaining individual crash analysis systems, one need only imagine today without the Highway Capacity Manual (HCM). Without the HCM, individual transportation agencies would still be researching their own capacity analysis procedures and developing their own highway capacity software, diverting their limited resources away from the task they should really be focusing on, i.e., capacity analysis. It would also be hard to imagine if each Metropolitan Planning Organization (MPO) in Florida today were to develop its own demand modeling methods and software systems, instead of using the standard demand model known as the Florida Standard Urban Transportation Model Structure (FSUTMS). One can thus conclude that the current trend of developing and maintaining individual systems at the local level is rather cost-ineffective and potentially unsustainable. It is not cost-effective because these systems are individually costly to develop and even more costly to maintain. Some of these systems may not be sustainable because they lack a dedicated funding source and are likely to be discontinued when funding runs dry. Also, without using a system that is built on either state-adopted or nationally-accepted standards for crash analysis, an agency is more vulnerable to tort liability.

Recent developments at both the national and state level, including the much anticipated publication of the Highway Safety Manual (HSM, 2010), the release of the SafetyAnalyst software system, the completion of "one-map" project by the FDOT Safety Office, as well as the deployment of the Florida Traffic Safety Portal, have together provided an excellent opportunity to standardize crash analysis methods and tools in Florida. The standardization would allow the limited resources for safety programs to be channeled toward the daily task of crash analysis, leaving research on the best analysis methods to national experts and freeing up national pooled funds for software implementation. The standardization would also ensure that the crash analysis practices in Florida are up to the national standards and are applied consistently throughout the state. It would further permit other cost-saving opportunities, such as statewide training similar to that for FSUTMS.

However, to succeed in the transition to standardizing crash analysis in the state, it is important to ensure that no stakeholders will be short-changed, perceived or otherwise, by the process and that their local needs will not only continue to be met after the transition, but potentially met more efficiently and effectively. It is also likely that some local systems and practices could be adapted for statewide application, benefiting other agencies and avoiding the duplication of efforts. Surveys of transportation agencies to learn about their current practices, problems, and needs are thus the focus of this study.

In addition to FDOT districts and local transportation agencies, the law enforcement community is increasingly recognized for the important role it plays in traffic safety. The SAFETEA–LU (Safe Accountable Flexible Efficient Transportation Equity Act – A Legacy for Users) of 2005 requires that states develop comprehensive plans that include enforcement as one of the four pillars of highway safety, i.e., Engineering, Education, Enforcement, and Emergency response, or better known as the 4 E's of traffic safety.

While transportation and law enforcement agencies both aim to improve traffic safety, their approaches and needs are different. For example, while a crash analysis software system like SafetyAnalyst could be very useful to safety engineers, it is not suitable to law enforcement officers who are generally not trained in the engineering analysis involved. For example, a police officer may be more interested in identifying locations with a high number of crashes as stratified by their contributing factors over a three-month period, instead of the multiple years required by a safety engineer, who is looking to draw conclusions that require statistical significance. Similarly, a police officer may also be interested in examining the impact of the "Click It or Ticket" (CIOT) campaign by comparing crashes three months before and three months after the campaign was launched, while such an application is not typically performed by safety engineers.

1.2 Project Objective

This project aimed to identify the existing crash analysis practices, problems, and needs in Florida in order to help move Florida in the direction of standardizing its crash analysis methods and tools. This was accomplished mainly by conducting three online surveys targeting three major traffic safety stakeholders in Florida, i.e., FDOT district offices, local transportation agencies, and low enforcement offices. In addition, this project also reviewed the state-of-the-art crash analysis methods and tools, including the Highway Safety Manual (HSM), SafetyAnalyst, Interactive Highway Safety Design Model (IHSDM); and three major GIS systems currently being used by agencies in Florida, namely, the Web Crash Data Management System (WebCDMS), the Traffic Safety Analysis Tool (TSAT), and the Signal Four Analytics (S4).

1.3 Report Organization

The rest of the report is organized as follows. Chapter 2 introduces the overall safety management process and discusses the traditional and advanced safety analysis methods. Moreover, common safety analysis tools and software tools, including the HSM, SafetyAnalyst, and IHSDM, are discussed. Chapter 3 describes the efforts made to design the surveys targeting the three major agency groups involved in crash analysis: FDOT districts, local transportation agencies, and law enforcement agencies. Results and key findings from the three surveys are presented in Chapters 4 through 6 for the three agency groups, respectively. Chapter 7 reviews the crash analysis functionalities of three major GIS systems in Florida, i.e., WebCDMS, TSAT, and S4. The crash analysis features and functionalities of the three systems are highlighted. Finally, Chapter 8 summarizes the key findings from this project and provides several recommendations.

CHAPTER 2
CRASH ANALYSIS METHODS AND TOOLS

2.1 Overview

This chapter discusses the entire safety management process and delves deeper into the network screening and economic evaluation steps. Both traditional and advanced site selection methods are discussed. In addition, major safety analysis tools that have only become available recently are introduced. This information provides some of the input needed to better understand the materials to be presented in the subsequent chapters of this report.

2.2 SAFETEA-LU

The introduction of SAFETEA–LU (Safe Accountable Flexible Efficient Transportation Equity Act – A Legacy for Users) in 2005 was clearly a positive step in the direction of improving the country's current transportation system. As the name implies, safety is the key focus of the act's overall program goals and objectives. The act requires states to develop Strategic Highway Safety Plan (SHSP) and comprehensive Highway Safety Improvement Program Guideline (HSIPG) to improve highway safety, emphasizing safety improvements on highways. The act further emphasizes addressing the 4 E's (Engineering, Education, Enforcement, and Emergency response) of highway safety to qualify for federal funding. It also requires states to identify new and intensive data-driven approaches to crash data analysis, network screening, and countermeasure selection and their evaluation.

Figure 2-1 lists the three main phases (i.e., planning, implementation, and evaluation) of the HSIPG that aid in achieving its final goal (Herbel et al., 2010). The planning phase includes collecting and maintaining data, identifying problematic locations (i.e., sites with potential for safety improvements), conducting engineering studies, and establishing project priorities. The implementation phase includes scheduling projects, their design and construction, and conducting operational review. The final phase, evaluation, includes determining the effect of completed projects. SHSP must show the effectiveness of treatments through formal HSIP process. Therefore, it is important to ensure proper selection of sites for countermeasure implementation (Herbel et al., 2010).

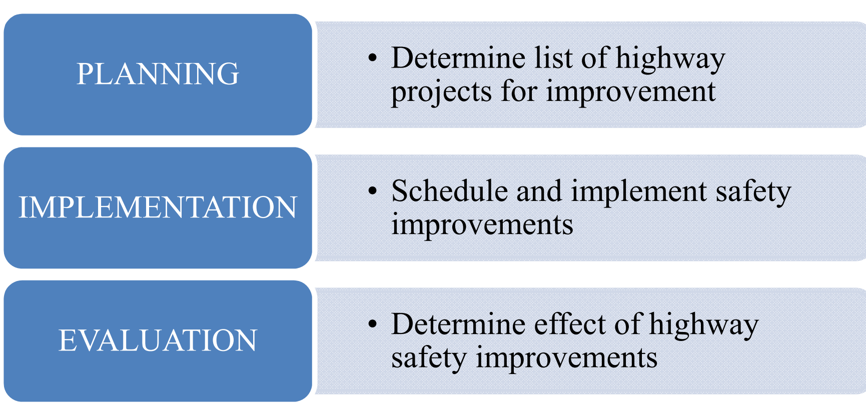


Figure 2-1: Components of Highway Safety Improvement Program

Newer approaches to crash data analysis and site safety improvements include the use of advanced tools including SafetyAnalyst, Interactive Highway Safety Design Model (IHSDM), and Highway Safety Manual (HSM). Different states have different approaches towards the highway safety problem with the bottom line of improving safety by reducing the frequency and severity of crashes. If sites for safety improvement are not chosen using proper methods, the effectiveness of the implemented countermeasures will be reduced or even eliminated.

With varying levels of available crash, roadway characteristics, and traffic data, different states have developed different methods for conducting crash data analysis. Some of the most popular analytical methods include using crash frequencies and crash rates. However, these methods have major drawbacks, like regression-to-the-mean (RTM) effect and bias toward high volume roads, which can only be rectified by rigorous analysis approaches, such as the empirical Bayes (EB) method.

2.3 Roadway Safety Management Process

A roadway safety management process is "a quantitative systematic process for studying roadway safety on existing transportation systems, and identifying potential safety improvements". The benefits of implementing a roadway safety management process include (HSM, 2010):

- A systematic and repeatable process for identifying opportunities to reduce crashes and for identifying potential countermeasures in a prioritized list of cost-effective safety countermeasures.
- A quantitative and systematic process that addresses a broad range of roadway safety conditions and tradeoffs.
- The opportunity to leverage funding and coordinate improvements with other planned infrastructure improvement programs.
- Comprehensive methods that consider traffic volume, collision data, traffic operations, roadway geometry, and user expectations.
- The opportunity to use a proactive process to increase the effectiveness of countermeasures intended to reduce crash frequency.

The six steps of the roadway safety management process (shown in Figure 2-2) are:

1. *Network Screening:* Reviewing a transportation network to identify and rank sites based on the potential for reducing average crash frequency.

2. *Diagnosis:* Evaluating crash data, historic site data, and field conditions to identify crash patterns.

3. *Select Countermeasures:* Identifying factors that may contribute to crashes at a site, and selecting possible countermeasures to reduce the average crash frequency.

4. *Economic Appraisal:* Evaluating the benefits and costs of the possible countermeasures, and identifying individual projects that are cost-effective or economically justified.

5. *Prioritize Projects:* Evaluating economically justified improvements at specific sites, and across multiple sites, to identify a set of improvement projects to meet objectives such as cost, mobility, or environmental impacts.

6. *Safety Effectiveness Evaluations:* Evaluating effectiveness of a countermeasure at one site or multiple sites in crash frequency or severity.

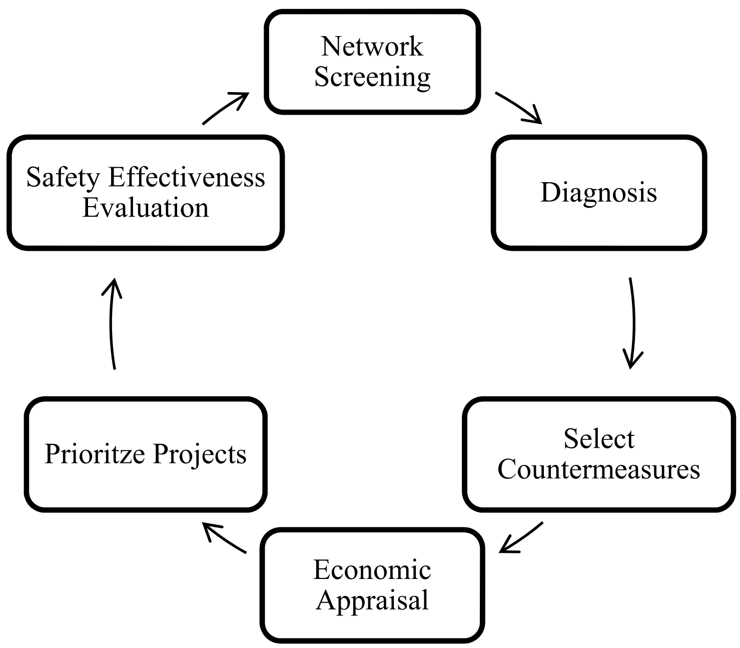


Figure 2-2: Roadway Safety Management Process

Of all the aforementioned steps, network screening (i.e., identification and prioritization of sites) is the most fundamental building block for a successful safety management program, since improper identification of high priority sites results in less cost-effective solutions (Hauer et al., 2002).

2.4 Network Screening

Over the last 50 years, many methods, tools, and measures in practice have been developed to help in the process of identification and prioritization of sites. These traditional methods use accident counts or their proportions to identify unsafe sites. Today, superior methods are available for use, employing advanced statistical methods (i.e., empirical Bayes and full Bayes approaches). These methods have been developed over the last decade and have recently been made available through IHSDM, SafetyAnalyst, and HSM.

While evaluating the pros and cons of traditional and advanced methods, it was found that the traditional methods require little data, but are fraught with problems and false assumptions, including site selection bias, false assumption of a linear relation between crash count and traffic volume, bias toward heavier volume roads and smaller segment lengths, etc. (Alluri, 2008). Although superior safety analysis tools address the biases associated with traditional methods, they tend to require more complete and comprehensive data for crashes, roadway characteristics, and traffic to be fully utilized. However, these advanced methods have the flexibility of performing incremental analysis depending on the current data availability and technical expertise. Thus, as states are ramping up data collection and analysis procedures, they can still make use of the new tools. Table 2-1 gives a summary of the data requirements for the basic (crash frequency, crash rate, and rate quality control) and the three newer safety analysis tools.

Table 2-1: Data Requirements for Various Safety Analysis Tools

Methods	Crash Data by Type and Location	Traffic Volume	Basic Roadway Characteristics by Location	Full Geometric Roadway Characteristics	Safety Performance Functions
Category A - Screening Based on Counts					
Frequency[1]	Yes	No	Yes	No	No
Rate[1]/ Rate Quality Control[1]	Yes	Yes	Yes	No	No
Category B - Screening Based on Potential for Safety Improvement					
IHSDM[2]	No	Yes	Yes	Yes	No
SafetyAnalyst[3]	Yes	Yes	Yes	No	Yes
HSM[1]	Yes	Yes	Yes	Yes[4]	Yes

Source: [1] (HSM, 2010); [2] (FHWA, 2010); [3] (AASHTO, 2010); [4] Sample of roads required for calibration purposes

The various types of data that are required include crash data by type and location, traffic volume data, basic roadway characteristics, complete geometric roadway characteristics, and safety performance functions (SPFs). SPFs represent the relation between crashes and exposure (usually traffic volume) for a group of reference sites. The method of site selection by crash frequency requires minimal information on crashes and roadway characteristics. Crash rates and critical crash rates (used to perform rate quality control) are the most commonly used methods and require crash data along with traffic volume, roadway characteristics, and segment length.

Florida's total number of motor vehicle fatalities and fatal crash rates, even though on a decreasing trend, are above the national average. With limited resources, Florida needs to make the best decisions about where to put its resources. For crash data analysis and site selection, many different approaches are in practice today, some basic and some advanced. Each approach has its own advantages and limitations. While many states are using the basic analysis methods like crash rates, crash frequencies, and high proportion methods these were shown recently to be subpar to their advanced counterparts.

2.4.1 General Issues with Traditional Methods

Crash frequencies, crash rates, and safety indices are often termed as traditional (or basic) site selection methods as they require minimum data and expertise. Even though these methods are simpler, they are fraught with problems, issues, and limitations. These documented issues wer addressed by the newer methods. The following paragraphs discuss the several issues with traditional methods.

2.4.1.1 Regression-To-The-Mean Effect (RTM)

Irrespective of the type of the traditional network screening method used, one of the major shortcomings is the use of few years of historical crash data, resulting in the RTM phenomenon. This is defined as "the phenomenon of repeated measures of data in the long run drifting towards a mean value" (HSM, 2010). Due to the random nature of crashes, it is observed that the short-term average crash frequency at a site is independent of its long-term average, the true safety characteristic of the site, thus questioning the reliability of safety predictions made with few years of crash data. Further, the RTM bias is a statistical phenomenon resulting from non-random selection of crash analysis locations. Some high crash locations may be erroneously selected for safety improvements, when their high crash status is due only to random fluctuations in crash numbers. This misidentification reduces the cost-effectiveness of safety programs.

In practice, the RTM bias, also known as "selection bias", might not be addressed depending on the site selection method used by the state DOTs. Traditional or basic methods including crash frequency, crash rate, and safety indices do not address the aforementioned issue of RTM. Figure 2-3 shows the RTM effect at a hypothetical site (HSM, 2010). In this example, when a countermeasure was implemented in 2007 based on a three-year-before average, the observed safety effect was lower when the three-year-after average was compared to the long term average crash frequency at the site. Crash data analysis without accounting for the RTM effect could estimate higher benefit to cost ratios. Also, as a result of the RTM bias, a reverse trend (i.e., under predicting the safety effect of a treatment) could also be observed.

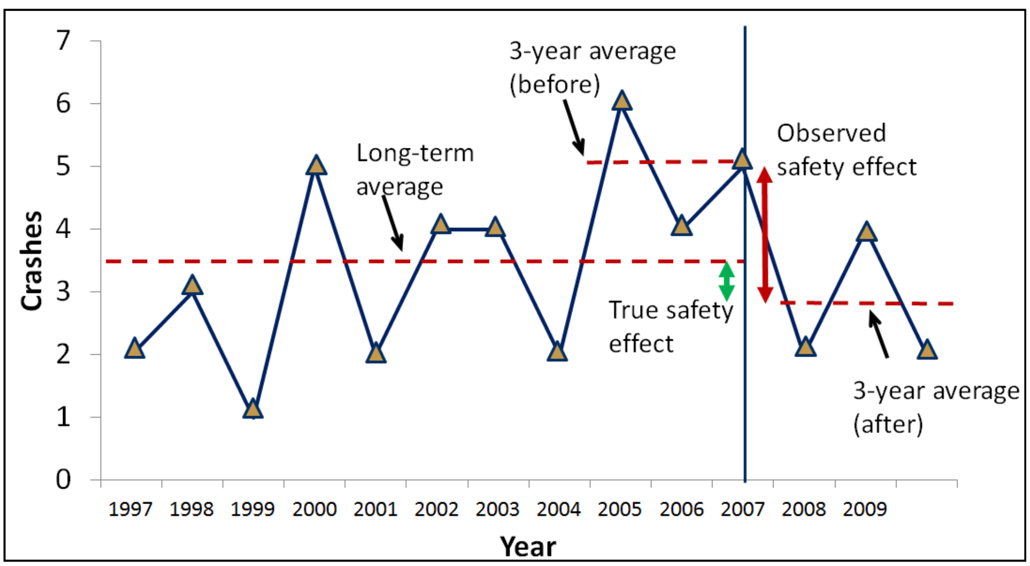


Figure 2-3: Regression-To-The-Mean Effect

2.4.1.2 False Assumption of Model Form

Ranking based on crash rates has its own drawbacks and constraints. When proper random variables like annual average daily traffic (AADT), segment length, lane width, shoulder width, median type etc. for determining rates are not selected, crash rates appear to be misleading (Hauer et al., 2002). Crash rates assume a linear relation between exposure per unit time and crash frequency, but in most cases the actual relation is non-linear (HSM, 2010). This non-linear relation can be represented by an SPF, a curve fit to actual crash observations. This could be explained with Figure 2-4.

An SPF represents the relation between crash experience and exposure (e.g., AADT). Sites above the curve tend to have higher PSI (Potential for Safety Improvement) while sites below the curve are not in need of safety improvement. For example, if there are 'Cr_A' total crashes at an AADT of A' and 'Cr_B' total crashes at an AADT of B', as shown in Figure 2-4, both the sites A and B have roughly the same 'level of safety' as they are both located on the safety performance curve, which portrays the relation between crashes and traffic for that particular roadway type. However, when rates are considered, the crash rate for A is much greater than the crash rate for B (as the slope of line segment OA is steeper than the slope of line segment OB). Using rates, one might flag site A as a problematic site since its rate is much higher than rate of site B. Using frequencies, one might flag site B as a problematic site since it has more crashes than site A. In fact, neither site A nor site B would be considered for safety improvement because they do not deviate from the estimated trend line. Therefore, assumption of a linear relation between crashes and exposure questions the credibility of crash rates (Qin et al., 2005).

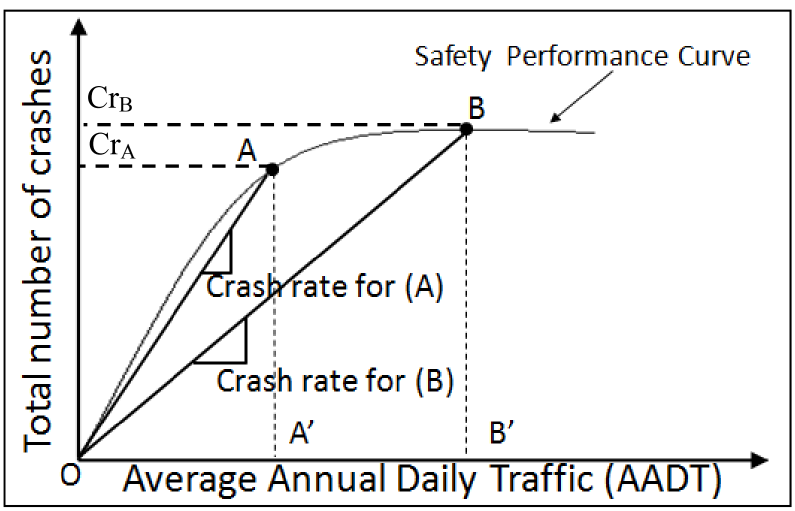


Figure 2-4: Rate Misleading Effect (Qin et al., 2005)

2.4.1.3 Influence of AADT

When crash frequencies are considered for site selection, crash reduction potential will be greater for sites with higher crash counts (number of crashes per year). It is obvious that the crash frequencies will be comparatively higher for sites with heavier traffic such as urban roads and Interstates (since more vehicles on road lead to more crashes, though, a linear relation does not necessarily prevail between crash numbers and traffic volume). Crash rates, defined as crash frequency per unit exposure, tend to identify sites with lower traffic volumes. When traffic volumes are very low, fewer crashes on a segment will produce a large rate. Thus, traffic plays a deciding role in identifying and prioritizing safety improvement projects depending on the type of network screening method used.

2.4.1.4 Influence of Shorter Segments

When crash rates are considered, shorter segments result in higher crash rates compared to relatively longer segments (Alluri, 2008). Figure 2-5 and Figure 2-6 help in understanding the influence of segment length on crash rate. Consider a hypothetical situation, in which one crash has occurred on a 1 mile long segment with an AADT of 1000 veh/day in the year 2004 (as shown in Figure 2-5).

Figure 2-5: One Mile Segment with One Crash

Exposure = AADT × 365 × segment length / 1 million VMT
= (1000×365×1/1000000)

Crash Rate = (Number of crashes) / (Exposure)
= 2.739 crashes/mile/year

Consider another similar case (as shown in Figure 2-6) where the previous 1 mile segment has been divided into 10 segments of 0.1 miles each based on the variations in roadway inventory elements, with a single crash in 2004 and an AADT of 1000 veh/day.

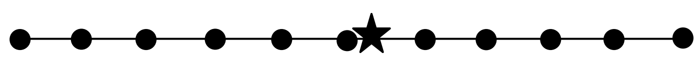


Figure 2-6: One Mile Segment Divided into 10 Segments of 0.1 Mile Each with One Crash

Exposure = AADT × 365 × segment length / 1 million MVMT
= (1000 × 365 × 0.1/1000000)

Crash Rate = (Number of crashes) / (Exposure)
= 27.39 crashes/mile/year

In this case, segment length has a drastic influence on crash rate and also on the criteria for prioritizing sites with greater potential for safety improvement. When crash frequency is used for site selection, shorter segments are not typically flagged as “problematic sites.” This occurs because fewer crashes are typically recorded on shorter segments in comparison to their corresponding longer segments.

2.4.1.5 Estimate Future Safety Performance of a Roadway

Crash rates and frequencies, similar to other traditional methods, are reactive methods, meaning, the analysis is based on the past safety experience at a site. Over the past decade, safety professionals across the country have agreed on the shift of safety analysis from reactive to proactive methods. Network screening based on the expected future safety performance of a roadway is identified to yield more accurate results. The newer, advanced tools, i.e., SafetyAnalyst and a few methods in the HSM, are based on the empirical Bayes analysis, a proactive approach to crash data analysis.

2.4.1.6 Reliability of the Site Selection Methods

Most of the traditional methods have no reliability measures. With no specific confidence intervals, the safety improvement projects could not be justified. Lack of reliability measures coupled with the RTM effect could be difficult, if not impossible to justify. The newer methods that use empirical Bayes approach estimates the expected future crash frequency and severity with confidence. Therefore, these advanced methods result in convincing justification of safety improvement projects and also more realistic benefit-to-cost ratios.

2.4.2 Overview of Traditional Methods

The following are the most common site selection methods that are being used by the states (as shown in the HSM (2010).

2.4.2.1 Crash Frequency

The locations with highest number of crashes per year are identified and ranked. Crash frequency is calculated using the following formula:

$$Crash\ frequency = \frac{Total\ crash\ count}{Number\ of\ years} \qquad (2\text{-}1)$$

Table 2-2 gives the advantages and limitations of this method.

Table 2-2: Advantages and Limitations of Crash Frequency Method

Advantages	Limitations
• Simple to use • Very little data requirements	• Does not account for RTM bias • Does not consider traffic volume • Does not consider crash severity • Biased toward high volume roads and longer segments • Does not estimate the site's future safety performance

2.4.2.2 Crash Rate

The crash rate method normalizes crash frequency with exposure, which is often AADT. Exposure (EXPO) in million vehicle miles traveled (MVMT), is calculated using the formula:

$$EXPO = \frac{AADT \times 365 \times number\ of\ \ years \times total\ segment\ \ length}{1{,}000{,}000} \tag{2-2}$$

$$Crash\ rate = \frac{Total\ crash\ \ count}{EXPO} \tag{2-3}$$

The locations with highest crash rate are identified and ranked. Table 2-3 gives the advantages and limitations of this method.

Table 2-3: Advantages and Limitations of Crash Rate Method

Advantages	**Limitations**
• Simple to use • Very little data requirements • Considers the influence of traffic/ exposure	• Does not account for RTM bias • Assumes a linear relation between traffic and crashes while the relation is non-linear • Might not consider crash severity • Biased toward low volume roads and shorter segments • Does not estimate the site's future safety performance

2.4.2.3 Critical Crash Rate

Critical crash rate for a set of sites is calculated using the formula:

$$Rci = RA + Kc \times \sqrt{\frac{RA}{EXPO}} + \frac{1}{2 \times EXPO} \tag{2-4}$$

where:

R_{ci} = critical crash rate for site i,
R_A = average crash rate for each reference population,
K_c = 1.645 (the probability constant based on the confidence interval of 95%), and
$EXPO$ = million vehicle miles of travel.

The difference between the crash rate for each site obtained from Equation (2-3) and the critical crash rate obtained from Equation (2-4) is calculated and sorted in descending order. The site with highest positive difference is ranked first, the site with second highest positive difference is ranked number 2, and so on. However, sites are ranked only if their observed crash rate is greater than the critical crash rate. It is to be noted that critical crash rate is calculated only for a set of similar sites. Therefore, segments need to be sub-classified into site subtypes prior to performing this analysis. Table 2-4 gives the advantages and limitations of this method.

Table 2-4: Advantages and Limitations of Critical Crash Rate Method

Advantages	Limitations
• Reduces over-representation of sites with low traffic volume • Considers variance in crash data • Establishes a threshold for comparison • Classifies roads to sub-categories	• Does not account for RTM bias • Assumes a linear relation between traffic and crashes while the relation is non-linear • Might not consider crash severity • Does not estimate the site's future safety performance

2.4.2.4 Crash Severity Index

A fatal crash needs to be weighed heavily than a PDO (Property Damage Only) crash in any type of crash data analysis. However, crash severity is rarely accounted for while sites are prioritized based on crash frequency and crash rate. Addressing this limitation, this method assigns monetary costs to all crashes at a site. The average crash cost at this site is then compared to the average crash cost at reference population. The locations with the highest average crash costs compared to the reference population are identified and ranked. Table 2-5 gives the advantages and limitations of this method.

Table 2-5: Advantages and Limitations of Crash Severity Index Method

Advantages	Limitations
• Simple to use • Considers collision type and crash severity • Uses reference sites for comparison	• Does not account for RTM bias • Does not account for traffic volume • May overemphasize sites with fatal crashes • Does not estimate the site's future safety performance

2.4.2.5 Equivalent Property Damage Only (EPDO)

The Equivalent Property Damage Only (EPDO) method assigns weighting factors to crashes by severity (i.e., fatal, injury, PDO) to develop a combined frequency and severity score per site. The weighting factors are often calculated relative to PDO costs. Table 2-6 gives the advantages and limitations of this method.

Table 2-6: Advantages and Limitations of EPDO Method

Advantages	Limitations
• Simple to use • Considers crash severity	• Does not account for RTM bias • Does not account for traffic volume • May overemphasize sites with low frequency of fatal crashes depending on weighting factor used. • Does not identify a threshold to indicate sites experiencing more crashes than predicted for sites with similar characteristics

2.4.3 Advanced Methods for Network Screening

The issues and limitations of the most commonly used traditional methods urge researchers to develop statistically proven safety analysis methods. The EB and full Bayes (FB) methods are the two advanced methods of site selection and prioritization. The EB approach is considered a simplified version of the full Bayesian analysis obtained by making certain assumptions. When the data and statistical expertise is available, FB analysis is preferred to EB method as the former accounts for all the uncertainties in the analysis. The uncertainties in the EB method are addressed to an extent by SPFs, and EB method might yield unrealistically optimistic results (Carriquiry and Pawlovich, 2004).

However, the EB method is considered to be an acceptable replacement to the existing site selection methods. The EB method could be used not only for network screening, but also in the other steps of roadway safety management process (e.g., in economic appraisal, countermeasure selection, and evaluation steps). Because of the statistical complexity that exist in performing the EB approach, the recent safety analysis tools, such as SafetyAnalyst have focused on making the approach as simple as practically possible. Additionally, the HSM discusses the EB method in the greatest detail with very specific examples. The next section discusses in details the EB method and its estimation procedure.

2.4.3.1 The Empirical Bayes (EB) Method

The EB method is a more sophisticated method of selecting sites for safety improvements as it addresses all the issues and limitations of traditional methods. However, it is extremely data intensive and requires extensive statistical expertise. Figure2-7 shows the concept behind the EB method which compares the safety performance of a site with a group of similar sites (or the so-called reference sites) (HSM, 2010).

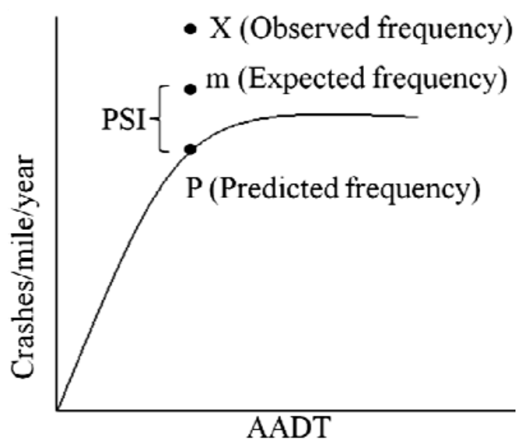


Figure 2-7: Calculation of Expected Crashes Based on Predicted and Observed Crashes

The safety performance of a group of similar sites for a particular AADT is the predicted crash frequency. As the actual crash statistics at a site portray the site's existing safety performance, the future expected crash frequency at the site is calculated as the weighted average of the observed frequency and the predicted crash frequency at the site. The weighting factor is a function of the fit of the SPF and the number of years of available crash data. The better the fit of the SPF, the greater the weight on the predicted crash frequency. Similarly, the greater the number of years of available crash data, the lower the weight on predicted crash frequency. With more years of available crash data, the observed crash frequency is more representative of the site's actual safety performance. Once the expected and predicted crash frequency are calculated, a site is ranked based on its potential for safety improvement (the PSI, which is basically the difference between the expected and predicted crash frequency at a particular AADT). Table 2-7 identifies the advantages and limitations of the empirical Bayes method.

Table 2-7: Advantages and Limitations of EB Method

Advantages	**Limitations**
• Accounts for RTM effect • Assumes a non-linear relation between crashes ad exposure • Identifies and prioritizes sites based on their potential for safety improvement	• Requires SPFs calibrated to local conditions • Has intense data requirements • Require statistical expertise

As mentioned earlier, the main limitation of the EB approach is its intense data requirements. In addition to the crash, roadway characteristics, and traffic data, the EB method requires safety performance functions, crash modification factors (CMFs), and calibration factor (C_r). These three basic elements that are required to perform the EB method are explained as follows (HSM, 2010).

- *SPFs:* A SPF establishes the relation between crashes and exposure, generally, exposure being AADT. These SPFs are called "base SPFs" as they are used to estimate the crash frequency of certain types of roadway with specified base conditions. The SPFs in the HSM and SafetyAnalyst takes the functional form of the negative binomial (NB) model.

- *CMFs:* CMFs are defined as the ratio of the effectiveness of one condition in comparison to the other condition. CMFs need to be calculated for various roadway features, if they deviate from the predefined "base conditions". The safety performance of a roadway is affected by various roadway characteristics like lane width, shoulder width, presence of horizontal, vertical curve, etc. These CMFs when multiplied by the predicted crash frequency obtained using the base SPFs account for the difference between the existing site conditions and specified default base conditions.

- *Calibration factor (C_r):* A calibration factor is calculated as the ratio between the total observed crashes and the total predicted crashes. This factor mainly addresses the differences between the jurisdiction and the time period for which the base models were developed, and the present jurisdiction and the time period for which they are being applied. It is also used to address the variations of roadway characteristics between the base conditions and the conditions in the analysis area. A calibration factor greater than 1.0 implies that these roadways, on average, experience more crashes than the roadways used in developing the SPFs. And, a value lower than 1.0 implies that these roadways, on average, experience fewer crashes than the roadways used in developing the SPFs.

The predicted crash frequency at a site is calculated by adjusting the predicted frequency calculated using base conditions to the site specific and local conditions using CMFs and calibration factors, respectively. Given the three basic elements, predicted crashes at a site are calculated using the following formula:

$$N_{predicted} = N_{spf} \times C_r \times (CMF_{1r} \times CMF_{2r} \times CMF_{3r} \times \ldots \times CMF_{12r}) \quad (2\text{-}5)$$

where:

$N_{predicted}$ = predicted number of crashes in crashes per year;
N_{spf} = predicted number of crashes (for base conditions) in crashes per year;
CMF_r = crash modification factors for various roadway characteristics; and
C_r = calibration factor to adjust for differences in jurisdiction and time period.

The predicted crash frequency at a site with base conditions is a function of AADT alone as shown in the following equation. Note that the shown functional form is the NB (or exponential) form per the HSM.

$$N_{spf} = e^{(a + b \times \ln(AADT))} \quad (2\text{-}6)$$

where:

N_{spf} = predicted total crash frequency per site for roadway segments with base conditions,
$AADT$ = annual average daily traffic in veh/day, and
a and b = regression coefficients.

From the predicted and the observed crash frequency, the expected crash frequency is calculated using the following equation:

$$N_{expected} = w \times N_{predicted} + (1\text{-}w) \times N_{observed} \quad (2\text{-}7)$$

where:

$N_{expected}$ = expected number of crashes in crashes per year at a site,
$N_{predicted}$ = predicted number of crashes in crashes per year at a site,
$N_{observed}$ = observed number of crashes in crashes per year at a site, and
w = weighting factor where $0 \leq wt \leq 1$.

The weighting factor is calculated using the following equation:

$$w = \frac{1}{1 + d * \sum N_{predicted}} \quad (2\text{-}8)$$

where:

w = weighting factor used in the EB method,
d = overdispersion parameter of the fitted SPF, and
$N_{predicted}$ = predicted average total crash frequency from an SPF.

2.5 Economic Appraisal

Economic appraisal, the fourth step of the roadway safety management process, is the process of evaluating the benefits and costs of the possible countermeasures, and identifying individual projects that are cost-effective or economically justified. Project prioritization is based on the potential projects' economic appraisals. In this step, the project costs and potential benefits are addressed in monetary terms. The net present value (NPV) and benefit-cost ratio (B/C) analyses are the two most frequently used methods for economic appraisal (HSM, 2010).

2.5.1 Net Present Value (NPV)

The NPV method is used to calculate the difference between discounted costs and discounted benefits of an individual safety improvement project as a single amount. The NPV method is used for the following two functions:

- Determine which countermeasure provides the most cost-efficient means to reduce crashes. Countermeasures are ranked from the highest to lowest NPV.
- Evaluate if an individual project is economically justified. A project with a NPV greater than zero implies that its benefits are greater than the project's costs.

The steps to calculate NPV are as follows:

1. Estimate the number of crashes reduced due to the safety improvement project.
2. Convert the change in estimated average crash frequency to an annual monetary value representative of the benefits.
3. Convert the annual monetary value of the benefits to a present value.
4. Calculate the present value of the costs associated with implementing the project.
5. Calculate the NPV using the following equation:

$$\text{NPV} = \text{Present value of project benefits} - \text{Present value of project costs} \quad (2\text{-}9)$$

Table 2-8 gives the advantages and limitations of this method.

Table 2-8: Advantages and Limitations of NPV Method

Advantages	Limitations
• It evaluates the economic justification of a project • It ranks projects with the same rankings as produced by the incremental benefit-to-cost ratio method	• The magnitude cannot be as easily interpreted as a benefit-cost ratio

2.5.2 Benefit-Cost Ratio (B/C)

A B/C ratio is the ratio of the present-value benefits of a project to the implementation costs of the project. The project is considered to be economically feasible if the ratio is greater than 1.0.

This method is used to determine the most valuable countermeasure for a specific site and is also used to evaluate economic justification of individual projects.

The steps to calculate B/C ratio are as follows:

1. Calculate the present value of the estimated change in average crash frequency.
2. Calculate the present value of the costs associated with the safety improvement project.
3. Calculate the benefit-cost ratio by dividing the estimated project benefits by the estimated project costs.

Table 2-9 gives the advantages and limitations of this method.

Table 2-9: Advantages and Limitations of B/C Method

Advantages	Limitations
• The magnitude of the ratio makes it evident to decision makers. • This method can be used by highway agencies in evaluations to justify improvement projects	• BCR method cannot be directly used in decision making between project alternatives or to compare project at multiple sites. • It considers projects individually and does not provide guidance for identifying the most cost-effective mix of projects within a specific budget.

2.6 Safety Analysis Tools

After discussing the traditional and advanced methods used for crash analysis in the previous sections, this section mainly covers the common safety analysis tools. The past decade has developed momentum for much awaited change in the highway safety culture resulting in understanding the need for more advanced and statistically proven techniques of highway safety improvement. The HSM, SafetyAnalyst, and IHSDM are the three of the many safety analysis tools developed and funded by the federal government. These tools have the potential to define a new era in highway safety. The HSM was released in July 2010, while SafetyAnalyst and IHSDM were released in March 2010 and 2003, respectively.

For their complete implementation, advanced tools require a wide range of data in comparison to the basic methods. For example, SafetyAnalyst and HSM require SPFs which are rarely available at the state level. As such, both tools come with a set of default SPFs. The default SPFs for SafetyAnalyst were developed using multiple year data from California, Minnesota, Ohio, and Washington. The default SPFs for HSM came from various states and different analysis periods. The individual SPFs included as defaults were chosen as most representative based on R^2 values. On another note, IHSDM and HSM require complete geometric alignment information. For IHSDM, this requirement only includes geometric data for the sections under evaluation. HSM requires complete geometric and roadside information for a minimum of 30-50 roadway sections totaling 100 crashes/year for SPF calibration purposes. A summary of the HSM, SafetyAnalyst, and IHSDM tools is presented in the following three sections.

2.6.1 Highway Safety Manual

The Highway Safety Manual, released as an AASHTOWare product in July 2010, provides analytical tools for quantifying effects of potential changes at individual sites. The HSM is better suited for site specific analysis – although HSM can be used for statewide analysis, but the data needs are significant. The manual "presents tools and methodologies for consideration of 'safety' across the range of highway activities: planning, programming, project development, construction, operations, and maintenance". The HSM can be used to do the following (HSM, 2010):

- Identify sites with the most potential for crash frequency or severity reduction.
- Identify factors contributing to crashes and associated potential countermeasures to address these issues.
- Conduct economic appraisals of improvements and prioritize projects.
- Evaluate the crash reduction benefits of implemented treatments.
- Calculate the effect of various design alternatives on crash frequency and severity.
- Estimate potential crash frequency and severity on highway networks.
- Estimate potential effects on crash frequency and severity of planning, design, operations, and policy decisions.

The HSM is divided into the following four parts:

- Part A: Introduction and Fundamentals
    - Chapter 1: Introduction and Overview
    - Chapter 2: Human Factors
    - Chapter 3: Fundamentals

- Part B: Safety Management Process
    - Chapter 4: Network Screening
    - Chapter 5: Diagnosis
    - Chapter 6: Select Countermeasures
    - Chapter 7: Economic Appraisal
    - Chapter 8: Prioritize Projects
    - Chapter 9: Safety Effectiveness Evaluation

- Part C: Predictive Methods
    - Chapter 10: Rural Two Lane Roads
    - Chapter 11: Rural Multilane Highways
    - Chapter 12: Urban and Suburban Arterials

- Part D: Crash Modification Factors
    - Chapter 13: Roadway Segments
    - Chapter 14: Intersections
    - Chapter 15: Interchanges
    - Chapter 16: Special Facilities
    - Chapter 17: Road Networks

In summary, the HSM is a comprehensive safety analysis tool that discusses all the steps in the roadway safety management process. The manual discusses all the available safety analysis methods including the EB approach. However, the analysis procedures (like SPFs and CMFs) are available for only three types of roadways: rural two lane roads, rural multilane highways, and urban and suburban arterials. Analysis of other facility types such as freeways is currently unavailable.

2.6.2 SafetyAnalyst

SafetyAnalyst is a state-of-the-art analytical tool for making system wide safety decisions. The software provides a suite of analytical tools to identify and manage system-wide safety improvements by incorporating all the steps in the roadway safety management process. It incorporates the EB approach for network screening. It also includes many modules and could act as a complete "safety toolbox" for any safety office. The modules in SafetyAnalyst include (AASHTO, 2010):

1. *Network Screening Module:* It identifies and ranks sites with potential for safety improvements.
2. *Diagnosis and Countermeasure Selection Module:* The diagnosis module is used to diagnose the nature of safety problems at specific sites. The countermeasure selection module assists users in selecting the countermeasures to reduce crash frequency and severity at specific sites.
3. *Economic Appraisal and Priority Ranking Module:* The economic appraisal module performs an economic appraisal of a specific countermeasure or several alternative countermeasures for a specific site while the priority ranking module provides a priority ranking of sites and proposed improvement projects based on the benefit and cost estimates determined by the economic appraisal tool.
4. *Countermeasure Evaluation Module:* It provides the capability to conduct before/after evaluations of implemented safety improvements.

SafetyAnalyst software has a Data Management Tool, Analytical Tool, Administration Tool, and Implemented Countermeasure Tool to perform the complete roadway safety management process. The Data Management Tool is used to import, post process, and calibrate data. The Analytical Tool is used to perform analysis on the data. All the modules of SafetyAnalyst discussed earlier could be performed in this tool. The Administration Tool is used to perform a variety of tasks like adding and removing data items (with an exception of mandatory data elements). Data recoding of various data elements' attributes could also be performed. This tool also gives access to the national default SPFs used within the software which could be replaced with agency specific SPFs, whenever available. Further, diagnostic questions and countermeasures could also be edited within this tool.

In summary, SafetyAnalyst is a suite of software tools implements the advanced EB method and automates all the steps of the roadway safety management process. Even though data requirements are intense, once the data is imported, the analyses are easy requiring minimum statistical expertise.

2.6.3 Interactive Highway Safety Design Model

IHSDM is a product of FHWA's Safety Research and Development Program, and according to Chen (2009) "is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on highways". It is designed "to support project-level geometric design decisions by providing quantitative information on the expected safety and operational performance" (FHWA, 2010). There are two main benefits of IHSDM (FHWA, 2010):

- IHSDM results help project developers make design decisions that improve the expected safety performance of designs.
- IHSDM helps project planners, designers, and reviewers justify and defend geometric design decisions.

The software suite has the following modules:

- *Crash Prediction:* This module implements, to the extent possible, the predictive methods discussed in the HSM.
- *Design Consistency:* This module focuses on estimating the 85th percentile speed profile along alignment to evaluate operating speed consistency.
- *Policy Review:* This module evaluates nominal safety. It is recommended to be used in conjunction with the predictive methods discussed in the HSM. This module checks roadway segment geometry against relevant design policy and flags variations.
- *Intersection Review:* This module applies rules of good practice in a comprehensive diagnostic review of individual intersections. It further identifies possible safety concerns and typical treatments.
- *Traffic Analysis:* This module estimates traffic level of service measures like speed, level of service (LOS), control delay, etc. The module further plots the mean speed and percent time spent following along the alignment.
- *Driver/Vehicle Behavior:* This module simulates driving behavior and vehicle dynamics on two-lane highways. It also provides profiles of predicted speed and other response variables through a simulation of a single driver/ vehicle combination.

It is noted that IHSDM is not comprehensive, meaning, not all types of roadways can be evaluated using its latest version. Two-lane rural roads can be evaluated using all the existing six modules. However, only crash prediction module is currently compatible with multilane rural highways and urban and suburban arterials. Evaluations could be performed on both the existing and proposed alternative highway geometric designs.

CHAPTER 3
SURVEY PREPARATION AND DESIGN

3.1 Overview

This chapter describes the preparation and design process of three separate surveys targeting the three major agency groups that deal with traffic safety: Florida Department of Transportation (FDOT) districts, local transportation agencies, and law enforcement agencies. On-site visits were first made to FDOT districts and local agencies in South Florida to learn about their crash analysis practices and needs. These visits played a significant role in designing the survey questions by initiating a perspective about the adopted safety analysis procedures and needs. Further, current crash analysis methods (including site screening and selection, site prioritization, countermeasures selection, and site evaluation) were also reviewed and the results were summarized in the previous chapter. All of the above activities combined to play a significant role in preparing and designing the survey questions by learning about the current practice and needs and initiating a perspective about the adopted safety analysis procedures and needs.

The next section highlights a summary of each on-site visit made to Districts 4 and 6, and Miami-Dade and Broward Public Works Departments. This summary mainly highlights the safety analysis procedures that each agency adopt, including, but not limited to, the identification of high crash locations, project evaluation, software tools used in the crash analysis, and the documentations utilized in performing crash analysis. The last three sections discuss an overview of the designed questions in each of the three online surveys, respectively, and their distribution process.

3.2 On-Site Visits of Local Agencies in South Florida

3.2.1 FDOT District 4 (D4)

A summary of the district's crash analysis procedures is as follows:

1. D4 uses the CAR system to retrieve crash data from the FDOT mainframe, and then imports to an Excel spreadsheet for further analysis. D4 reported that they do not use the CAR system for crash analysis. From their perspective, the CAR's interface is not user-friendly and has some data input limitations. They therefore rely on GIS for visual representation of crashes, and then screen for specific types of problematic crashes (such as rear-end, sideswipe, angle, etc.).

2. D4 usually uses five years of crash data to perform crash analysis and to identify high crash locations. Three years of crash data are also sometimes used in the analysis.

3. The methodology being used by D4 is summarized in the flow chart shown in Figure 3-1. In brief, there are two main analysis steps: preliminary and the final analysis. For the preliminary analysis, high crash locations with abnormal crash counts are identified; next, specific crash patterns (such as increased rear-end crashes or angle crashes) using collision diagrams and crash statistics are highlighted. Potential countermeasures are then specified

for each problematic crash type, field visits, whenever possible, are then scheduled to examine the feasibility of implementing the identified countermeasures. Later, an economic evaluation based on the benefit to cost ratio (B/C) and NPV (Net Present Value) is performed for each potential countermeasure. The preliminary analysis is subsequently distributed to the pre-safety review committee, which is comprised of traffic operations engineers, for evaluation. The committee will then determine whether the project is worthy of investigation. If the committee decides to continue working on the project, a final analysis is conducted.

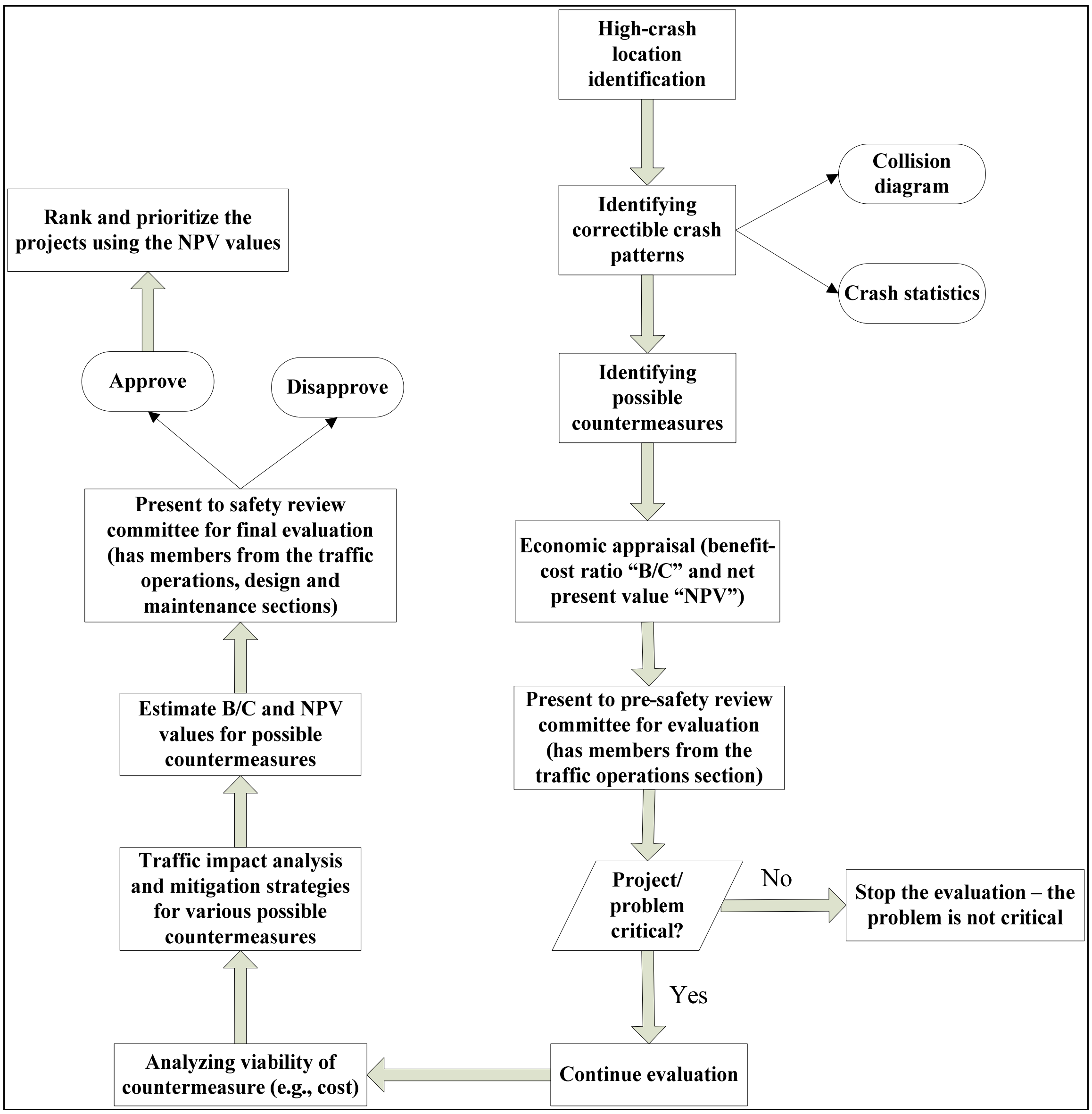


Figure 3-1: Crash Analysis Methodology Adopted by District 4

4. The final analysis is very similar to the preliminary analysis, however involves a more detailed investigation. For example, an economic evaluation is done for each of the recommended countermeasures. In this case, every countermeasure has its own B/C ratio, as

well as an NPV value. The final analysis procedure is distributed to the safety review committee that includes members from the traffic operations, design, and maintenance sectors. The committee has the choice to either approve or abandon the project. If the project is approved, the recommended countermeasures are ranked and prioritized based on B/C ratio or NPV. The District usually prefers the NPV economic evaluation for ranking and prioritizing various projects. Note that the B/C ratio and the NPV estimates for economic appraisal are calculated based on the most up-to-date crash costs; thus, the District relies on the National Cooperative Highway Research Program (NCHRP) 500 report for cost estimates. For further references, D4 uses the Florida Strategic Highway Safety Plan (Florida SHSP) and several other NCHRP reports.

5. D4 usually focuses on specific problematic crash types at intersections and arterials (e.g., rear-end, angle, sideswipe). As such, D4 officials do not focus heavily on total crashes because the objective is to propose appropriate countermeasures for each target crash type.

6. District 4 analyzes only state roads (SRs) excluding county and local roads. Crashes on county roads are often imprecisely located as they often lack milepost location and roadway ID data. Similar issue exists with locating crashes on local roads.

9. District 4 adopts specific countermeasures based on the NCHRP reports. D4 also conducts field visits to determine whether the proposed countermeasures could be implementable (for example, with respect to the available right-of-way).

10. District 4 locates crashes on local roads using a GIS application based on the names of the two approaches (e.g., for crashes which occur at an intersection). In some cases, D4 officials check the police crash reports from the Hummingbird intranet system to double-check for dubious crash types. The writing and the sketch in the last two pages of the report were verified with the codes (e.g., whether the reported crash type is correct, whether the crash injury severity is correct). The codes in the CAR system are fixed if there are any discrepancies.

The wish list for District 4 includes the following:

1. D4 would like to see automated collision diagrams to facilitate the identification of specific crash types. Diagrams that include additional details such as indications of night crashes, types of vehicles, alcohol/drug involvement, road surface conditions, and inclement weather conditions are preferred.

2. D4 would like to see improvements to the existing CAR system with increased accuracy in data inputs for the crash types; for example, it was found that there is approximately a 40% discrepancy between the CAR data and the actual crash reports.

3. D4 would like to have a special training course for police officers to learn how to code crashes correctly, and to become more familiar with traffic safety analyses in general.

4. D4 would like to share safety study information among other districts. To achieve this, D4 suggested developing a safety database to help safety engineers track the status of different safety projects in the entire state.

5. D4 would prefer to include detailed signal timing information in the Roadway Characteristics Inventory (RCI) database.

6. D4 prefers to have face-to-face statewide meetings, rather than conference calls.

7. D4 would like to have a centralized, uniform methodology for the evaluation of safety projects among different districts. This requirement is in accordance with the project's objective of standardizing crash analysis tools in Florida.

8. D4 would like to have an actionable safety performance measure. This could be similar to the "level of service" measure in the Highway Capacity Manual.

3.2.2 FDOT District 6 (D6)

A summary of the district's crash analysis procedures is as follows:

1. D6 uses the CAR system primarily to retrieve the crash records. In some cases, discrepancies arise in the reported crash injury severity or the crash type in the police crash reports. The police officer's description and the sketch in the crash report are compared to the corresponding codes in the CAR database. In case of observable mistakes (e.g., the documented crash severity was PDO, and the selected injury level was fatal, or the documented crash type was listed as "others", and the sketched type was rear-end), the police department under charge (e.g., the Florida Highway Patrol, or the City of Hialeah Police Department) is contacted for verification. The discrepancies are later fixed in the CAR system.

2. Three years of crash data are used for analyzing vehicle/vehicle crashes, and five years data are used for crashes involving vulnerable road users (i.e., pedestrians, motorcyclists, and bicyclists).

3. For site selection and prioritization, D6 follows the method recommended in the Florida SHSP. High-crash locations are identified for intersections, segments, vulnerable road users, lane departures, and aggressive driving.

   While identifying the high crash locations for vulnerable road users and lane departures, crashes are extracted from the CAR system in the form of crash density (crashes/mile). For the identification of high crash locations at intersections and along segments, the district officials rely on the annual 5% report of the Florida SHSP, i.e., the top 5 percent intersection and segment locations that have the greatest potential for safety improvement. Moreover, safety engineers at D6 identify high crash locations for intersections and segments themselves and add their own high crash locations to the 5% list for further consideration.

D6 ranks high crash locations using total crash frequency. Further, the locations are prioritized and narrowed down based on crash severity and crash rate. Then, the prioritized locations' crash history is analyzed for any noticeable crash patterns. A detailed analysis is then conducted on locations with observable crash patterns (e.g., rear-end, left-turn, or angle crashes).

4. D6 uses a web-based crash analysis system, TSSMS (Traffic Safety Study Management System, http://gis.atectrans.net/TSIMS/MainPage.aspx). This application is mainly used for project management and storing databases (thus acting as a data warehouse). TSSMS is also used for narrowing down high crash locations by selecting specific drop down menus representing specific variables (such as crash severity), for highlighting the study cost, reporting the budget, etc. Furthermore, TSSMS can be used for performing economic appraisal based on the B/C ratio for a broad range of selected countermeasures. Note that the adopted crash analysis framework as part of TSSMS is named TSIMS (Traffic Safety Information Management System). A snapshot of the TSIMS flowchart is shown in Figure 3-2.

5. D6 analyzes only state routes excluding county and local roads.

6. For reference, D6 relies on the Florida SHSP and the FDOT manual.

7. For economic appraisal, D6 uses the B/C ratio estimates and TSSMS. The most updated FDOT manual for crash cost estimates based on the roadway type (e.g., 3 lanes, divided, or undivided roadway) is used.

8. D6 adopts specific countermeasures based on similar traffic safety problematic situations where similar countermeasures were implemented. In addition, field visits are also conducted to determine whether the proposed countermeasures could be implementable.

The wish list for District 6 includes the following:

1. D6 would like to make the CAR system more user-friendly, with increased accuracy in data inputs for the various features (e.g., crash types, geometric characteristics, crash severity, etc). D6 prefers the CAR system to be a web-based application with a built-in GIS application for ease of use.

2. D6 wishes to standardize Florida's high crash location list. This requirement is in accordance with the project's objective of standardizing crash analysis tools in Florida.

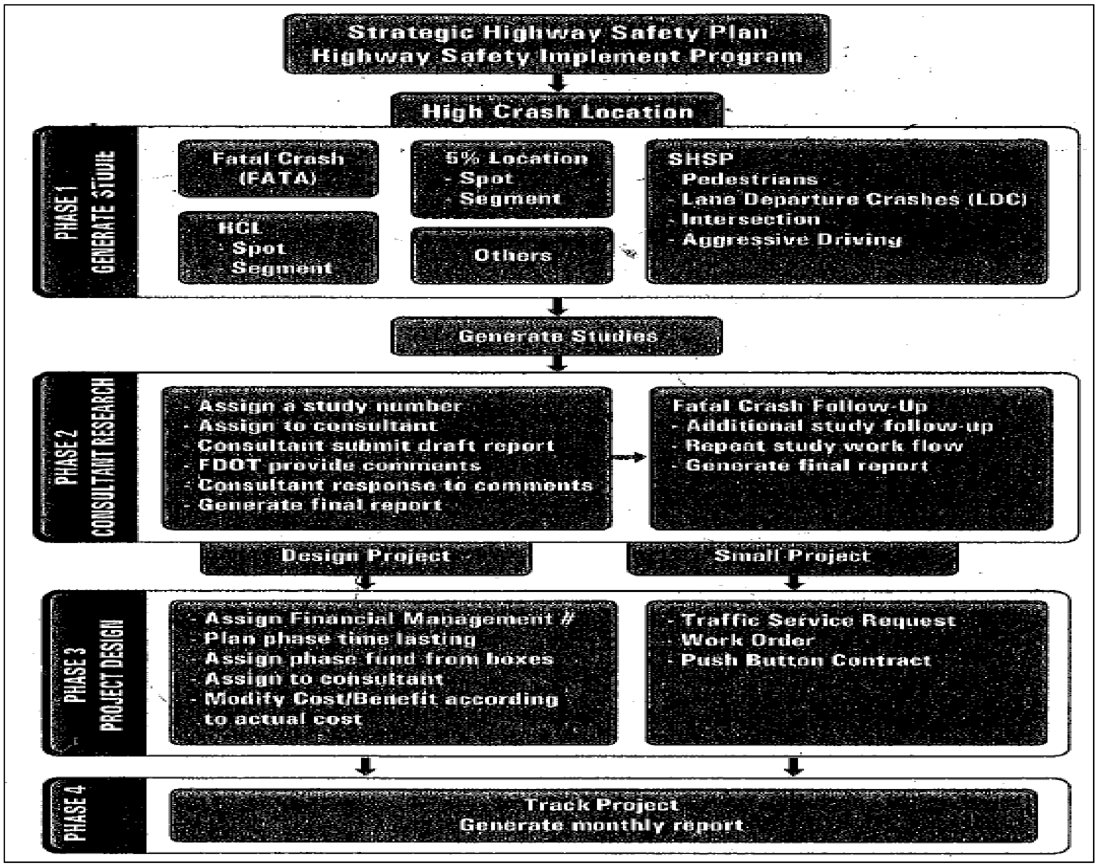


Figure 3-2: A Snapshot of the Flowchart for Identifying High Crash Locations in District 6

3.2.3 Miami-Dade County Public Works Department

A summary of the department's crash analysis procedures is as follows:

1. For crash data, the department relies on police crash reports obtained from the Miami-Dade County Police Department. Although the department is accustomed to receiving hard copies from the Police Department, some employees are working on computerizing the crash report by inputting different variables (e.g., first harmful event, age, sex, etc.). Crash frequency at a specific signalized intersection is calculated based on the names of the major and minor streets. This, however, poses difficulties for some situations in which the street names are switched, often requiring special care and attention.

   Furthermore, crash reports are obtained for intersections having 15 or more crashes per year. A more accurate crash count is possible, as the department obtains both short and long-form reports. It is believed that PDO crashes are under-reported in long-forms.

2. The department usually focuses on analyzing the latest three years of crash data. For example, if the current fiscal year is 2011, crash data from 2008, 2009, and 2010 is analyzed.

3. For identifying high crash locations, three methods are used: crash frequency, crash rate, and equivalent property damage only (EPDO) method. Each intersection is ranked based on these three methods, with the intersection having the highest number of crash frequency, crash rate, or EPDO ranked first. Note that the crash rate is estimated by normalizing crash frequency, which is done by calculating the total entering vehicles from each of the intersection's approaches. EPDO analysis is mainly done by giving monetary estimates to each crash severity level. The monetary estimates are adopted from the US DOT reports. Table 3-1 shows an example of the monetary estimates used for each severity level.

Table 3-1: Monetary Values for Each Severity Level

Severity Level	Cost per Injury (2007 dollars)
Fatal	5,800,000
Incapacitating	402,000
Evident	80,000
Possible	42,000
PDO	4,000

Source: Bryer, T. Intersection Safety Implementation Plan Process. USDOT, FHWA, November 2009.

After ranking intersections based on the three methods, the ranks based on the three methods are added and listed in descending order of the total rank. The total rank determines the order of the hazardous intersections. Note that the Miami-Dade County focuses only on county roads; thus, if one of the intersection's streets is a state road, the entire intersection is ignored (i.e., for an intersection to be included in the analysis, the two intersecting streets should be either county or local roads).

4. The department's analytical procedure first focuses on total crashes at intersections, and then has a breakdown for various factors. This breakdown includes crash type, crash severity level, month of the year, day of the week, time of the day, sex, age, lighting conditions, road surface conditions, etc. Then, intersections are assessed based on average crash frequency, and 90^{th} and 95^{th} crash percentiles for each breakdown. These values are then compared to the corresponding expected values set by the FDOT. Finally, a safety performance index (calculated by dividing actual crashes by expected crashes) is estimated for each intersection and for each analysis year. If any intersection has a safety performance index ≥ 1 for a given year, the intersection requires further investigation; leading to the countermeasure selection phase. For selecting and implementing countermeasures, a field visit is made to determine whether the proposed countermeasures could be implementable.

5. The department mainly adopts the US DOT reports and the reports issued by the FDOT highlighting the expected values for the crash frequency and crash rate methods used for identifying high crash locations.

6. The department relies mainly on the Highway Safety Analysis (HSA) software, a web-based application for querying crash data, and a web-based application related to the AADT. A description of the two software tools is outlined below.

   The HSA software is primarily used to draw collision diagrams. This software works on MS Access background, however it does not allow importing data from an outside source;

rather, the user has to input each specific crash before running the analysis. The software, nonetheless, is user-friendly and easy to implement.

For the web-based application for querying crash data, a simple application is being used for running yearly statistics for each intersection. The application interface is shown in Figure 3-3. The user can analyze either an intersection or a corridor. For intersections, the user should specify the name of the two intersecting streets. For corridors, the user has to specify the start and the end of the corridor, i.e., the start and the end intersections of the corridor. A sample bar chart and a pie chart output from the application are shown in Figures 3-4 and 3-5, respectively. The output has a detailed table displaying the characteristics of each crash, as shown in Figure 3-6. The user, moreover, can export the output to Excel for further analysis if desired. Note that the database used in this application has crashes reported only on long-forms.

The web-based application related to AADT is mainly used to convert traffic counts on a daily and yearly basis to "per hour volume". Additionally, the application estimates the peak-hour factor, K factor, and D factor for each approach, and then summarizes all the estimates for each approach into single values for each intersection.

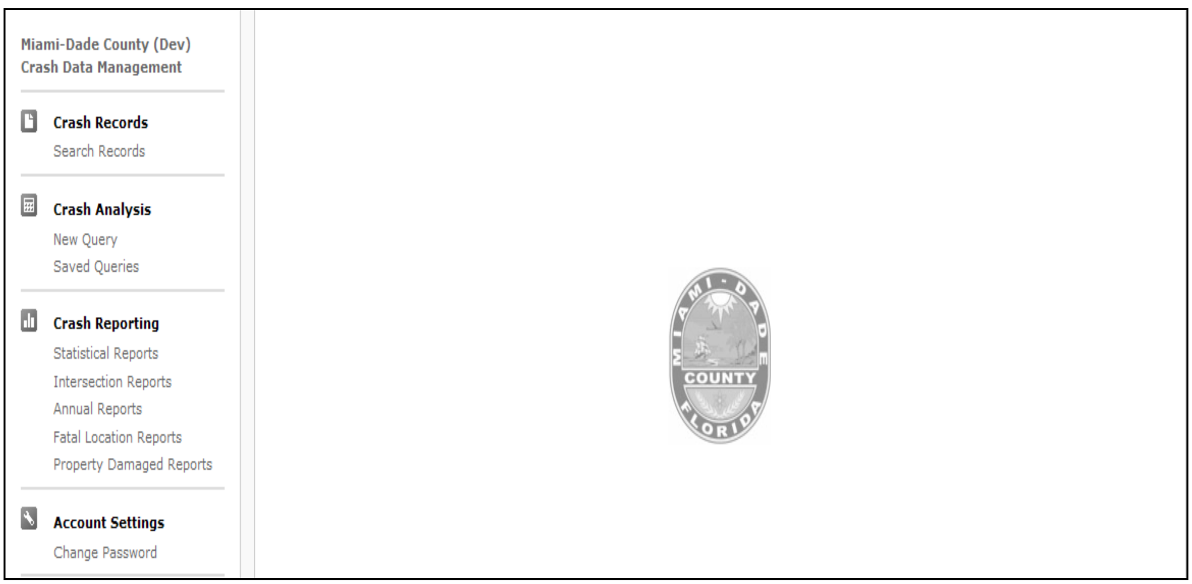


Figure 3-3: Main Interface of Crash Analysis System in Miami-Dade County Public Works Department

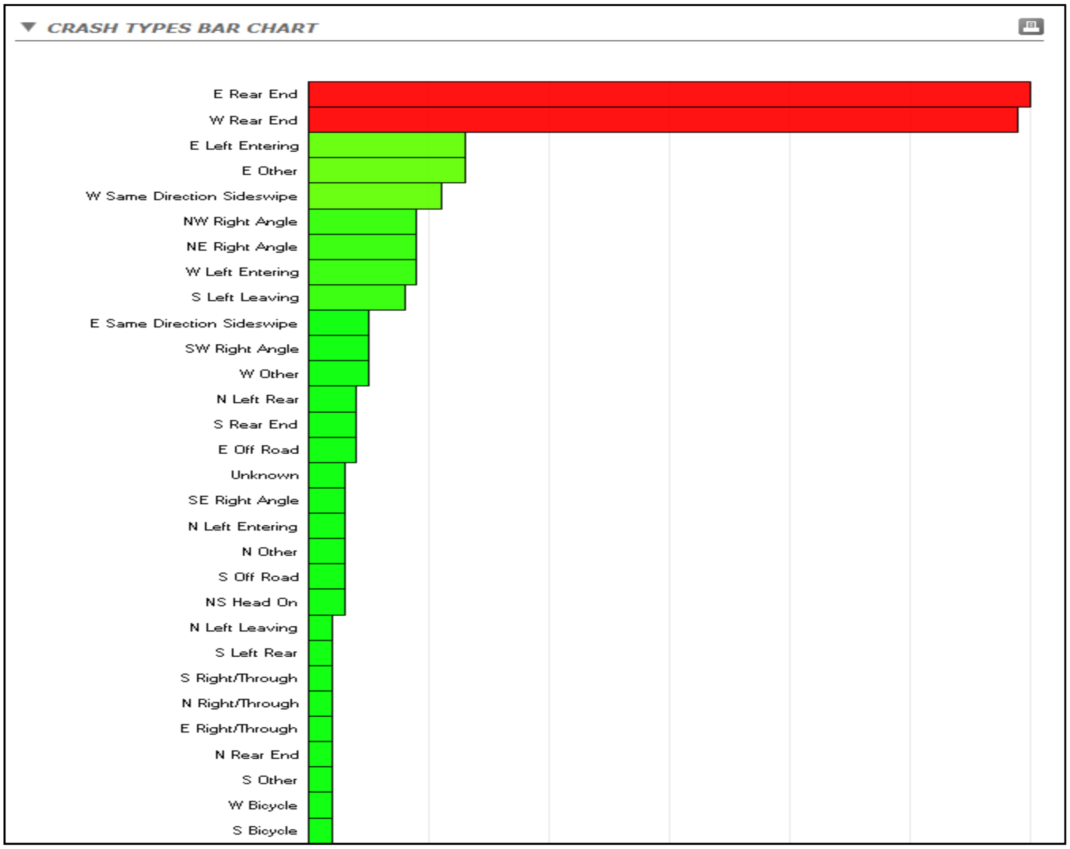


Figure 3-4: Sample Bar Chart Output of Crash Analysis System of Miami-Dade County Public Works Department

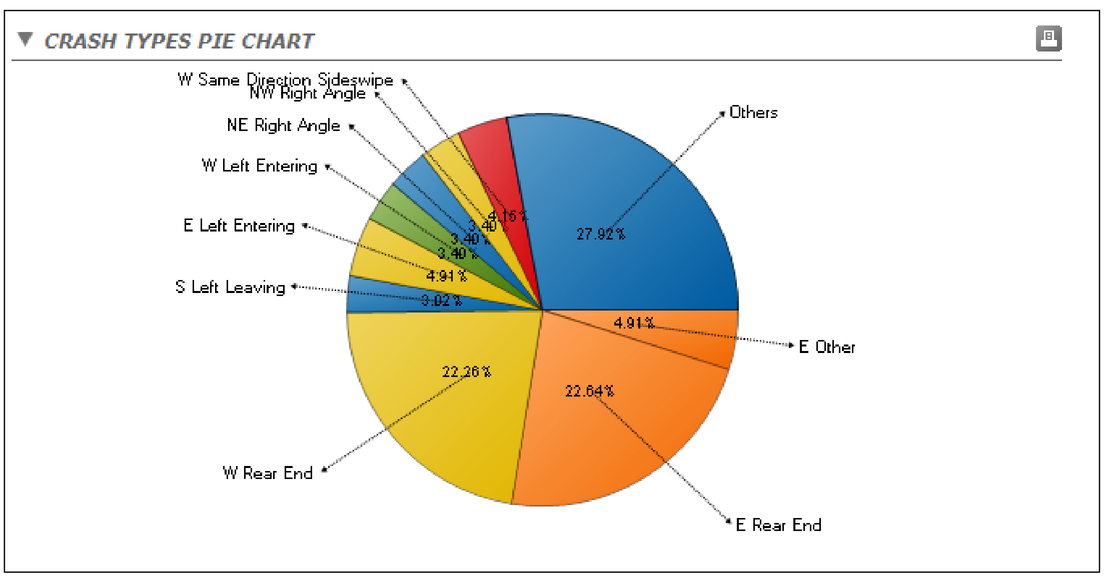


Figure 3-5: Sample Pie Chart Output from Crash Analysis Web-Based Application of Miami-Dade County Public Works Department

▼ CRASH DETAIL

Core

Crash Event (Core)									
Crash Type	HSMV Number	On Street	Intersecting Street	Dir	Dist	Weather	Alc/Drug Use	Date	Time
	EW Head On (1 record)								
	74456805	SR976	SR973		0	Clear	No	12-09-2005	06:20 am
	NS Head On (3 records)								
	74420764	SR 976	SW 90 AV		0	Clear		03-06-2006	02:30 pm
	74456644	SR 9776	SR 973		0	Cloudy	No	06-17-2005	11:29 am
	76939408	SR 976	SW 84 AVE		0	Clear	No	11-04-2006	10:58 am

Figure 3-6: Sample Table Showing Detailed Characteristics of Each Crash from Crash Analysis System of Miami-Dade County Public Works Department

7. Miami-Dade County adopts specific countermeasures for the target crash types based on the recommendations by FDOT and NCHRP reports. Also, field visits are conducted to determine whether the proposed countermeasures could be implementable (e.g., with respect to the available right-of-way, or administrative and political issues).

8. Miami-Dade County usually focuses on analyzing signalized intersections located on county roads. All unsignalized intersections and a few crash corridors are also analyzed. As such, analysis of signalized intersections is the main focus of the department.

The top priority of the Miami-Dade County Public Works Department is to include the short-form reports in the crash database. The high number of missing short forms is considered to affect the analysis disproportionately as most county roads are minor and low-speed roads, and crashes are usually less serious and often reported on short forms. As such, when the short forms are not included, a majority of the crashes are not analyzed.

3.2.4 Broward County Public Works Department

The main finding from the meeting is that the department does not perform crash analysis and has no crash database. The department does not have a safety section as no safety projects exist.

The department engineers reported that, although they once attempted to submit a safety project, it did not move forward because of budget constraints at that time. In rare circumstances, a simple safety study based on complaints is performed. However, no software tools for safety analysis are available with the department.

Moreover, districts do not share safety studies with the department, except on rare occasions when District 4 asks for assistance. When requested, the department's main responsibility lies in proposing countermeasures at specific signalized intersections. The department takes care of installing and maintaining traffic control devices for target intersections, and modifies the signal timing as well. However, the department does not propose countermeasures related to construction (e.g., adding a lane, modifying or removing medians, etc.).

The department's sole need from the state is to obtain the list of high crash locations to start getting involved in traffic safety analysis.

3.3 FDOT District Survey

3.3.1 Survey Design

Post the on-site meetings at Districts 4 and 6, and a comprehensive review of the crash analysis procedures per the HSM, a detailed list of survey questions were compiled to identify the current safety practices and needs of FDOT districts. The survey questions were noticed to be quite lengthy and time-consuming to answer; hence, were re-reviewed. The final set of questions was then sent to the project manager for approval. Based on the project manager's feedback, some modifications were made and the survey questions were finalized. Since online surveys were the desirable means of delivery, the survey questions were posted online via the Qualtrics website (http://www.qualtrics.com).

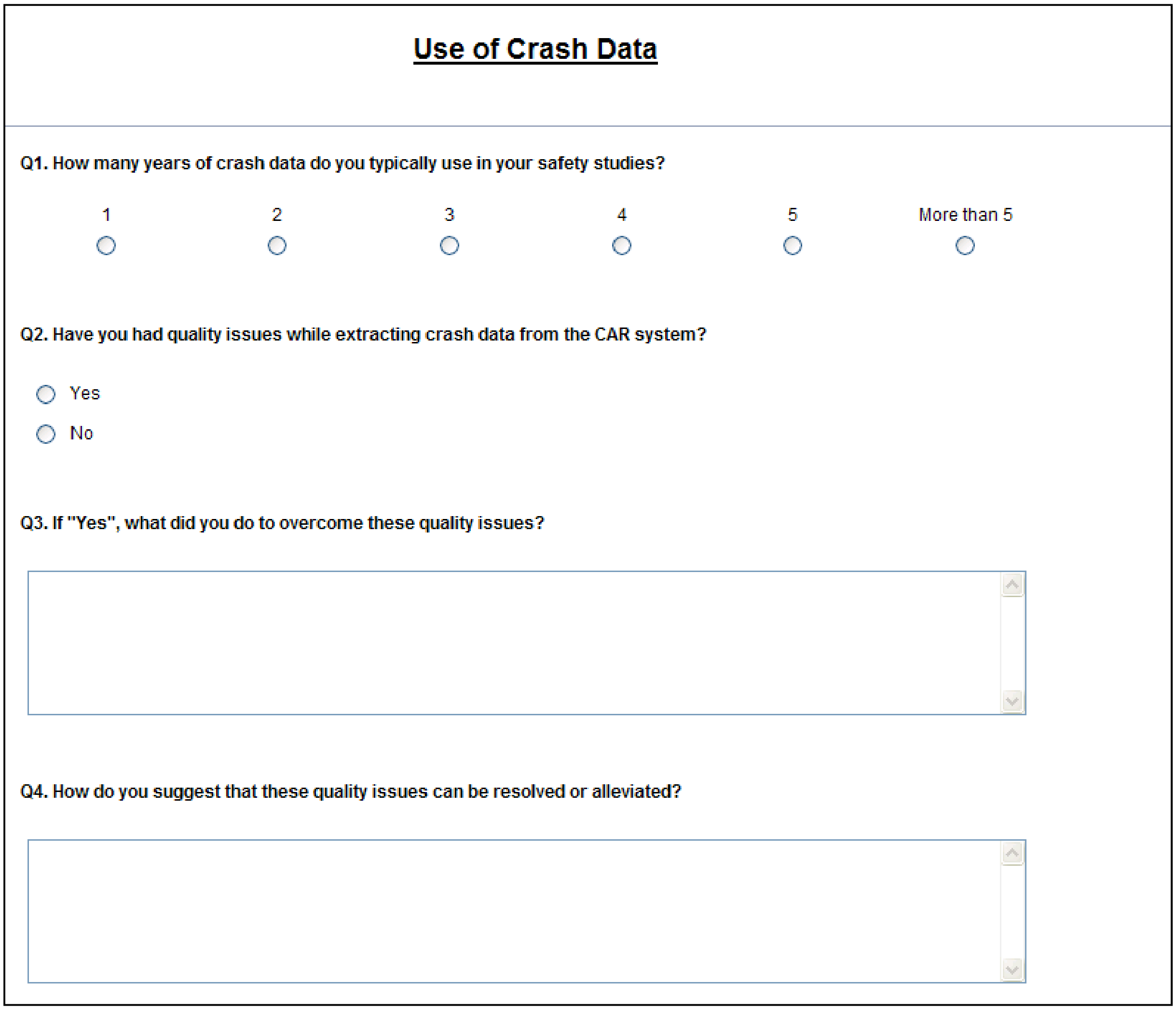
Qualtrics is a website designed for conducting online surveys and it includes user-friendly icons and menus including built-in functions for displaying questions. A screenshot of the website is shown in Figure 3-7. The website incorporates functions to edit the designed survey, distribute the survey, and view the survey results. Another screenshot from the online survey showing four of the displayed questions is presented in Figure 3-8.

Figure 3-7: Designing Online Surveys Using Qualtrics

The survey questions targeting FDOT districts are shown in Appendix A. The survey includes 48 questions and covers the following seven areas of interest:

1. Use of crash data.

2. High crash locations.
3. Project selection, implementation, and evaluation.
4. Crash analysis software systems.
5. Crash analysis standardization.
6. Crash analysis documentation.
7. Meetings and training.


Use of Crash Data

Q1. How many years of crash data do you typically use in your safety studies?

1 | 2 | 3 | 4 | 5 | More than 5

Q2. Have you had quality issues while extracting crash data from the CAR system?

Yes
No

Q3. If "Yes", what did you do to overcome these quality issues?

Q4. How do you suggest that these quality issues can be resolved or alleviated?

Figure 3-8: Sample Survey Questions for FDOT Districts in Qualtrics

3.3.2 Survey Distribution

An online link to the survey to FDOT districts was generated and sent out via an invitation email to the eight FDOT districts (including the Florida Turnpike). A PDF version of the survey questions was also included in the email. The invitation email is shown in Figure 3-9. A detailed interpretation of the survey results is given in Chapter 4.

Dear District Traffic Safety/Operations Engineers:

On behalf of the FDOT Safety Office, we would like to invite you to participate in an important online survey of FDOT district safety analysis practices and needs. More information about this survey can be found on the first page of this survey. To respond to the survey, simply click on the survey link below:

https://fiu.qualtrics.com/SE/?SID=SV_9MjvDLkQX2ueO8Y

The survey includes 48 questions covering seven different areas of interest. We estimate that the survey will take about 45 minutes to complete.

Please note that the survey will require that you complete all questions on a page before you can move on to the next page. The attached PDF file allows you to preview the survey questions if you wish to do so. If you do not complete the entire survey at once, you may return to the last survey page where you stopped by clicking the survey link again (you must use the same computer). Your response on a page is saved only if you click the Next button to advance to the next page. However, you response will not be submitted until you complete the entire survey and click the Submit button.

Your feedback through this survey will help the Department identify best practices and needs, and lead to better allocation of future resources. We would appreciate very much if you could complete the survey by August 3, 2011.

If you experience any problems completing the survey or have a question, please do not hesitate to contact me at (305) 348-3116 or email gana@fiu.edu. We thank you for your kind assistance in this matter.

Sincerely,

Albert Gan, Ph.D.
Associate Professor
Department of Civil and Environmental Engineering
Florida International University
10555 West Flagler Street, EC 3603, Miami, FL 33174
Tel: (305) 348-3116   Fax: (305) 348-2802
Email: gana@fiu.edu

Figure 3-9: Invitation Email Sent to FDOT Districts

3.4 Local Transportation Agency Survey

3.4.1 Survey Design

Post the on-site meetings at the Miami-Dade and Broward Public Works Departments, and a comprehensive review of the crash analysis procedures per the HSM, a detailed list of survey questions were compiled to identify the current safety practices and needs of local transportation agencies. The designed questions were similar to those targeting FDOT districts, but with slight differences. Additionally, questions dealing with the cooperation with the FDOT districts were included in the survey. Earlier discussed procedures for designing and finalizing the questions were followed. The questions were re-reviewed, modified, and were approved by the project manager. The questions were posted online via the Qualtrics website and the associated unique survey link was generated.

The survey questions targeting local agencies are shown in Appendix B. The survey includes 39 questions covering the following eight areas of interest:

1. Use of crash data.
2. High crash locations.
3. Project selection, implementation, and evaluation.
4. Crash analysis software systems.
5. Crash analysis standardization.
6. Crash analysis documentation.
7. Training.
8. Working with FDOT.

3.4.2 Survey Distribution

All Florida counties including transportation engineering divisions and public works departments were identified to distribute the survey. However, the contact information (e.g., email or phone number) of transportation divisions of some of the counties was not provided on the website. In that case, the generic email system within these counties was used and an email describing the purpose of the project and the possibility of getting the contact information of traffic safety personnel was sent. After that, contact information of a few agencies was received and a final list of the county agencies was compiled. The survey link was then sent out via an invitation email to the earlier identified agencies. A PDF version of the survey questions was also included in the invitation email. The invitation email is shown in Figure 3-10. A reminder email was also sent to non-responding counties.

As the response rate was quite low, city agencies and other local agencies were also included to get an acceptable sample size. The same invitation email was sent out to several city agencies and private transportation corporations and the deadline for submitting completing the survey was extended. With a total of 37 responses, the response rate was high enough to reach reliable conclusions. A detailed interpretation of the survey results is given in Chapter 5.

Dear Sir/Madam:

On behalf of the Florida Department of Transportation (FDOT), we would like to invite you to participate in an important online survey of local transportation agencies on their traffic safety analysis practices and needs. This survey is best completed by a person who deals with traffic safety in your agency. If you feel that another person in your agency is better suited to complete this survey, we would appreciate if you could either provide us with his/her contact information or help forward this invitation.

To respond to the survey, simply click on the survey link below:

https://fiu.qualtrics.com/SE/?SID=SV_2s1kOOoErXYdPCI

The survey includes 39 questions covering eight different areas of interest. We estimate that the survey will take about 30 minutes to complete.

Please note that the survey will require that you complete all questions on a page before you can move on to the next page. The attached PDF file allows you to preview the survey questions. If you do not complete the entire survey at once, you may return to the last survey page where you stopped by clicking the survey link again (you must use the same computer). Your response on a page is saved only if you click the Next button to advance to the next page. However, you response will not be submitted until you complete the entire survey and click the Submit button.

Your feedback through this survey will help the Department identify best practices and needs, and lead to better allocation of future resources. We would appreciate very much if you could complete the survey by November 9, 2011.

If you experience any problems completing the survey or have a question, please do not hesitate to contact me at (321) 276-7889 or email khaleemm@fiu.edu. We thank you for your kind assistance in this matter.

Sincerely,

Kirolos M. Haleem, Ph.D.
Post-doctoral Research Fellow
Lehman Center for Transportation Research
Department of Civil and Environmental Engineering
Florida International University
10555 West Flagler Street, EC 3680, Miami, FL 33174
Tel: (321) 276-7889
Email: khaleemm@fiu.edu

Figure 3-10: Invitation Email Sent to Local Transportation Agencies

3.5 Law Enforcement Agency Survey

3.5.1 Survey Design

After reviewing relevant studies targeting law enforcement agencies with regard to the crash analysis procedures, a detailed list of survey questions were compiled to identify the law enforcement agencies' current safety practices. Earlier discussed procedures for designing and finalizing the questions were followed. The questions were posted online via the Qualtrics website and the associated survey link was generated.

The survey questions targeting law enforcement agencies are shown in Appendix C. The survey includes 25 questions covering the following four areas of interest:

1. Selection of enforcement locations.
2. Traffic violations and safety campaigns.
3. Crash reports.
4. Working with transportation agencies.

3.5.2 Survey Distribution

To distribute the online survey, the Community Traffic Safety Team (CTST) coordinator or liaison in each District in Florida was contacted to identify the law enforcement agencies that are part of each district's CTST and deal with traffic safety. The invitation email was forwarded to the law enforcement agencies, along with a PDF version of the survey questions. The invitation email is shown in Figure 3-11. A reminder email was sent to non-responding agencies. In total, 46 responses were received and a detailed interpretation of the survey results is given in Chapter 6.

Dear Sir/Madam:

On behalf of the Florida Department of Transportation (FDOT), we would like to invite you to participate in an online survey of your agency's practices and needs in dealing with traffic safety. To respond to the survey, simply click on the survey link below:

https://fiu.qualtrics.com/SE/?SID=SV_2nuo2tzSQPwf7ne

The survey includes 25 questions covering four different areas of interest. We estimate that the survey will take about 20 minutes to complete.

Please note that the survey will require that you complete all questions on a page before you can move on to the next page. The attached PDF file allows you to preview the survey questions. If you do not complete the entire survey at once, you may return to the last survey page where you stopped by clicking the survey link again (you must use the same computer). Your response on a page is saved only if you click the Next button to advance to the next page. However, you response will not be submitted until you complete the entire survey and click the Submit button.

Your feedback through this survey will help FDOT identify best practices and needs of law enforcement agencies in the state. We would appreciate very much if you could complete the survey by November 4, 2011.

If you experience any problems completing the survey or have a question, please do not hesitate to contact me at (321) 276-7889 or email khaleemm@fiu.edu. We thank you for your kind assistance in this matter.

Sincerely,

Kirolos M. Haleem, Ph.D.
Post-doctoral Research Fellow
Lehman Center for Transportation Research
Department of Civil and Environmental Engineering
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Tel: (321) 276-7889
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Figure 3-11: Invitation Email Sent to Law Enforcement Agencies

CHAPTER 4
FDOT DISTRICT SURVEY RESULTS

This chapter summarizes the results and key findings of the survey of FDOT district offices. As indicated in the previous chapter, the survey includes a total of 48 questions addressing each of the following areas of interest:

1. Use of crash data.
2. High crash locations.
3. Project selection, implementation, and evaluation.
4. Crash analysis software systems.
5. Crash analysis standardization.
6. Crash analysis documentation.
7. Meetings and training.

A survey request was emailed to all the eight FDOT districts and responses were received from six of them. This chapter also summarizes safety related documents provided by some districts.

4.1 Use of Crash Data

Q1: How many years of crash data do you typically use in your safety studies?

Four responding districts (66.7%) indicated that they use three years of crash data for crash analysis while two districts (33.3%) use five years. Both are within the range of three to five years of crash data suggested by HSM.

Q2: Have you had quality issues while extracting crash data from the CAR system?

Three of the six responding districts indicated they had encountered quality issues while extracting crash data from CAR.

Q3: If "Yes", what did you do to overcome these quality issues?

Table 4-1 lists the responses on ways to overcome data quality issues. They included calling the Central Office in Tallahassee to resolve the issue, reading some or all long-form crash reports to generate crash summaries, and reading the collision diagrams and recoding the spreadsheet for crash data analysis.

Table 4-1: Ways to Overcome Data Quality Issues in CAR

- *Some issues were resolved by Central Office after a phone call and explanation. Local roads crash data was inconsistent. Began working with ARCGIS.*
- *Read all or at least a sample of the long form crash reports to create my own summary.*
- *By "quality issues" I meant discrepancies between the crash data as reported in CAR and the actual collision diagram. We overcame those quality issues by reading the actual collision diagrams and recoding the spreadsheet used for crash data analysis. A second issue is that local law enforcement agencies often have more crash data than what is included in CAR (long forms only).*

Q4: How do you suggest that these quality issues can be resolved or alleviated?

Table 4-2 lists two original responses that suggested ways to resolve data quality issues. They suggested that crash data quality could be improved by using engineering judgment to correct crash types and contributing factors, and by paying more attention to coding.

Table 4-2: Suggestions for Resolving Data Quality Issues in CAR

- *Very time consuming but the narrative along with some engineering judgment would have to be used to "correct" the crash type and contributing factors.*
- *Paying more attention to coding.*

Q5: Other than the crash records from the CAR system, please list any other data sources you have used in your safety studies.

Table 4-3 shows that the majority of the districts obtained crash data from local enforcement agencies as supplements to the CAR data. In addition, District 3 also obtained data from Emergency Medical Services (EMS) District 7 from its Crash Data Management System (CDMS).

Table 4-3: Data Sources Other than CAR Used in Safety Studies

- *We request data from the local government and we utilize a crash data management system as a tool to extract information and reports from CAR data.*
- *Obtained short form crashes from local law enforcement.*
- *Conversations with Emergency Medical Services (EMS) and local law enforcement.*
- *GIS shapefiles provided by central office. Crash data provided by local law enforcement agencies.*
- *Local crash data.*
- *District 7 Crash Data Management System.*

4.2 High Crash Locations

Q6. Please describe the process you now use to identify high crash locations in your district.

As shown in Table 4-4, all of the six responding districts use the annual 5-percent list to identify high crash locations. Additionally, District 2's in-house staff reviews the accuracy of the crash data to identify possible patterns/trends, and then a consultant performs the crash analysis whenever a further study is required. District 4 uses GIS to identify high crash locations with correctible crash patterns through engineering countermeasures. District 5 uses CAR to query target crash types, such as lane departure and rear-end collisions on two-lane rural roads. District 7 uses the CAR and the CDMS system to identify locations with high frequency of specific crash types such as nighttime crashes and median opening angle crashes.

Table 4-4: Methods for Identifying High Crash Locations

- *We utilize the 5% list and the other high crash listings provided by Central office.*
- *The 5% transparency report is reviewed for the D2 locations. An initial review is performed by in-house staff to determine accuracy of the crash data and identify whether trends exist that are worth studying further. If further study is to be done, a consultant performs the review.*
- *5% transparency report generated by FDOT Central Office Safety.*
- *For high crash locations we use the high crash list. We, however, are interested in locations with crash patterns correctible through engineering countermeasures. In order to indentify these locations, we use GIS.*
- *We use the HC Segment/spot lists and the 5%. Use CAR to run special types of subset details (i.e. lane departure 2-lane rural, rear-end 2-lane rural....).*
- *High crash locations are identified using the CARS high crash spot and high crash segment routine and the 5% list. Also the District uses the CDMS to identify locations with high frequency/percentage of certain types of crashes such as: clusters of nighttime wet weather crashes (702 justification), median opening left turn and angle crashes (qwik kurb justification), pedestrian crashes (HEC, refuge island, and right turn island justification).*

Q7. How many high crash locations were on your list last year?

The numbers of high crash locations of the previous year (i.e., 2010) for five responding districts are summarized below:

- District 2 identified 31 high crash segments and 8 high crash intersections.
- District 3 identified 130 locations.
- District 4 identified the same number as in the high crash list from CAR.
- District 7 flagged 25 intersections and 33 segments as high crash locations.

In addition, District 5 indicated that it had a total of 859 high crash segments in the past 3 years.

Q8. Out of these locations, how many were investigated?

The number of high crash locations investigated in each district is summarized below:

- Districts 1 and 7 investigated all the identified high crash locations.
- District 2 investigated 11 locations from its high crash location list, or about 25%.
- District 3 investigated about 50 high crash locations, also about 25%.
- District 4 investigated most of the locations in its high crash list.
- District 5 investigated about 50 high crash locations, a relatively small faction of its high crash segments.

Q9. Who performed this investigation? (Check all apply)

Out of the six responding districts, three districts used only consultants and two districts used both consultants and in-house staff. One district indicated that it had used others in addition to consultants and in-house staff. No indication of who the other people were was provided.

Q10. Please list the top three types of safety concerns at the locations investigated.

Table 4-5 lists the top three types of safety concerns. Three districts identified intersection crashes as one of the top safety concerns. Following the SHSP, District 4 listed listed intersection crashes, lane departure crashes, and vulnerable road user crashes. District 5 focused on intersection crashes, access management crashes, and pedestrian crashes. Districts 1 and 2 considered left-turn crashes, angle crashes, rear-end crashes, and run-off road crashes as major safety concerns. District 3 listed the top three safety concerns as whether the roadway contributes, whether there is engineering solution, and whether there are opportunities for education or enforcement. District 7 listed high speed roadways with high right-turn turning volumes and no right turn lanes exist, left-turn crashes at median openings, and angle crashes as a result of red-light running.

Table 4-5: Top Three Types of Safety Concerns

- *Mostly intersection crashes such as rear ends, left turn, and angle.*
- *Left-turn and angle crashes; rear-end crashes; run-off-the-road crashes.*
- *Did the roadway contribute? Is there an "asphalt and concrete" or engineering solution? Are there opportunities for education or enforcement?*
- *We follow the strategic highway safety plan, thus, we focus our studies on: 1) intersection crashes 2) lane departure crashes 3) vulnerable user crashes*
- *Intersection type crashes, access management type crashes, and pedestrian crashes.*
- *Higher speed roads with high right-turn volumes and no right turn lanes, median openings left turn, and angle crashes red-light-running crashes.*

Q11. Please list all funding sources and the funding amounts for conducting safety studies for the previous year.

Table 4-6 gives the list of funding sources and amounts within each district. Highway Safety Program (HSP) funds were the main source for the majority of the districts. District 1 received funds from the High Risk Rural Roads (HRRR) and Safe Routes To School (SRTS) programs.

Table 4-6: Funding Sources and Amounts for Conducting Safety Studies Last Year

- *We use HSP funds, HRRR and SRTS. I do not recall the total amounts.*
- *HSP funds - $291,000; The Jacksonville Transportation Authority studies were performed under Better Jacksonville Plan monies funded through taxes (I have no estimated cost amounts).*
- *HSP $250,000 Seem to average $5,000 to $6,000 per study.*
- *Last year we used state dollars for our studies. Approximately, 800K were invested in safety studies.*
- *HSP, $318K for studies and concepts for 2010.*
- *99% HSP and 1% District fund - annually program $1m for studies contracts.*

Q12. Safety study information (e.g., study cost) should be shared among the FDOT District Offices.

All the responding districts either agreed or strongly agreed that safety study cost information should be shared among the districts.

4.3 Project Selection, Implementation, and Evaluation

Q13. Please describe the analysis method your office uses to select safety improvement projects (e.g., benefit-cost analysis).

Table 4-7 discusses the methods used for selecting safety improvement projects. All the responding districts use the B/C ratio to select and prioritize safety improvement projects. District 3 identifies a few projects based on potential safety improvement such as sidewalk and pedestrian projects, while additional projects are requested by CTST, and few other projects address the high crash locations identified in 5 percent transparency report or HRRR listings. District 4 uses the NPV method in addition to the B/C ratio.

Table 4-7: Method for Selecting Safety Improvement Projects

- *We usually prioritize projects by the Benefit to cost ratio.*
- *We utilize benefit-cost analysis as our primary. Sometimes we utilize Plans Prep criteria for median guardrail. We also use physical evidence such as queuing, delay, signs of crashes such as broken glass or marks on barrier walls, or worn paths for sidewalk.*
- *For most projects we use B/C analysis. Some projects are based off of need / potential safety improvement such as sidewalks and pedestrian improvements. Some projects are requested by CTST's based on potential safety improvement or to address specific safety concerns. Some projects are to address the 5% transparency report high hazard listings or High Risk Rural Roads listing.*
- *We use two methods: 1) Net Present Value 2) Benefit to Cost ratio*
- *Benefit to cost analysis.*
- *Safety projects are identified/selected as follows: 1) RSA findings which cannot be implemented through 3R 2) High crash/5% reviews 3) Districtwide projects through DBPB contract. All projects must have positive B/C ratio.*

Q14. Please rank the following four emphasis areas of the Florida Strategic Highway Safety Plan (SHSP) when selecting projects for implementation (from 1 for the highest priority to 4 for the lowest priority).

Table 4-8 gives the ranking from each responding district of the four emphasis areas of the Florida SHSP when selecting projects for implementation. The last column of the table gives the summation of the districts' ranking numbers with respect to each emphasis area. The lower the summation, the more emphasized an area, and vice versa. It is thus clear that the responding districts emphasized Intersection Crashes the most and Aggressive Driving the least. Lane Departure is ranked second and Vulnerable Road Users the third. It is interesting to note that aggressive driving is ranked consistently by all responding district as the least emphasized. Also, Districts 1 and 2 ranked the four emphasis areas consistently, so are Districts 3 and 5.

Table 4-8: Ranking of the Four Emphasis Areas of the Florida SHSP

	D1	D2	D3	D4	D5	D7	Summation
Intersection Crashes	1	1	2	1	2	2	9
Lane Departure Crashes	2	2	1	3	1	3	12
Vulnerable Road Users	3	3	3	2	3	1	15
Aggressive Driving	4	4	4	4	4	4	24

Q15. The SHSP emphasis areas have served the traffic safety needs of our district well.

For districts agreed (66.7%) and one district (16.7%) strongly agreed that the SHSP emphasis areas have well-served the traffic safety needs. One district (16.7%) is neutral.

Q16. Please describe any important issues specific to your district that are not directly addressed by the SHSP.

Table 4-9 identifies the important issues that are not directly addressed by the SHSP. Three districts have no issues specific to them that are not directly addressed by the SHSP. District 4 indicated nighttime crashes. District 3 said that they have many miles of rural county roads with narrow lanes of 10 ft or less with no paved shoulders and minimal improved shoulders, and there were no sufficient lane departure crashes to make it to the HRRR listing and they suggested helping the locals widen the lanes and improve the shoulders with HSP or HRRR funding. Moreover, they were unable to generate a B/C ratio greater than 2. District 7 suggested that the SHSP could be broken down further relating them to countermeasure strategies so that the districts could develop specific strategies and then learn from each other.

Table 4-9: Important Issues Not Directly Addressed by the SHSP

- *We have many miles of rural county roads with narrow lanes of 10' or less with no paved shoulder and minimal improved shoulders. The roads are relatively low volume of less than 2500 ADT. May only average a fatal crash or severe injury crash per year. Not enough crashes to make the HRRR listing but certainly enough fatalities or potential for severe/fatal crashes to generate concern for safety by the locals. It would be nice to be able to help the locals widen the lanes and improve the shoulders with HSP or HRRR. While these are lane departure crashes that fit the SHSP we may not be able to generate a B/C greater than 2.*
- *Night time crashes.*
- *Almost every crash falls under one of the SHSP emphasis areas. These can be operationalized by breaking them down and relating to countermeasure strategies. Intersection = urban signalized (progression/conspicuity), urban unsignalized (access mngt), rural 2-way stop controlled (advance warning/conspicuity), rural isolated signal (advance warning/dilemma zone). Lane Departure = urban multilane (wayfinding), divided highway median cross-over (guardrail/enforcement); rural single vehicle (edgeline, paved shoulder, safety edge, guardrail/chevrons) Etc... By breaking the SHSP down districts can develop specific strategies and then learn from each other based on results.*

Q17. Do you evaluate implemented safety improvement projects to determine their effectiveness?

Five districts (83.3%) evaluate a sample of the implemented projects to determine their effectiveness, while one district (16.7%) assumes that the locations were improved. None of the responding districts evaluate all of the implemented projects.

Q18. If "Yes", please describe how the evaluation was performed.

Table 4-10 presents the methods used for evaluating safety improvement projects. All the responding districts use before-and-after crash analysis to determine the effectiveness of the implemented countermeasures. Districts 3 and 7 use the Crash Reduction Analysis System Hub (CRASH) system to perform the before-after analysis.

Table 4-10: Methods for Evaluating Safety Improvement Projects

- *We compared before and after crash data to determine effectiveness of the countermeasures taken.*
- *We perform a review of before vs. after data.*
- *All projects are in the CRASH system and before and after data can be gathered. However, off system projects may not report accurately. I have only been in this position for 3 years. We will begin to look at before and after data as some of the completed projects have been in place 3 yrs.*
- *Through a before and after study. While we try to do this every year, we did not do them last year.*
- *Before/After crash analysis use of CRASH system.*

4.4 Crash Analysis Software Systems

Q19. Other than for retrieving crash records, what other functions have you used the CAR system for?

As shown in Table 4-11, the districts use CAR for functions beyond crash data retrieval. District 2 uses CAR to retrieve crash costs. District 3 gets estimates for the average crash rates for segments. District 4 uses CAR to query crash data. District 5 retrieves statistics, both statewide and districtwide. District 7 retrieves high crash segment reports.

Table 4-11: Functions for Using CAR

- *Cost per crash numbers.*
- *Average crash rates for a segment(s).*
- *Perform queries.*
- *Statistics – statewide and districtwide.*
- *High crash spot/segment reports Skid hazard.*

Q20. The Department should replace the CAR system with a web-based system.

All the responding districts either agreed (16.7%) or strongly agreed (83.3%) to replace the CAR system with a web-based system.

Q21. If a web-based system is to be developed in place of the CAR system, how important are the following functions, besides for crash data download, be included?

As shown in Figure 4-1, all the districts agreed that it is extremely important to apply filters to select specific crash types and to allow spatial interpretation of crash data. In addition, five districts agreed that it is extremely important to generate high crash locations and to display detailed police reports. Moreover, generating reports within a new web-based system is considered to be more important than generating collision diagrams.

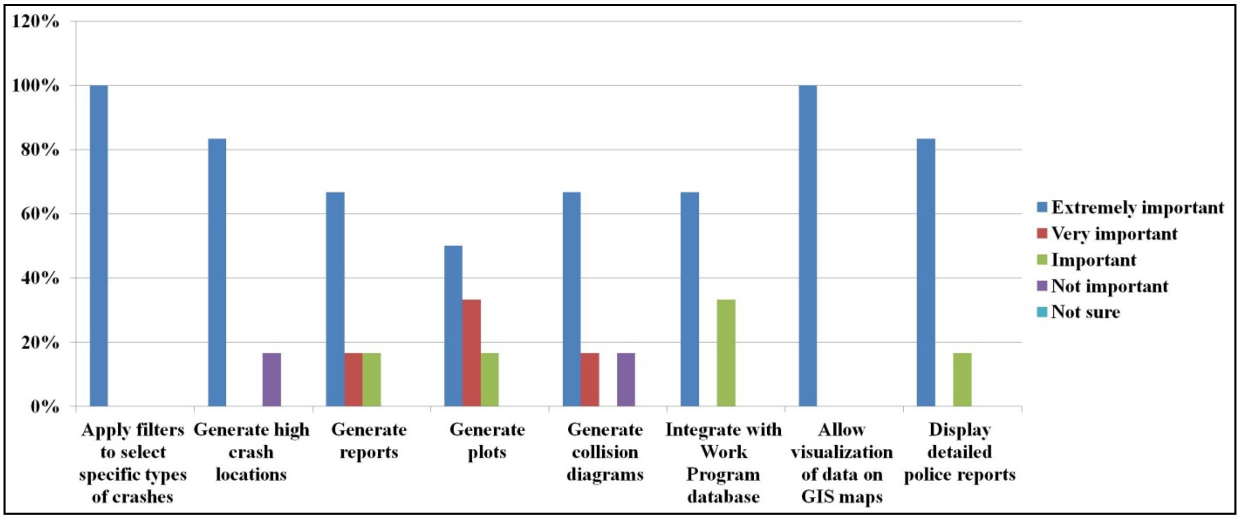


Figure 4-1: Preference on Features in a Web-Based System in Place of CAR

Q22. Please list any commercial software tools you now use for crash analysis.

Table 4-12 lists the commercial software tools for crash analysis being used by districts. District 7 uses a desktop version of the WebCDMS application, while District 1 uses the web version. District 4 works internally to create most of the web-based system's functionalities except for generating collision diagrams and displaying police reports.

Table 4-12: Commercial Software Tools for Crash Analysis

- *We utilize a Crash Data Management System developed by Tindale and Oliver.*
- *None. We have worked internally to create most of the functions mentioned in Q21 (except for the generation of collision diagrams and the display of detailed police reports).*
- *District 7 desktop CDMS developed by Tindale-Oliver*.

Q23. Please list any crash analysis software tools your office has developed in-house.

As shown in Table 4-13, several crash analysis software tools were developed in-house. District 3 developed the web-based version of TSAT (Traffic Safety Analysis Tool). District 4 developed GIS system to create macros to identify locations with crash patterns. District 7 worked with TOA to define the reports and methodologies for the WebCDMS system.

Table 4-13: Crash Analysis Software Tools Developed In-House

- *TSAT (Traffic Safety Analysis Tool). D6's consultant developed it for their own use. We further developed it to make it web based.*
- *They are unnamed but we have used GIS extensively to create macros that help us identify locations with crash patterns.*
- *D7 worked with TOA to define reports and methodologies for the CDMS.*

Q24. Please describe any crash analysis software tools currently being developed or being considered for development.

Table 4-14 lists the crash analysis software tools currently being developed. District 1 is currently examining the web-based version of CDMS. District 2 is currently considering using the WebCDMS system. District 3 would like to fund a continued development of TSAT. District 7 developed a specification to implement WebCDMS as an intranet web-based application to be consistent with the District's Enterprise Geodatabase model. However, the process was suspended pending the release of the Department's Enterprise Geodatabase model.

Table 4-14: Crash Analysis Software Tools Currently Being Developed

- *The CDMS developed by Tindale and Oliver has recently been changed to be web based and we are testing it.*
- *Considering utilizing the tool that Tindale-Oliver provides.*
- *Would love to be able to fund continued development of TSAT.*
- *Waiting on Tallahassee to develop.*
- *D7 developed a specification to implement the CDMS as an intranet web-based application consistent with the District Enterprise Geodatabase model, but this was suspended pending release of the Department Enterprise Geodatabase model.*

Q25. Can we contact you to find out more about the software tools?

As shown in Figure 4-2, five districts indicated that they could be contacted to find more about the software tools. Two analysis tools, WebCDMS and TSAT, are evaluated and are discussed in Chapter 7.

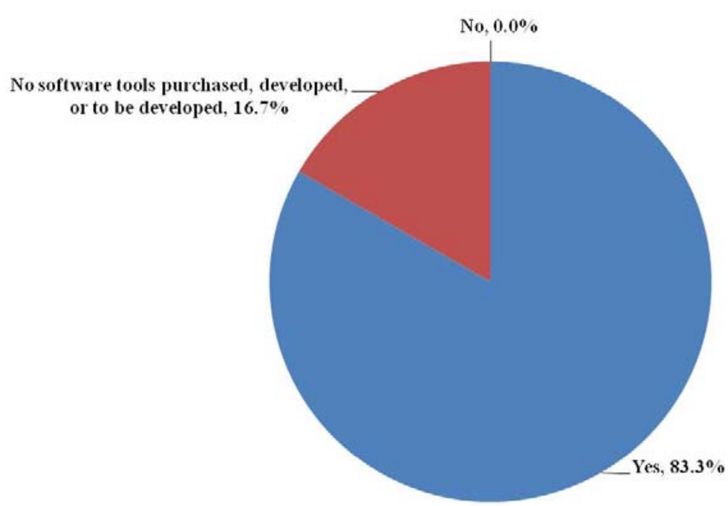


Figure 4-2: Preference of Districts on being Contacted

4.5 Crash Analysis Standardization

Q26. Crash analysis method and procedure should be uniform across the state.

As shown in Figure 4-3, all the responding districts either agreed or strongly agreed that the crash analysis method and procedure should be uniform across the state, emphasizing the need to standardize crash analysis across the State of Florida.

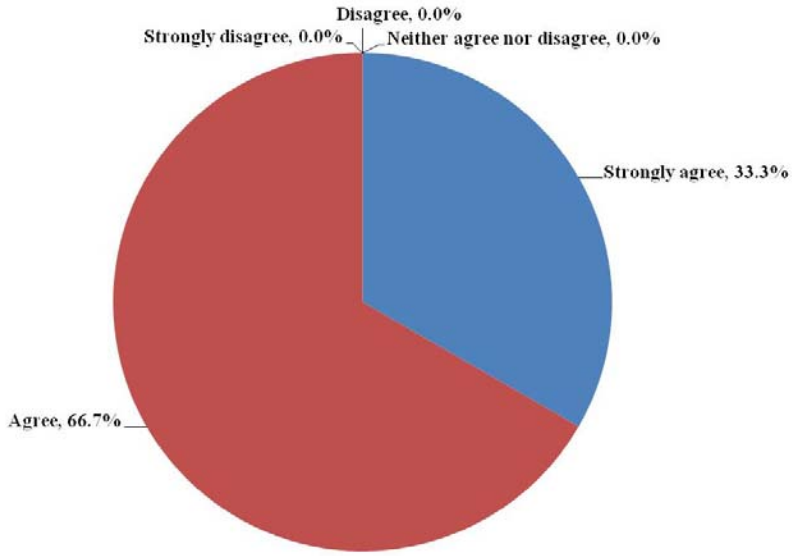


Figure 4-3: Preference of Districts on Standardizing Crash Analysis Methods

Q27. Please qualify your response to the above question.

Table 4-15 provides the districts' several notions for the idea of standardizing crash analysis. Specifically, District 1 said it would be beneficial if everyone uses similar crash analysis methods. District 2 said in spite of the fact that each location within Florida is different and requires engineering judgment; the primary crash analysis steps should be uniform. District 3 said it would be more defendable if all FDOT districts could perform the analysis in the same manner using same tools. District 4 indicated that since the funding is centralized, the Central Office needs to review safety studies that follow a common methodology, and quantify potential benefits and costs associated with the projects. District 5 emphasized that a standard procedure for crash analysis should be followed. District 7 highlighted the importance of sharing the best practices in identifying safety opportunities in addition to sharing the 5 percent transparency report of high crash locations.

Table 4-15: Notions for the Idea of Standardizing Crash Analysis

- *I think it would be beneficial if everyone were using the same crash analysis methods to improve consistency around the state. The Secretary has placed a high priority on consistency around the state in everything we do.*
- *Although each location is different requiring engineering judgment, the primary steps should be uniform across the state.*

Table 4-15 (Continued): Notions for the Idea of Standardizing Crash Analysis

- *It would make it much more defendable if FDOT were in litigation if all districts performed studies, analysis, and developed projects in much the same way. Certainly should use the same tools and templates.*
- *Since funding is centralized, in my opinion, Central Office needs to review safety studies that follow some general common methodology and quantify the benefits & costs of the project in the same way.*
- *Should be a standard procedure for crash analysis.*
- *Consistent with response to the SHSP questions, best practices to identify safety opportunities should be developed/shared beyond the 5% report/high crash locations. Analytical methods to identify safety improvement opportunities will help develop a back-log of projects with high B/C ratios.*

Q28. The newly released Highway Safety Manual or HSM should be adopted as standard for crash analysis in the state.

As shown in Figure 4-4, four districts were neutral on the proposal to adopt the HSM as a standard for crash analysis. Two districts either agreed or strongly agreed to adopt the HSM. Thus, based on the responses from the districts, it can be concluded that there are a few reservations in adopting the HSM as a standard for crash analysis.

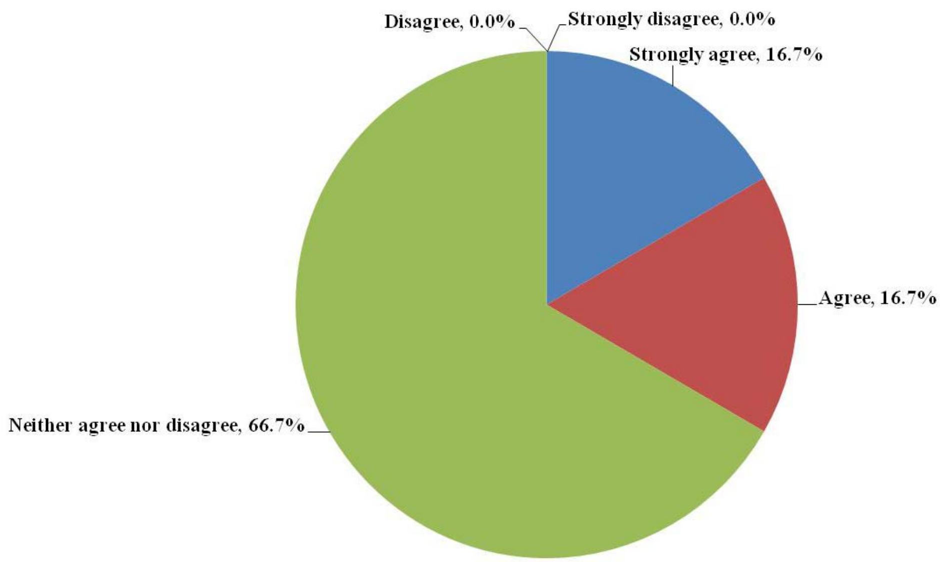


Figure 4-4: Preference of Districts on Adopting the HSM as a Standard

Q29. Please qualify your response to the above question.

Table 4-16 lists the districts' views on adopting the HSM. District 1 said that the HSM is a data driven manual and think that the necessary data is unavailable at this point. District 2 mentioned that it is early to make a decision about how helpful the HSM could be. District 3 suggested that the crash analysis per the HSM should be incorporated into the CRASH system. Moreover, District 3 recommended a web-based tool to be developed for the HSM predictive method to be used on projects such as sidewalks and local road projects. District 4 indicated that the HSM should be used whenever appropriate, but its limitations should also be recognized as the current HSM is the first edition. District 5 said that the HSM is a precise method of crash analysis. According to District 7, the HSM is appropriate; however, Florida's expected crash rates are more specific than what is included in the manual.

Table 4-16: Views about Adopting the HSM

- *The HSM is extremely data driven. I am not confident all of the necessary data is currently available or is currently being collected. I will need to know more about the implementation of the HSM to have confidence in it.*
- *It is still early in the process the make an informed decision as to how helpful this tool will be.*
- *The HSM crash data analysis method should be incorporated into our CRASH application with the ability to edit the crash data for use on local roads. A web based tool should also be developed for the HSM predictive method for use on projects such as sidewalk or local road projects where crash data isn't available.*
- *The HSM should be used when appropriate but we should also recognize its limitations - specially given that it is a first edition.*
- *HSM is a more precise method of analyzing crashes.*
- *HSM is OK, but Florida Crash Rate Categories /expected crash rates are already more specific than what is in HSM.*

Q30. FHWA has recently released a new safety analysis software system named SafetyAnalyst and FDOT is one of the sponsors of the development of this system. Do you agree that your office should take advantage of this system?

As shown in Figure 4-5, four districts were neutral on adopting SafetyAnalyst as a standard for crash analysis, while one district agreed, and another district disagreed. So, it can be concluded that there are some reservations in adopting SafetyAnalyst.

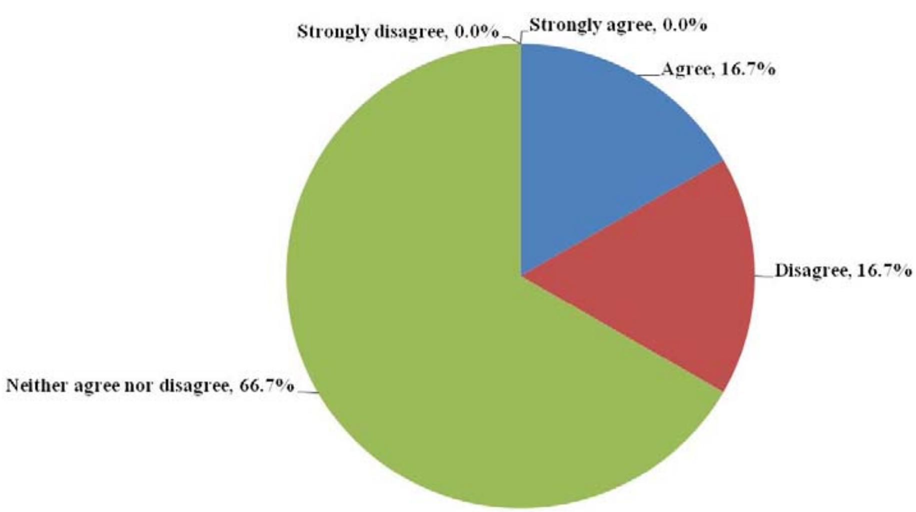


Figure 4-5: Preference of Districts on Adopting SafetyAnalyst

Q31. Please qualify your response to the above question.

As shown in Table 4-17, views about the adoption of SafetyAnalyst are very similar among the responding districts. For example, Districts 1 and 3 indicated that they are not familiar with SafetyAnalyst. Districts 4 and 7 agreed that SafetyAnalyst is quite cumbersome. District 7 further mentioned that SafetyAnalyst can be used at the county level to develop SHSP emphasis area-specific high crash lists. District 2 indicated that SafetyAnalyst still requires some development to be implemented and District 5 recommended integrating SafetyAnalyst with CAR.

Table 4-17: Views about Adopting SafetyAnalyst

- *I am not familiar with Safety Analyst.*
- *This is a tool that still has a lot of development to be done for the software to work as intended. Further, from the examples that I have seen, there are other tools already available that perform well and provide even more information than Safety Analyst.*
- *I'm not familiar enough with the capabilities of the SafetyAnalyst to suggest it adoption.*
- *We tried using it in D4, the software appeared to cumbersome to use; i believe our current analysis methods yield comparable results in less time.*
- *Central office needs to first integrate CAR into it.*
- *Safety Analyst is quite complicated and may be difficult to master at an operational level. The ability to look at overrepresentation of crash types (rather than just overall crash rate) is quite powerful. At the CO level, Safety Analyst could be used to develop SHSP emphasis area-specific high crash lists (although this could be done using simple data queries as well).*

Q32. A standard web-based GIS application should be adopted for crash analysis across the state.

As shown in Figure 4-6, all the responding districts either agreed or strongly agreed on adopting a standard web-based GIS system for crash analysis across the state.

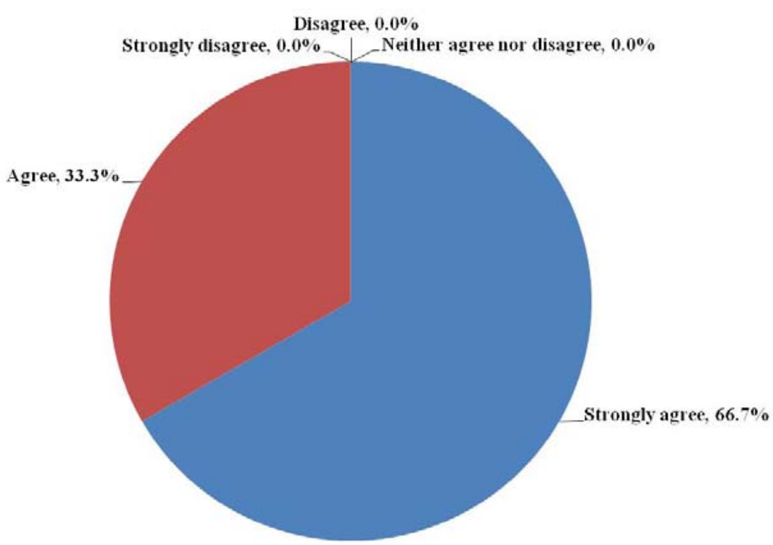


Figure 4-6: Preference of Districts on Adopting a Standard Web-Based GIS System

Q33. Please qualify your response to the above question.

Table 4-18 provides the districts' views on adopting a standard web-based GIS system. District 1 is currently using the WebCDMS system because of its capabilities such as running reports and locating crashes on GIS maps; however, a statewide standard web-based GIS system is preferred due to accuracy related issues. District 2 mentioned that a standard application would provide consistency in the reviews. District 3 emphasized that a web-based application would provide easy access and user-friendliness, while the GIS functionality will provide spatial representation of locations. District 4 suggested integrating this application with Work Program, pavement rating, and RCI databases. District 5 indicated that the GIS application would facilitate identification of high crash locations. District 7 suggested that the application should be well maintained, simple enough to perform basic analysis, and responsive to the users' needs.

Table 4-18: Views about Adopting Standard Web-Based GIS System

- *We currently utilize the CDMS developed by Tindale and Oliver because of its capabilities to run reports, look at crashes on a GIS map, and perform various filters of the car data which has been extremely useful. However, we have had some issues with its accuracy on occasion and would prefer a GIS based state system.*
- *I agree that a standard web-based GIS application would help provide consistency in the reviews.*
- *Web based makes it easy to access and user friendly while GIS will offer a "picture" of the situation. Many of our public requests through media or political entities would better understand a picture with the crashes shown and a summary table. Our current CAR system output is VERY cryptic.*
- *As long as the web-based application is both easy to use and offers a high degree of customization (for those who desire it), it should be used, we should also seek to integrate this tool with the department's other databases (work program, pavement rating, RCI, etc).*
- *This will make identifying high crash locations much easier.*
- *Must be well maintained, simple to do basic analysis, and responsive to end user needs.*

Q34. A shared, standard software system for crash analysis across the state can help:

As shown in Figure 4-7, there was an agreement that a shared, standard software system for crash analysis could allow statewide training. However, there was less agreement on the following: potential to save on software development, licensing, and maintenance costs; ability to provide better control of crash data; and ability to protect agency from legal liability. Moreover, minimizing software development cost received greater agreement than minimizing licensing cost. Additionally, reducing software and hardware maintenance costs received the same level of agreement as providing better control of crash data.

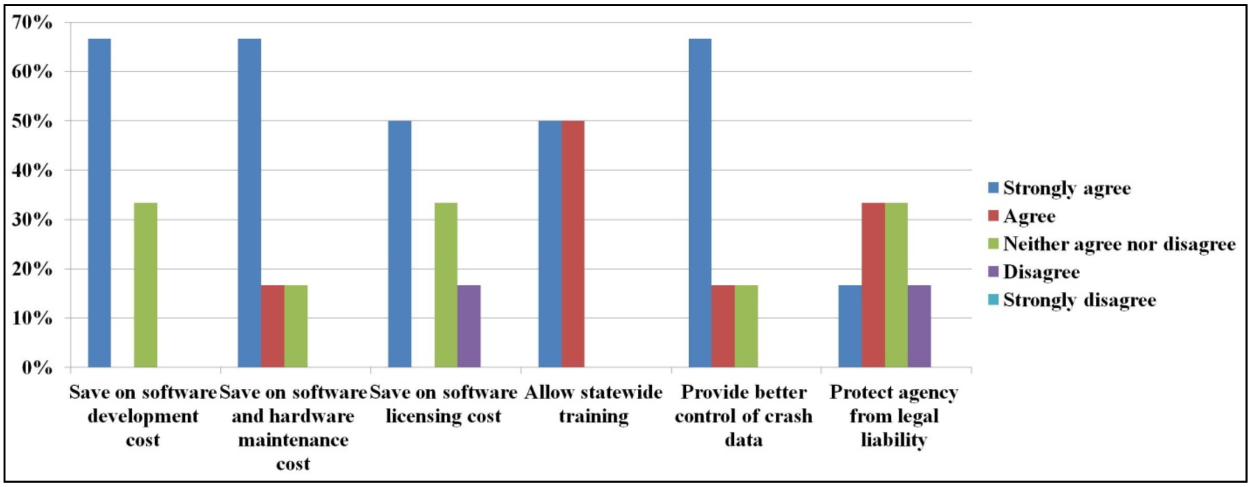


Figure 4-7: Preference on Having a Shared, Standard Crash Analysis System

Q35. Please list any conditions unique to your district that may require special consideration in a standard crash analysis procedure.

Table 4-19 lists the conditions unique to each district that require special consideration in a standard crash analysis procedure. Only two districts indicated that there are unique conditions. District 3 is located in a rural area and might need the ability to look at locations with lower crash threshold than that for urban areas. District 7 stressed on the importance of working hard to develop off-system projects.

Table 4-19: Conditions Requiring Special Consideration in Standard Crash Analysis Procedure

- *While more rural in nature we may need the ability to look at locations with lower crash thresholds than what might be used in an urban environment. However, central Florida north shares those same needs.*
- *Working very hard to develop off-system projects so on-system and off-system analysis is important.*

4.6 Crash Analysis Documentation

Q36. What is the primary documentation(s) you use for crash analysis?

As shown in Table 4-20, most of the responding districts use B/C reports and worksheets as their primary documentation.

Table 4-20: Documentation Used for Crash Analysis

- *CRASH for the development of the B/C.*
- *Summary and detail reports are primary.*
- *Crash report coupled with B/C. Most projects have a concept developed and certainly an engineer's estimate of cost prior to programming.*
- *Hard copy crash plot, B/C.*
- *S&S technical studies B/C worksheet.*

Q37. Which part of the Highway Safety Improvement Program Guideline (HSIPG) manual you use the most?

As shown in Figure 4-8, four districts indicated that "Countermeasure Identification" is the most important part of the HSIPG, one district indicated "Project Prioritization", and one district identified "Project Evaluation".

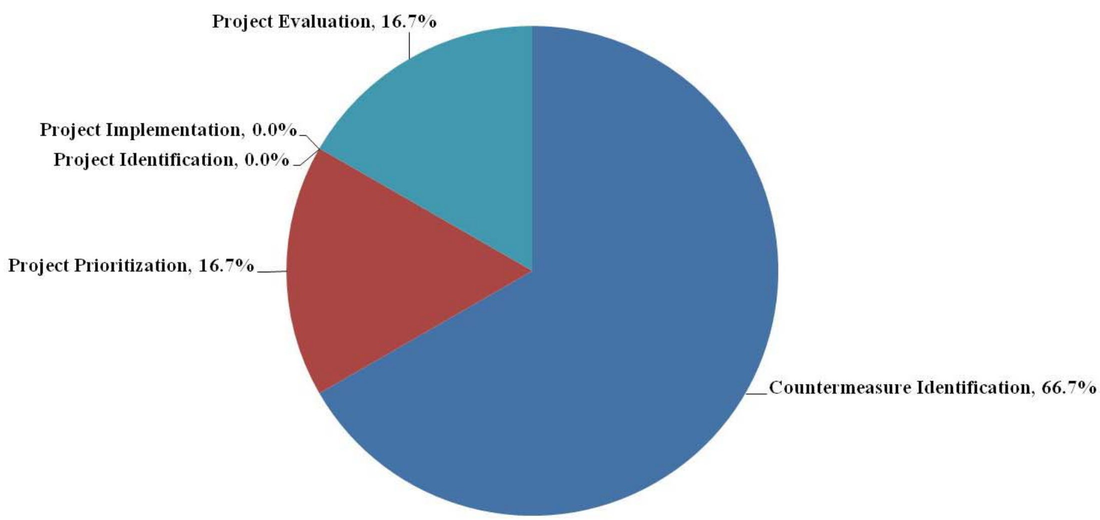


Figure 4-8: Most Used Parts of the HSIPG Manual

Q38. The HSIPG manual should be updated.

As shown in Figure 4-9, two districts strongly agreed, two districts agreed, and two were neutral about the need to update the HSIPG manual. No districts were negative about the update.

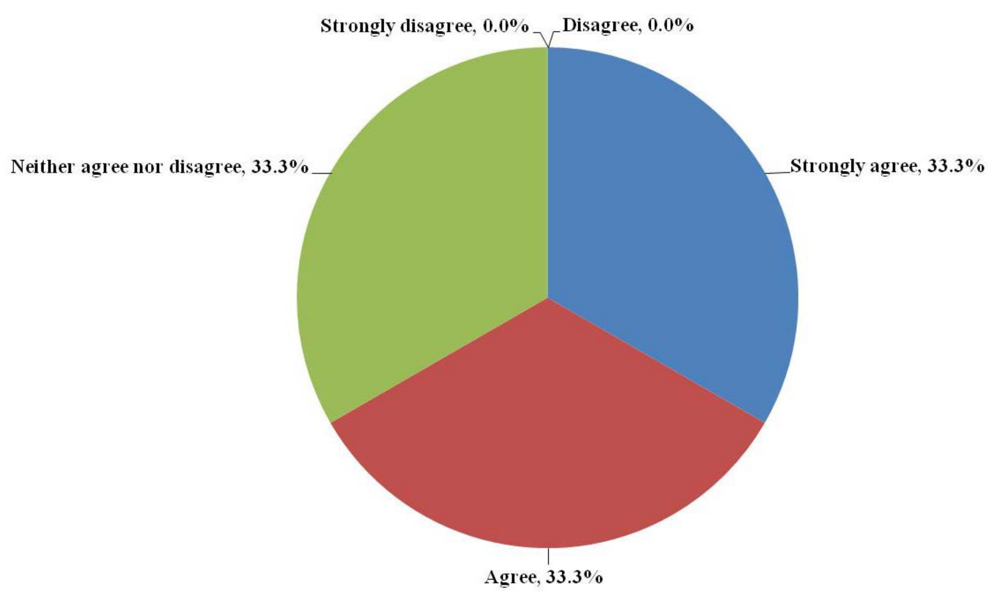


Figure 4-9: Districts' Opinion on Updating the HSIPG Manual

Q39. If this manual is to be updated, what new materials do you like to see included?

Table 4-21 lists the suggested new materials to be included in the HSIPG manual. District 3 indicated that the HSM and the Traffic Engineering manuals should be sufficient and would cover the needs of the district. District 5 recommended the HSM to be incorporated in the HSIPG. District 7 recommended that the new materials could be in line with the current FHWA guidance manual, and the 23 Code of Federal Regulations (CFR) 924.

Table 4-21: New Suggested Materials To Be Included in the HSIPG Manual

- *D1: We have provided comments to Central office in this area.*
- *D3: Won't this manual be superseded by the HSM since we are adopting it? Do we really need a duplicate manual? We already have the Traffic Engineering Manual. Between it and the HSM we could be covered.*
- *D4: We have not used HSIPG manual often as a reference guide. instead we use federal or international materials (ex., NCHRP report 500 series).*
- *D5: HSM.*
- *D7: To be in line with the current FHWA HSIPG guidance manual and 23 CFR 924.*

Q40. Please list any safety related documents your office has developed.

As shown in Table 4-22, four districts indicated that they have developed safety related documents. District 1 has developed numerous safety reports. District 2 has developed a document highlighting the guidelines for Florida's Safe Routes to School program and a document for the district's Safety Work Program (e.g., HSIPG and High Risk Rural Roads). District 4 has developed a paper presenting the use of the Net Present Value (NPV) and a document showing how the NPV for estimating the benefits of various improvement projects is calculated. District 7 has developed few reports, including the Road Safety Audit (RSA) Policy Highway Safety Action Plan, the Pedestrian Safety Action Plans Presentation, Off-System Funding Request Design Safety Prompt Lists, and School RSA Process.

Table 4-22: Developed Safety Related Documents

- *D1: Numerous safety reports.*
- *D2: We have created documents for applicants explaining the various programs (HSP, SRTS, and HRRR), the types of work allowable, and the information required.*
- *D4: We have developed a few papers recommending the use of NPV to evaluate safety projects. we have also developed flowcharts that outline the safety study process we follow in the district.*
- *D7: District RSA Policy District 7 Highway Safety Action Plan (draft), Pedestrian Safety Action Plans Safety Summit Presentation (draft), Off-System Funding Request Design Safety promptly lists (draft), and School RSA process and promptly list (draft).*

Q41. Can we contact you to obtain these documents?

All districts agreed to share their safety related documents. The documents received are summarized in the next section.

4.7 Meetings and Training

Q42. How often do you think the Safety Office should hold face-to-face meetings?

As shown in Figure 4-10, three districts (50%) suggested semi-annual face-to-face meetings with the Central Safety Office, while the other three (50%) suggested these meetings to be annual. None of the responding districts thought face-to-face meetings were unneeded and could be replaced with web meetings.

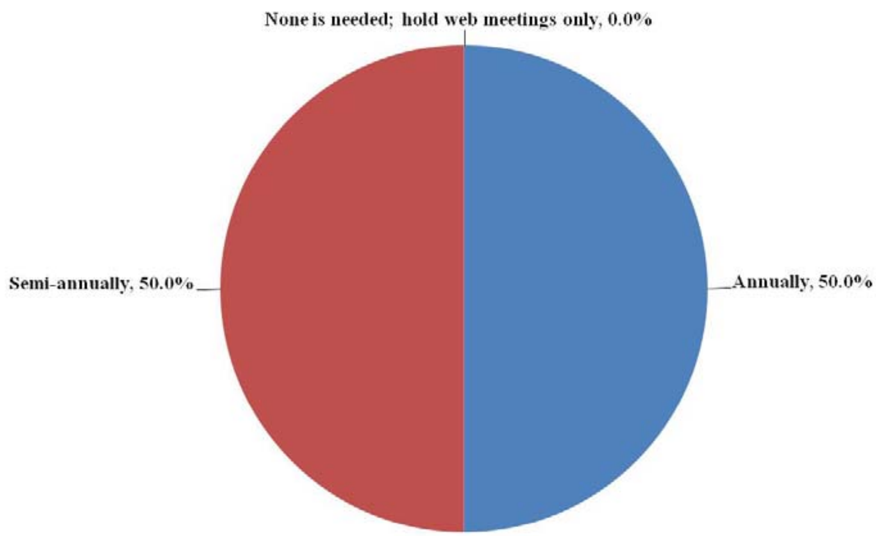


Figure 4-10: Preference on the Frequency of Face-to-Face Meetings

Q43. How often should the Safety Office hold web meetings?

As shown in Figure 4-11, half of the responding districts would like to have quarterly web meetings with the Central Safety Office. One district suggested semi-annually, one suggested bi-monthly, and one district suggested that the meetings be conducted as often as needed.

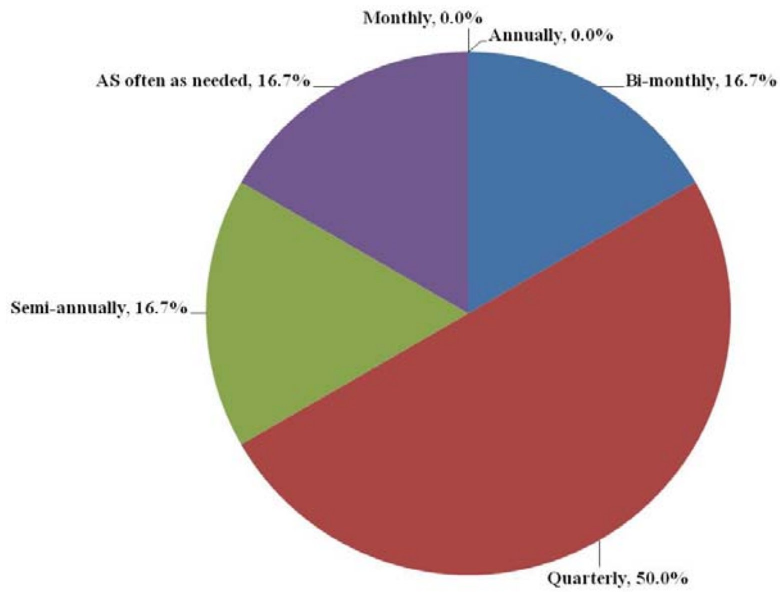


Figure 4-11: Preference on the Frequency of Web Meetings

Q44. FDOT should provide statewide training on crash analysis.

As shown in Figure 4-12, five districts either agreed (16.7%) or strongly agreed (66.7%) to provide statewide training on crash analysis, while one district was neutral. One district (16.7%) was neutral and none were negative about providing such training.

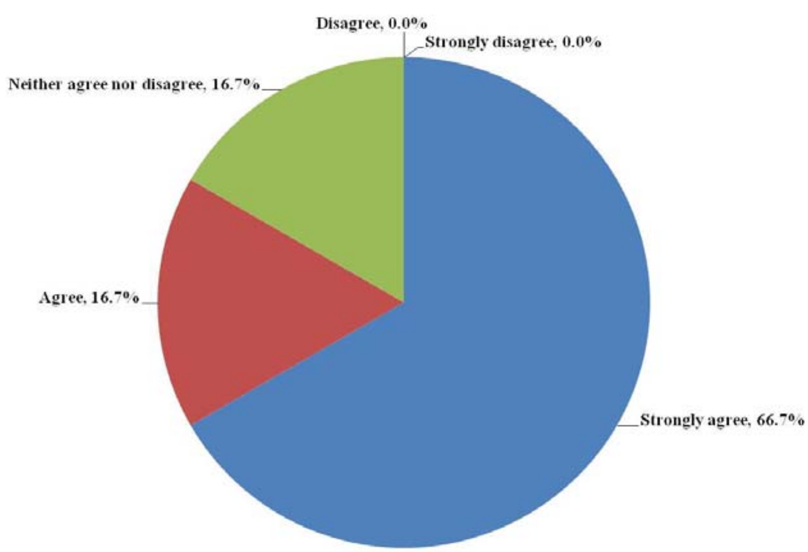


Figure 4-12: Preference on Having a Statewide Training on Crash Analysis

Q45. If FDOT is to provide statewide training, in which specific areas of training would you like to see included?

Table 4-23 lists the specific areas of statewide training that are of interest to the responding districts. District 1 preferred the training to be in crash data management, Work Program, and safety analysis techniques. Districts 3 and 5 were interested in the HSM training. District 4 would like to be provided with a comprehensive training of the entire crash analysis process, with special emphasis on statistics. District 7 requested training on the HSIPG manual, low cost safety improvements, and RSA.

Table 4-23: Suggested Areas of Statewide Training

- *D1: Crash data management, Work Program, and safety analysis techniques.*
- *D3: Study procedures and application of HSM.*
- *D4: Comprehensive training of the entire crash analysis process. Special emphasis should be given to statistics and how we can be fooled by numbers (ex., seeing crash patterns when there are none).*
- *D5: HSM.*
- *D7: Highway Safety Improvement Program, Low Cost Safety Improvements, and Road Safety Audits.*

Q46. Please rank your preferred mode of delivery for such training from 1 for the most preferable to 4 for the least preferable.

Table 4-24 gives the ranking from each responding district of three modes of delivery for statewide training, plus an Other option for the respondents to specify other modes. The last column of the table gives the summation of the districts' ranking numbers with respect to each delivery mode. The lower the summation, the more emphasized an area, and vice versa. It can be seen that the responding districts clearly prefer face-to-face meeting over other modes of delivery. This is followed by webinars and online web-based training. One agency cited (instructional) manual as the second most preferred mode of training after face-to-face meetings.

Table 4-24: Ranking of Preferred Mode of Delivery for Statewide Training

Training Delivery Mode	D1	D2	D3	D4	D5	D7	Summation
Face-to-face meetings	1	1	1	1	1	2	7
Webinars	3	2	2	3	2	1	13
Online web-based training	2	3	3	4	3	3	18
Other (specify)	-	-	-	2	-	-	-

Q47. Please select up to five of the following FHWA-NHI courses that you wish to see offered by FDOT.

Table 4-25 shows the list of available FHWA-NHI courses and the number of times each course was selected by the respondents. Those courses selected by at least three districts are highlighted. It can be concluded from the selection results that the districts are interested in courses that focus on intersection safety, pedestrian safety, roadway safety audits/assessment, and safety effects of roadway design features. It should be noted that two pedestrian safety courses other than the one highlighted also received votes from the districts, reflecting the importance of pedestrian safety and the desire of the districts to learn more about the subject.

Table 4-25: Selected FHWA-NHI Courses

Course No.	Course Title	Number of Times Selected
380003	Design and Operation of Work Zone Traffic Control	0
380032A	Roadside Safety Design	1
380034	Design, Construction, and Maintenance of Highway Safety Appurtenances and Features	1
380060	Work Zone Traffic Control for Maintenance Operations	0
380063	Construction Zone Safety Inspection	0
380069	Road Safety Audits/Assessments	3
380070	Safety and Operational Effects of Geometric Design Features	3
380071	Interactive Highway Safety Design Model	1
380072	Advanced Work Zone Management and Design	0
380073	Fundamentals of Planning, Design, and Approval of Interchange Improvements to the Interstate System	1
380074	Designing and Operating Intersections for Safety	3
380075	New Approaches to Highway Safety Analysis	2
380076	Low-Cost Safety Improvements Workshop	2
380077	Intersection Safety Workshop	4
380078	Signalized Intersection Guidebook Workshop	0
380079	AASHTO Roadside Design Guide	0
380083	Low-Cost Safety Improvements	0
380085	Guardrail Installation Training	0
380088	Improving Safety of Horizontal Curves	0
380089	Designing for Pedestrian Safety	3
380090	Developing a Pedestrian Safety Action Plan	1
380091	Planning and Designing for Pedestrian Safety	2
380093	Application of Crash Reduction Factors (CRF)	1
380094	Science of Crash Reduction Factors	1

Q48. Please use the box below to provide any additional comments you have.

Table 4-26 lists the additional comments provided by two districts. One district complimented the survey and another emphasized a need to standardize the statewide HSIP process (see Table 4-26 for suggested areas of the process) and to require that each district routinely reports on its progress on implementing the Florida Strategic Highway Safety Plan (SHSP). The respondent appears to desire more accountability on the implementation outcomes of safety projects and want to see more documentation to instill accountability. The respondent also would like to see more clearly defined roles and responsibilities for district safety engineers and managers and better training be provided to them.

Table 4-26: Additional Comments

- *No further comments. Interesting survey. Thank you.*
- *Need a standardized statewide HSIP process: Data collection, problem ID, countermeasure selection, prioritization, implementation, and evaluation requires documentation and accountability at the District and HQ levels. Set of Roles and Responsibilities, core competencies and training curriculum for the District Safety Engineers and Managers. Requiring each District to routinely report on its progress on implementing the Florida Strategic Highway Safety Plan is wonderful.*

4.8 Key Findings from the FDOT Districts Survey

Based on the responses from the six responding districts, the following are the key findings from the FDOT district survey:

- Most districts use the annual 5-percent transparency report to identify high crash locations.
- All districts agreed that cost information of safety studies should be shared among the FDOT District Offices.
- All districts use the B/C ratio to select safety improvement projects.
- Most districts agreed that the SHSP has well-served the traffic safety needs.
- The districts prioritize projects in the following order of SHSP's four emphasis areas: Intersection Crashes, Lane Departure Crashes, Vulnerable Road Users, and Aggressive Driving.
- All districts agreed to replace the CAR system with a web-based system.
- All districts agreed that a standardized crash analysis method and procedure should be followed across the state.
- Most of the districts are still not confident in implementing the HSM and SafetyAnalyst due to their extensive data requirements and the necessary statistical/software expertise. All districts agreed that a standard web-based GIS system should be adopted for crash analysis across the state.
- The majority of the districts would like to update the HSIPG.
- Half of the responding districts preferred to have face-to-face statewide meetings every half a year and the other half preferred to meet only once a year.
- Quarterly web meetings with the Safety Office received the most consensuses among the districts.
- The majority of the districts agreed that FDOT should provide statewide training on crash analysis.
- Face-to-face meetings are the most preferable mode of providing training on crash analysis.
- The districts are interested in FHWA-NHI courses that focus on intersection safety, pedestrian safety, roadway safety audits/assessment, and safety effects of roadway design features.

4.9 Safety Related Documents

As a follow up to the survey, the districts that were willing to share their safety related documents were contacted once again. The following sections give an overview of the documents received from districts 1, 2, and 4.

4.9.1 Documents Received from District 1

The following documents were received from District 1:

1. *A sample intersection safety study on a skewed four-way stop-controlled intersection.* The purpose of the study was to determine whether an improvement could reduce the crash

occurrences at the intersection in a cost-effective manner. Three years of crash data were collected and used in the analysis.

Based on the analysis and engineering judgment, it was recommended that the two intersecting roadways should cross each other at 90°. Additionally, lighting was recommended to be installed within the vicinity of the intersection and the median opening was recommended to be closed across from the intersection. Further, the utility poles in the vicinity were suggested to be relocated away from the roadway. A benefit/cost analysis as per the HSIPG was performed for the recommended improvements.

The analysis methods used in the study were based on the following references: the FHWA's Manual on Uniform Traffic Control Devices (MUTCD), the University of Florida's Accident Reduction Factors for Use in Calculating Benefit/Cost, the FDOT's Manual on Uniform Traffic Studies (MUTS), the SHSP, and the Traffic Engineering Manual (TEM).

2. *A sample pedestrian safety study along a 4.7-mile stretch on SR 37 (Florida Avenue).* The main objective of this study was to improve pedestrian safety along the corridor. Three and half years of crash data were used in the analysis. Additionally, traffic volume data, and pedestrian and bicycle count data at strategic locations along the study corridor were collected.

   The following recommendations were provided: reconstructing the sidewalk along Florida Avenue to have a minimum of 6-ft width, upgrading the pedestrian signals, installing overhead "Pedestrian Warning" signs, and resetting the pedestrian detectors per MUTCD guidance (Section 4E.08) at all signalized intersections.

3. *A sample corridor safety study in Polk County.* The main objective of this study was to gather and summarize the crash data needed to assess traffic safety along the corridor and to make recommendations to potentially improve safety. Five years of crash data were collected and used in the analysis.

   The analysis indicated that the overall crash rate along the corridor was decreasing and the most frequent crash type was rear-end crashes. The following recommendations were made to further improve safety along the corridor: road safety assessments, signal warrant studies, and further police enforcement.

4.9.2 Documents Received from District 2

The following documents were received from District 2:

1. *A document highlighting the guidelines for Florida's SRTS program.* The SRTS program provides funding to help communities address their school transportation needs, encourage more students to walk and/or bike to school, and make walking and biking to school safer and more appealing. SRTS is a federal reimbursement program administered by the FHWA to facilitate the planning, development, and implementation of projects that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity of schools. In

addition to encouraging more children to walk or bike to school, the program also seeks to address the safety needs of children already walking or biking in less than ideal conditions. Florida's SRTS Program is 100% federally funded, and is managed through FDOT on a cost-reimbursement basis. Most of Florida's SRTS funds are distributed to the seven districts based on the number of children in grades K-8.

2. *A document highlighting the district's Safety Work Program.* The Safety Work Program provided an overview and the guidelines of the HSIPG, Skid Hazard Elimination Program, Highway Safety Grant Program, HRRR, SRTS, and bicycle and pedestrian considerations.

4.9.3 Documents Received from District 4

The following documents were received from District 4:

1. *A document discussing economic evaluation of proposed safety improvement projects.* The document discusses the calculations on estimating the improvement project's NPV. A sample Excel spreadsheet was also provided.

2. *A paper presenting the use of the NPV for selecting and prioritizing projects that are justified based on their utility to society.* The projects include transportation safety projects that produce benefits (i.e., crashes prevented/reduced) at a cost (i.e., capital and recurring investments).

CHAPTER 5
LOCAL TRANSPORTATION AGENCIES SURVEY RESULTS

This chapter summarizes the results and key findings of the survey of local transportation agencies. The survey includes a total of 39 questions addressing each of the following areas of concern:

1. Use of crash data.
2. High crash locations
3. Project selection, implementation, and evaluation.
4. Crash analysis software systems.
5. Crash analysis standardization.
6. Crash analysis documentation.
7. Training.
8. Working with FDOT.

An online survey request was emailed to local transportation agencies across the state. Responses were received from 37 agencies. This chapter also summarizes safety related documents provided by some of these agencies.

5.1 Use of Crash Data

Q1: How many years of crash data do you typically use in your safety studies?

As shown in Figure 5-1, about half of the responding local agencies use 3 years of crash data, over 40% use 5 or more years, and close to 11% use 2 years. These responses are quite similar to those from the FDOT districts survey.

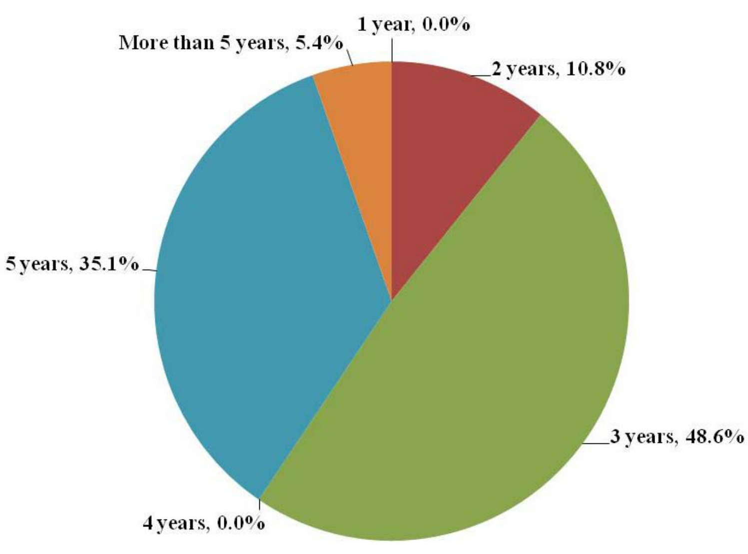


Figure 5-1: Years of Crash Data Used in Safety Studies

Q2. What is your source of crash data?

Table 5-1 lists the crash data sources used in safety studies. The majority of local agencies use crash reports from local law enforcement agencies, the county database, crash data provided by the districts, the FDOT database (e.g., CAR and GIS layers), and the Department of Highway Safety and Motor Vehicles (DHSMV).

Table 5-1: Crash Data Source

- *Lake County Law enforcement agency crash report.*
- *Law Enforcement Agencies, FDOT.*
- *FDOT Crash Analysis Reporting (CAR) System.*
- *The Florida Department of Highway Safety and Motor Vehicles provides crash data via electronic CD. In addition, several of the local law enforcement agencies provide crash report hard copies.*
- *Miami-Dade Police Dept. / Municipal Police dept's / State Police.*
- *We receive copies of crash reports from the (7) cities, sheriff's office and FHP.*
- *County Database.*
- *Sheriff's Department and FHP.*
- *Palm Beach County Crash Data System.*
- *Prior to 2011 we were using a PC based Crash Management System developed for FDOT District 7 by Tindale Oliver. Due to the changes made by DHSMV we are now in beta testing of a new Web based Crash Management System developed by Tindale Oliver. Crash data and reports are now received from DHSMV.*
- *DHSMV.*
- *Local PDs.*
- *We obtain long form and short form crash data from Pride Enterprises, contractor for DHSMV. We are currently working with law enforcement to obtain crash data directly from them.*
- *From the Department.*
- *FDOT Crash History Reports.*
- *Typically FDOT, sometimes local police department.*
- *Accidents reports from law enforcement.*
- *FDOT and HSMV.*
- *CAR - Crash Analysis Reporting System data provided by FDOT District Safety Office, Palm Beach County Crash also maintains and provides crash data for roadways operated and maintained by PBC/other municipalities within the County.*
- *County Records or FHP –HMV.*
- *State, Sheriff Office short forms, Currently using consulting services for crash data management system.*
- *Any source available.*
- *Highway Patrol Crash Reports.*
- *St. Petersburg Police Department crash data system.*
- *FDOT - Accident Data provided by District / County Sheriff's Records on as-requested basis.*
- *FDOT, Local Agencies, Law Enforcement Agencies, FHWA, related publications.*
- *Local data - city/county data systems.*
- *CDMS, previously sponsored by FDOT D7.*
- *Lakeland Police Department.*
- *Florida Department of Transportation crash summaries.*
- *FHP, County Sheriff Dept., all local City PD*
- *Intersection Magic.*

Table 5-1 (Continued): Crash Data Source

- *FDOT - GIS layers from FHWP crash reports.*
- *Police crash reports.*
- *Florida Highway Patrol (FHP) Long & Short Form Accident Reports / City of Orlando Police Department (OPD) Long & Short Form Accident Reports / FDOT*
- *City Police Department.*
- *County Crash Database.*

Q3. What are the problems you have seen in your crash data?

Table 5-2 identifies the several problems observed with crash data. Based on the survey responses, the following are the main problems with crash data:

- There are many inconsistencies in filling out (data entry) and collecting the crash reports.
- There are significant differences between the old and new crash report forms.
- Most of the data are missing in the short forms.
- Data obtained from municipalities are not timely.
- Crash locations are not accurately identified.
- The crash type (e.g., angle and left turn) and contributing causes are often inaccurate and incomplete.
- Crash reports need to be geocoded and are often incomplete.
- The database is often incomplete.
- The crash reports fail to identify crashes that involved bicyclists and pedestrians, and specific fixed objects like utility poles.
- Data are difficult to be narrowed down.

Table 5-2: Problems with Crash Data

- *Old crash data is different from the new data forms. For example, old forms use distance from the next major intersection if the crash is not at that intersection. The new forms use GIS/GPS node.*
- *Inconsistencies, incorrect information, lack of information. It would be better if the data is available online.*
- *Does not distinguish crashes involving bicyclists or pedestrians.*
- *Crash data is inaccurate or incomplete (Occasionally). 2. Delays in receiving crash report updates.*
- *Data obtained from municipalities are usually provided late.*
- *Intersection street names incorrect. 2. Harmful Event Type incorrect. 3. Missing data from reports (Required short form data is lacking in regards to analysis). 4. Contributing Cause Type incorrect.*
- *Data entry into the database, indexing problems.*
- *Not always thorough enough.*
- *Different police officers view record similar crash types differently*
- *The two biggest problems with crash report are getting an accurate location of the crash and the type of crash (angle, left turn etc.).*
- *The data does not include short forms. The database is not complete.*
- *Reports not found.*
- *The main problem is errors in entering the information on the crash form. Sometimes the location information does not match the sketch. Most of the time there are errors in categorizing the crash type and contributing causes. Some crash forms are also still handwritten which can be hard to read.*
- *Hard to reduce the data.*

Table 5-2 (Continued): Problems with Crash Data

- *Looking for crashes that involved utility poles or above ground utility features.*
- *Inconsistency in collection.*
- *Data generally assigns fault, but mitigating circumstances are unknown.*
- *Inconsistencies in the data entry, although the officers in the field are generally very detailed in the forms.*
- *Insufficient details about contributing factors/causes. A rather large number of crashes lumped together in the catch-all "All Other" category.*
- *Accuracy on the reports from the Local police.*
- *Not timely, often 6 months to a year in arrears. 2. State does not provide data from short forms; therefore crash data is not accurate or complete. 3. Crash locations not accurately located if it did not occur at an intersection.*
- *Pin pointing the location*
- *Location of the crashes: Street names using are different from organizations, distances of crashes from intersections are not accurate.*
- *Miss reporting or lack or reporting on options in the report by the Police officers.*
- *Difficulty in obtaining usable data, particularly from County Sheriff's office.*
- *Inconsistent coding and lack of information provided by law enforcement officers filling out the crash reports. Also, assignment of crash report numbers between agencies differs and is sometimes hard to match up to State crash report numbers. Nodes to be assigned to off-system roads as well.*
- *Lack on standardization on how reports are filled out by law enforcement officers - i.e., errors in location; incomplete description; incomplete data.*
- *CDMS is no longer sponsored by FDOT D7. 2. Law Enforcement information on forms is missing or suspect.*
- *Inaccurate information provided on forms*
- *Fixed objects not defined.*
- *Incomplete Reports are probably the biggest issue.*
- *Officers indicated the wrong type of collision or the wrong direction.*
- *None.*
- *Reports need to be geo-coded and are often not complete enough.*
- *Not all Long and/or Short Accident Forms are received from the Florida Highway Patrol (FHP) Agency. Found that the FDOT Crash Analysis Report Database had more accidents on OOCEA system than what was being received from the appropriate agencies.*
- *Essentially everything. Locations are often incorrectly identified. Data cannot be readily extracted from the file using location as a criterion. Reported facts are too few to be able to make any useful decisions as to root cause or what happened.*
- *Many times the type of crash is coded incorrectly.*

Q4. What did you do to overcome these problems?

Table 5-3 lists several ways to overcome problems with crash data. In summary, the local agencies do the following to improve crash data:

- Work toward updating the existing database to accommodate new crash report forms.
- Make reasonable judgment and do not rely on faulty data.
- Work with the local agencies to get more data in the short-form reports.
- Make assumptions and conclusions based on good engineering judgment.
- Review the written description of the crash and the sketch of all reports.

- Meet with the county staff to develop a system that includes corrective action.
- Conduct informal safety audits and site visits to identify potential safety hazards.
- Work with the law enforcement officials to improve data quality.
- Work with counties to develop system that includes corrective action.
- Omit questionable data from the analysis.
- Constantly contact the municipalities and local metropolitan planning organizations to obtain the required data.

Table 5-3: Ways to Overcome Crash Data Problems

- *Our crash database needs to be updated to the new form format and conversion*
- *Make reasonable judgment or don't use faulty data. Local knowledge.*
- *Used data from the local metropolitan planning organizations, if available.*
- *If available, FLHSMV will provide additional information but can't change the crash reports. Unfortunately, law enforcement officers aren't available to contact and are too busy to update/correct mistakes. If justified, we'll update/change the information in our databases.*
- *Unfortunately, at the local level there's not much we can do.*
- *Constantly contact the municipality to obtain the data. We coordinated with some municipalities to access a web link or they provide us with a CD in a regular basis to get the crash reports electronically.*
- *Worked with the local agencies to get more data filled out on the short forms. / Correct Harmful Event and Contributing Cause entries when applicable.*
- *Still suffering through it, but we are partnering with our local MPO to have them managed by a private agency.*
- *Make assumptions.*
- *Read the crash reports.*
- *Prior to doing any analysis on a location, we have to review all of the actual crash reports to verify location and crash type. Sometimes due to lack of information on the report it is not possible.*
- *Not much we can do unless the law enforcement agencies cooperate and DHSMV include all forms in what is provided.*
- *Request the agency to re-search.*
- *We have to read the full detail of every report including the written description the crash and the sketch.*
- *Nothing really. Just take the time to review fully.*
- *Request that the identified Utility Agency/Owner relocate their facilities out of the Control Zone whenever possible.*
- *Best to omit entire years, if known omissions occur.*
- *Site visits to determine if roadway alignment or visibility could be factors in the cause of the crash.*
- *Though reviewing the long form reports when the level of analysis justifies this additional expense and costs.*
- *Further refine the analysis, take educated guess, call concerned police office. Sometimes nothing works.*
- *Gather more data at same location.*
- *On not getting data timely, can't do anything locally. Problem is with the state. 2. Having Sheriff use long form to provide crash information filling out only the information required on the short form. Have consultant enter short form data into management system. 3. Hand checking data entry comparing to crash report.*
- *Look at crash type and then assign it to either the intersection of the road segment.*
- *Change street names of crash reports to meet our map.*

Table 5-3 (Continued): Ways to Overcome Crash Data Problems

- *Education at roll-call.*
- *Met with County staff, retrieved data, individually.*
- *Analyze and research as best as possible, make conclusions based on good engineering judgment. Try to attain additional information based on need.*
- *Partnership with County to develop system that includes corrective action.*
- *County is paying consultant for in-house version of CDMS, which is ongoing. 2. Spoke with command at Sheriff's Office.*
- *Continue to work with police to improve proper data.*
- *Have not been able to confirm what fixed objects are thus I have not overcome these problems.*
- *Call the officer that worked the crash.*
- *We screen the reports before they are entered into the system.*
- *Discussions with police officers explaining need for accurate reports.*
- *Discussed this issue with the proper FHP and OPD officials to let them know that OOCEA was not received all of the accident reports for they could try to eliminate the problem. It is the responsibility of the FHP and OPD staff to resolve any of these issues for OOCEA does not have any jurisdiction over them.*
- *Direct observation of traffic operations by myself and law enforcement personnel to identify potential safety hazards--essentially conducting an informal safety audit.*
- *Review the crash reports with emphasis on the narrative.*

Q5. How do you suggest that these problems can be resolved or alleviated?

Table 5-4 provides the suggestions of the responding local transportation agencies to alleviate problems with crash data. The following are the main suggestions for alleviating issues with crash data:

- Develop more training on crash data collection and analysis.
- Maintain a central server.
- Implement a statewide crash database system for counties and cities.
- Train law enforcement and field officers from the perspective of a traffic engineer or analyst.
- Train the personnel preparing crash reports.
- Improve coordination with municipalities, and among planning agency and local law enforcement agencies.
- Transfer data electronically.
- Pay more attention to specifics during investigation.
- Use GPS technology to locate crashes.
- Obtain detailed investigation reports from the insurance companies, if available.
- Make the crash report forms electronic to be readable by the existing accident analysis programs.
- Use modified long forms for all property damage only crashes.
- Add a comment field to provide brief explanation including contact details for addressing further questions.
- Automate the data collection process as much as possible.

Table 5-4: Suggestions for Alleviating Crash Data Problems

- *By implementing a Statewide Crash database systems for Counties and Cities with web link/download for crash date for studies*
- *More training on the crash data collection and crash analysis is needed. Proper identification of the crash hot spots is necessary. More coordination among planning agency and local law enforcement agencies could be beneficial.*
- *Support and fund the proper training of law enforcement officers.*
- *More coordination with municipalities and more automated/electronic data transfer*
- *Better training*
- *A statewide partnership that would leverage existing technology to create a web-based portal for entry and retrieval would solve the problems permanently.*
- *More attention to specifics during investigations.*
- *Better training of law enforcement and possible use of GIS to pinpoint the location.*
- *Require all agencies to submit to DHSMV in a form that will be recorded and compiled.*
- *Better vigilance by agency*
- *Better training for law enforcement perhaps from the perspective of a traffic engineer or analyst so they can better understand why this information is important and also making the crash form simpler to complete so they understand what information is requested. Have all crash forms completed electronically to address variances in handwriting and including GIS coordinates for quick and precise mapping of crashes.*
- *Possibly an easier format to perform the necessary review.*
- *Electronic submission is producing much better data this century.*
- *Require insurance companies to submit any post-crash reports of investigations they may have done.*
- *Continue to provide training for field officers.*
- *Add a comment field to provide brief explanation including contact details for addressing further questions.*
- *Central server and training.*
- *Require modified (shortened) long form for all property damage only crashes.*
- *Always having the diagram.*
- *Using GPS locations of crashed: X, Y coordinates.*
- *Better training in the academy.*
- *Accident Data forms could be made smarter, electronically, using software/hardware already available in police cruiser to be readable by Accident Analysis programs.*
- *Nodes to be assigned to off-system roads as well. Performance measures for officers filling out crash reports. Statewide crash report number assignment as opposed to related agency assignments.*
- *Training to law enforcement to emphasize importance / use of data.*
- *Department could reinstitute CDMS program. 2. Training of law enforcement on crash types, and other form field information.*
- *Automate as much of the process as possible*
- *Define fixed objects that way we will know if the objects are within the allowed right of way and need to be moved during a project.*
- *Attention to detail when the reports are being filled out.*
- *Never, there is always going to be that human factor in the reporting system*
- *More attention to detail when completing the reports*
- *It is the responsibility of the FHP and OPD staff to resolve any of these issues for OOCEA does not have any jurisdiction over them. A database that OOCEA could obtain access to may help and alleviate not receiving all of the data.*
- *Personnel preparing crash reports could be better trained and provide the information required.*
- *Continual communication with law enforcement on how traffic engineers use the data. However, manual checks of the crash reports will always be necessary and valuable.*

5.2 High Crash Locations

Q6. Please describe the process you now use to identify high crash locations in your area.

As shown in Table 5-5, the local transportation agencies use several methods to identify high crash locations. As seen from the responses, the local agencies do the following to identify high crash locations:

- Query crash database records for top 20 high crash locations and investigate the top 10 locations.
- Run monthly and annual reports to identify locations and review individual crashes and crash diagrams.
- Summarize crashes at intersections and rank them based on crash frequency.
- Maintain a database of all crash reports for IRC.
- Rank locations by total crash frequency, crash type, total recurring crashes, or by a composite score while accounting for crash rates and crash severity.
- Use GIS analysis and compare locations with those published statewide, as well as with district crash rates, by facility type and area type.
- Perform crash analysis only when improvement projects are scheduled or upon request.
- Use web-based crash analysis systems.
- Identify crashes based on specific criteria, e.g., number of fatalities, crash frequency, and safety ratio.
- Use FDOT crash summaries.
- Use observations made by law enforcement officers and field investigations.
- Use the list of high crash locations provided by FDOT.

Table 5-5: Methods for Identifying High Crash Locations

- *We use access database queries developed for Lake County by Tindale Oliver Associate Inc. We query our crash database records for 20 high crash location and investigate the best 10 locations for safety studies as be warranted.*
- *Local input from Planning and engineering Departments, Crash History, Crash Analysis, and Field Visits*
- *Memory and documents produced by the Florida - Alabama Transportation Planning Organization (local MPO). The corridor management plans usually show crash locations and sometimes the bicycle/pedestrian plans do as well.*
- *In 2003/2004, Manatee County developed an internal Accident Reporting System (ARS). ARS is a GIS web based crash management application. ARS produces top crash location reports. In addition, we manually review all crashes at signalized intersections to review annual crash rates.*
- *Obtain crash list for locations with 15 or more crashes per year for the last three years.*
- *Sort locations from high to low.*
- *Rank locations through three (3) phased schemes: the total number of crashes (Crash Frequency), crash rate (Safety Ratio), and crash loss value (Equivalent Property Damage Only – EPDO) methods. Finally, these intersections are ranked by a combination of these factors.*
- *I pull the data from the database tables and complete our annual crash facts booklet to determine high crash locations.*
- *We query our database which is set up to show the highest crash locations in our records.*
- *Review Sheriff Department data.*

Table 5-5 (Continued): Methods for Identifying High Crash Locations

- *Our crash data system can rank locations by total crashes and crash type*
- *We run monthly and annual reports to identify the locations of all crashes and individual reports on fatal, pedestrian and bicycle crashes.*
- *The County analysis the crashes annually by number of crashes as per the database.*
- *We don't identify high crash locations on a regularly basis. Several years ago we produced a report and looked at high crash locations. We ranked high crash locations based on a composite score that took into account crash rates and crash severity.*
- *Pin point based on mile post reference where the crashes occur.*
- *FHP Crash History Reports and field investigations.*
- *Local input from knowledgeable folk*
- *From the City's Police Department and meetings with the City's Transportation Advisory Committee.*
- *Use GIS analysis of the databases and compare with published statewide and district crash rates by facility type and area type.*
- *Highest number of crashes / Highest rate of crash.*
- *Police reports and FDOT accidents printouts. Collision Diagram and conceptual analysis.*
- *Due to budget limitations high crash locations are not identified. Crash locations are evaluated when improvement projects are scheduled and upon request by others. County staff uses Crash Data Management (CDM) system for evaluation. Data is inputted into system by consultant: 1. Crash Data Management System (consultant provided) identifying high crash locations at intersections, and 2. Provide ADT to consultant to determine locations of high crash rate.*
- *Spot accident rate per million vehicles.*
- *Run report from our AIMS: Accident Information Management System. It is an application that we use to manage our crash database.*
- *Computer system will identify the highest number of crashes per intersection as a parameter.*
- *Analyze accident diagrams if available from Sheriff's accident reports (best way) / Review FDOT accident data*
- *Criteria based on fatalities, # of crashes, safety ratio, etc.*
- *Web-based County/City system developed by University of Florida. Limited in data range - currently working to expand available years. System is complemented by archived electronic data from local police for current years.*
- *Full database scan, sorted descending. Specific sorts have been accomplished for specific crash types (e.g. pedestrian, lane departure, etc).*
- *We do monthly reports on top 10 locations for both signalized and non-signalized intersection and proceed with reviewing individual crashes and crash diagrams.*
- *I use the FDOT crash summaries and find where any multiple crashes happen within a certain amount of linear distance along the roadway.*
- *We maintain a database of all crash reports for IRC. At the end of every year we evaluate every intersection with 4 or more correctable accidents. Rear ends, side swipes, etc we omit.*
- *A intersection summary is performed and then we rank the intersections according to number of crashes and injuries.*
- *GIS layers with crash reports.*
- *crash reports are geo-coded and GIS makes numeric analysis much simpler.*
- *OOCEA identifies the high crash locations (areas of concern) by the number of reoccurring accidents. These areas of concern are identified by any crash locations having 5 or more accidents in the same direction of travel. Once these areas of concern are identified, they are monitored, and accidents reports are reviewed to help determine the cause to assist in determining if any safety improvements are needed to resolve the issues.*
- *Law enforcement observation.*
- *FDOT's listings; Pinellas MPO Annual Report.*

Q7. How many high crash locations were on your list last year?

Table 5-6 lists the various count of high crash locations last year. The number of high crash locations varied from top 10 (City of Gainesville and City of St. Petersburg), top 15 (St. Lucie County and Alachua County), top 20 (Lake County), top 30 (Hernando County), top 40 (Pasco County), top 100 (Pinellas County), and the annual 5 percent report of high crash locations by FDOT (City of Jacksonville).

Table 5-6: Number of High Crash Locations Last Year

- *20 were in our list last year.*
- *15 or less.*
- *Don't keep a list.*
- *20.*
- *20.*
- *>10.*
- *0.*
- *System is limited to top 100 locations.*
- *Approximately 40.*
- *5.*
- *0.*
- *We ranked the top 15 intersections and the top 15 road segments.*
- *2.*
- *None.*
- *3.*
- *We currently use the FDOT's 5% list and are preparing a list of priorities.*
- *Cannot answer the question, not responsible for keeping the high crash location lis*
- *2.*
- *Due to budget restrictions we do not annually identify high crash locations.*
- *6.*
- *We consider high crash locations when the crash rate (million car entering intersection over number of crashes) higher than 2.*
- *We typically run the Top 10, but once on the list, they never go away.*
- *5 -10.*
- *Focused on top 10.*
- *30 total of various crash types.*
- *15.*
- *0.*
- *55 intersections with 4 or more crashes.*
- *For the year we rank every intersection in the County.*
- *This information is shown by layers when customers request them.*
- *We don't have a set number*
- *Varies. Typically there are usually 3 to 4 locations.*
- *There is no list. Intersections are reviewed as concerns are voiced.*
- *Pinellas MPO produces a Top 100 list.*

Q8. Out of these locations, how many were investigated?

Table 5-7 lists the investigated number of high crash locations last year. Most agencies investigated a percentage of the list of high crash locations. For example, Pinellas County investigated 10% of the list and Collier County investigated only those locations identified by projects or requests. On the other hand, the City of St. Petersburg investigated all the identified locations.

Table 5-7: Investigated Number of High Crash Locations Last Year

- *5 were fully investigated.*
- *5.*
- *TPO staff hires consultants to produce the plans that document crashes when the plans are being updated.*
- *10.*
- *20.*
- *<3. There are not sufficient resources to conduct such investigations, nor funds to pursue construction within the County. Safety projects are usually handled by the TPO.*
- *0.*
- *We do mot specifically use the list to determine the need for study*
- *25.*
- *5.*
- *0.*
- *None.*
- *Potential project sites were visited for visual inspection of poles for scaring from crashes.*
- *3.*
- *As part of our studies, we as consultants perform the investigations.*
- *Cannot answer the question; not responsible for investigating the high crash location list.*
- *2.*
- *Only locations identified by projects and/or request are investigated.*
- *0.*
- *None.*
- *Top 10.*
- *4.*
- *3.*
- *10.*
- *1.*
- *0.*
- *Top ten based on a rate of # accidents per million vehicles entering the intersection.*
- *The top 15 intersections are monitored and investigated.*
- *Approximately 9 locations.*
- *No Investigations were conducted. OOCED identified these areas and meetings are held to discuss possible options to help improve any of the safety issues.*
- *Four locations in the last 12 months.*
- *10 - Goal is for 10 percent per year.*

Q9. Who performed this investigation? (Check all apply)

As shown in Figure 5-2, over one-third of the local agencies said that in-house staff investigated the high crash locations; 19% said consultants; close to 14% said both consultants and in-house staff; others and in-house staff were 11% each; and consultants, in-house staff, and others was close to 8%.

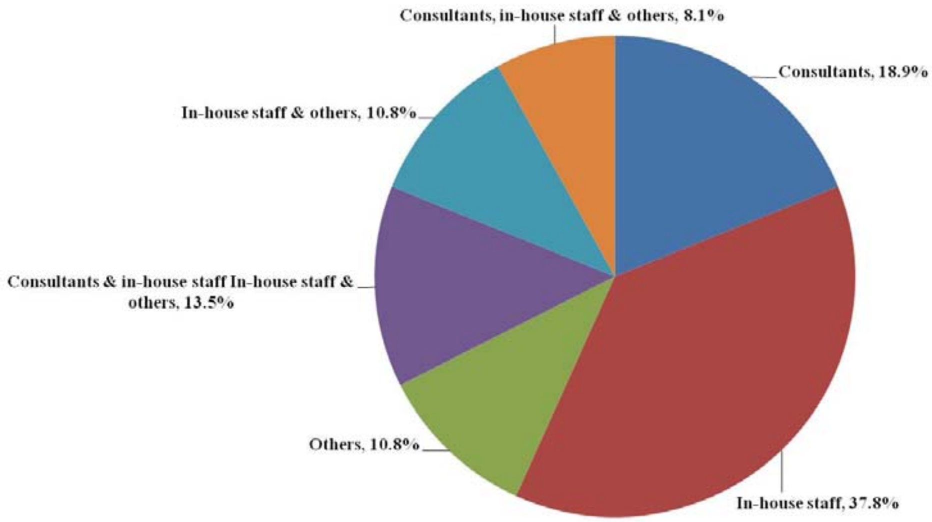


Figure 5-2: Distribution of Individuals Performing Safety Investigation for Local Agencies

Q10. Please list the top three types of safety problems at the locations investigated.

Table 5-8 identifies the local agencies' top three types of safety concerns. The concerned crash types included speeding, distracted driving, intersection-related, pedestrian, bicycle, running red lights, failing to yield right-of-way, specific crash types (such as rear-end, angle, and left-turn), and run-off road. Roadway related safety problems included access management, sight distance, intersection geometry, pavement markings, and signage. From the traffic operations perspective, traffic congestion, signal timing, equipment condition, street lighting, work zones, and turning movements were the potential areas of improvement. More specifically, speeding-related, distracted driving, and intersection-related crashes were of highest safety concerns.

Table 5-8: Top Three Types of Safety Concerns

• *Intersection Safety, Speeding issues on local and county collector roads, Signal Warrant studies, and traffic calming studies.*
• *Speeding, intersection Geometry, access management.*
• *1. Pedestrian/vehicle crashes. 2. Bicycle/vehicle crashes.*
• *At these locations, the majority of the crashes were contributed to driver actions (i.e. careless driving, failure to yield R/W, etc.) With that said, we investigated visibility issues, signal timings, back plates, equipment conditions, pedestrian and bicycle facilities.*
• *1. Sight distance: left-turns & right angle crashes. 2. Pavement markings and conditions: sideswipe / lane change & rear-end crashes. 3. Signage: sideswipe/lane change & right angle crashes.*
• *Left turn conflicts, rear-end crashes.*

Table 5-8 (Continued): Top Three Types of Safety Concerns

- *Rear-end crashes at traffic signal, left turn crashes at permissive left turns, angle crashes at non-signalized intersection.*
- *Run off the road, curve related and angle*
- *Running Red Lights, Failure to yield to pedestrians, and Permissive greens lack of understanding.*
- *Failure to yield the right-of-way, rear-end collisions, side swipes.*
- *Direct Hits.*
- *1. Pedestrian accommodation, 2. Bad maintenance of traffic, 3. Street (or other) lighting.*
- *Error in judging speed of on-coming vehicles. Error in assumption of driver's right-of-passage.*
- *Improper driving (including being distracted), failure to follow/comply with traffic control devices, congested intersection*
- *Signal timing, turn lane, signs.*
- *1. Permitted left turns with high opposing traffic volumes and sight distance associated with permitted left turns. 2. Sight distance limitations from landscaping or other encroachments (primarily on off-systems roadways). 3. Two-way left turn lanes (primarily on off-systems roadways). 4. Channelized right turn lanes at interchanges where stop conditions are not required.*
- *Sight distance, lighting and roadway surface.*
- *1. Pedestrian / bicycle crashes at stop controlled and right turn on red. 2. Run of the road crashes. 3. Speed related*
- *Rear-end collisions / left-turn vehicles / involving pedestrians or cyclists. See 2010 Doral Transportation Master Plan.*
- *Angle crashes at signalized intersections caused by red-light running.*
- *Rear-end, run off road, side swipe.*
- *Access management.*
- *Aged/weathered signage, access management, and non-forgiving roadsides.*
- *Driveways too close to signalized intersections, driver error, rear end collisions.*
- *I have worked on rural projects where high traffic crashes have not been present.*
- *Speeding, sight distance obstruction, driver error*
- *Turning on green ball, distraction to the driver, Careless driving*
- *1. Rear-ends. 2. High LOS. 3. Turning lanes needed.*
- *Poor visibility, Speed, turning movements*
- *High Traffic Congestion, ongoing Construction Activities; exceeding Safe Speed Limit, failing to Maintain Control of Vehicle*
- *Pedestrian safety, turning movement conflicts, and sight distance.*
- *Volume/Capacity ; ADA compliance*

Q11. Please list all funding sources and the funding amounts for conducting safety studies for the previous year.

Table 5-9 lists the local agencies' funding sources and amounts. The responses vary between state safety funds, local funding, collected toll revenue, district funding, and Project Development & Environment (PD&E) funds.

Table 5-9: Funding Sources and Amounts for Conducting Safety Studies Last Year

- *State Safety funds and Lake County local funds*
- *FDOT, Local funding*
- *Local MPO funds.*
- *Manatee County's Public Works Department Traffic Engineering Division provided all the funding for these safety related activities.*
- *Metropolitan Planning Organization (MPO) - $75,000*
- *Florida Department of Transportation funds / Rural Roadway grants / County Engineering funds*
- *No specific funding sources have been provided by the Boards.*
- *Some funding for low coat safety projects is provided in our capitol improvements program; this averages $50,000 per year. Long term higher cost projects required additional review and funding requests for future budgets. Additional funding and equipment has been providing thought FDOT District 7 and FHWA.*
- *County Funds. Impossible to access FDOT safety funds for this endeavor.*
- *Most of the studies that we conduct are based off traffic complaints and are not very detailed. These types of studies are funded through gas tax operating revenues. We conduct safety studies at the beginning of the design process for any capital project. These studies are funded from the project funds which can include gas tax, sales tax, or impact fees. We have no dedicated funding for traffic safety.*
- *State and Federal monies*
- *PL funds*
- *Cannot answer the question, not responsible for funding to conduct safety studies*
- *Safety funds.*
- *County general fund, normal operating budget at approximately 0.10 full time employee (FTE). No specific funding for safety studies.*
- *Miami-Dade Metropolitan Planning Organization*
- *Traffic Impact Fees (TIF) - $250,000 for studies and remediation. / Sales Tax - $100,000 for studies and remediation.*
- *FDOT Safety Improvements Funding*
- *State & FHWA*
- *None; studies performed with in-house staff and available operational funds*
- *Funding was from staff salaries, capital improvement fund, and MPO*
- *In house funding for studies and analysis*
- *County funds*
- *Gas Tax*
- *The traffic safety studies were conducted as part of PD&E's.*
- *OOCEA is a Toll Road Agency / Toll Revenues that are collected are the source of revenue.*
- *Since the work was done by in-house staff, there were no specifically allocated funds.*
- *County CIP - 100k ; Grants from FDOT D7 - unknown.*

5.3 Project Selection, Implementation, and Evaluation

Q12. Please describe the analysis method your office uses to select safety improvement projects (e.g., benefit-cost analysis).

Table 5-10 discusses the methods used for selecting safety improvement projects. The majority of responding local agencies use the B/C ratio to select safety improvement projects while a few agencies consider B/C analysis to be unrealistic and hence do not adopt. Other methods include field visits, citizen and law enforcement officials' requests, crash reduction factors from the HSM, engineering judgment, pedestrian and bicycle safety as a primary focus, Road Safety Audit Ranking Evaluations, and informal audits. Some of the important references include MUTCD, Traffic Engineering Handbook, and HCM. At local agencies, public impact, pressure from the public, and perception often drive the project selection process. A few agencies do select projects that target a specific crash type (for e.g., run off the road crashes). Funding is often considered as a deciding factor in selecting and prioritizing safety projects. A few agencies mentioned that they do not have a specified procedure or dedicated safety funding.

Table 5-10: Method for Selecting Safety Improvement Projects

- *MUTCD, Traffic Engineering Handbook and all lake county studies also use benefit-cost analysis for most of our safety studies.*
- *Benefit Cost Analysis.*
- *Do not use benefit-cost analysis.*
- *The majority of safety issues that were identified were on State roadways. As a result, we forwarded our findings and recommendations to the local FDOT office for consideration. To my knowledge, Major County projects are put on a CIP list and Commissioners determine priorities and funding.*
- *In some cases, benefit-cost analysis.*
- *We review crash history and field review locations. Citizen and law enforcement requests.*
- *ADT.*
- *For the 1 safety grant that we have, we used b-c analysis.*
- *Due to very limited staff and budget cuts, we do not perform any benefit-cost analysis.*
- *Benefit-Cost Analysis; public impact.*
- *We have no established safety program or dedicated safety funding. Most safety projects are generated based on complaints and are then compete with all our projects within the Capital Improvements Program for funding unless the improvement is small enough that it is immediately implemented with current year operating revenues. For projects that can be funded from operating revenues, projects are selected on a first come; first served basis.*
- *Benefit-cost analyses.*
- *Public pressure and perception*
- *Number of accidents assigned to a particular cause that can be minimized or eliminated. / Number of complaints pertaining to a particular intersection, location or vehicle movement. / Cost of the proposed improvement and available funding.*
- *We use the Highway Capacity Manual and the crash reduction factors and costs of crashes published by the safety office to determine benefit-cost ratios. We also look at LOS using Highway Capacity Manual based methods (usually SYNCHRO) and other data analysis per the MUTS.*
- *B-C analysis.*
- *Benefit cost ratio analysis and MUTCD Warrants.*
- *1. Use crash reduction factors from Highway Safety Manual. 2. Public input/request. 3. Engineering judgment / Benefit-cost analysis is NOT realistic analysis for local agencies.*
- *B/C analysis. Review of facilities for compliance to current design standards.*
- *Benefit cost*
- *Fund availability, B-C analysis, public requests.*
- *Frequency and severity of incidents.*
- *Size and scope of project, operational or capital funding, can project be included in planned project.*
- *We review locations for pedestrian and bicycle safety as a primary and then look at the benefit to cost.*

Table 5-10 (Continued): Method for Selecting Safety Improvement Projects

- *Plot all accidents and collect field conditions to determine the type of accidents that are occur and why.*
- *Once a problem is identified we use Traffic Engineering Standards to improve the situation.*
- *Most of the safety improvements were done on a benefit-cost analysis.*
- *OOCEA identifies the areas of concern and/or problem areas based on the accident reports. Once identified meetings are held to discuss and come up with ideas to implement any needed safety improvements based on reviewing the main causes of the accidents.*
  Informal safety audit. The city has no funding for roadway construction projects, so minor operational adjustments (e.g., signal timing changes and signing/marking) are the only available measures.
- *Benefit-Cost; Road Safety Audit Ranking Evaluation.*

Q13. Do you evaluate implemented safety improvement projects to determine their effectiveness?

As shown in Figure 5-3, over 40% of the responding agencies evaluate all of the implemented projects to determine their effectiveness. About 30% of the agencies assume that the project locations were improved, and 27% evaluate a sample of the implemented projects.

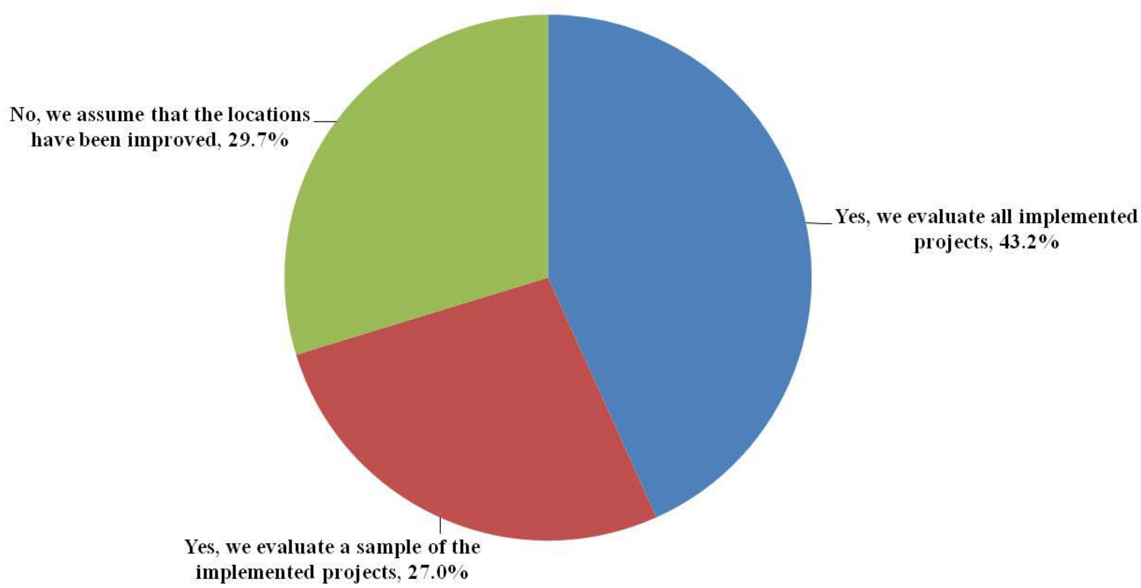


Figure 5-3: Distribution of Local Agencies Evaluating Safety Improvement Projects

Q14. If "Yes", please describe how the evaluation was performed.

Table 5-11 discusses the methods used for evaluating safety improvement projects. Most of responding local agencies use before-and-after crash analysis to determine the effectiveness of the implemented countermeasure. Other evaluation procedures include the number of complaints after the improvement projects are implemented, public opinion, field observations (i.e., qualitative analysis), continuous monitoring of locations and crash reports, review of crash history, and observation of traffic operations following the project implementation. From roadway design perspective, weather conditions, pavement conditions, and other design elements are reviewed. Further, while selecting improvement projects for evaluations, intersections and turn lanes are given priority. One agency mentioned that evaluation is not performed in most cases.

Table 5-11: Methods for Evaluating Safety Improvement Projects

- *The before study and other recommendation from the study, 3 year evaluate after implemented project evaluations.*
- *Determine the benefits of improvement over a certain time line vs. costs associated with the improvement.*
- *The evaluation was not performed.*
- *On occasion, we perform before and after studies to determine the effectiveness of the improvements.*
- *Review crash history.*
- *We review future crash data on some projects.*
- *We collect traffic and crash data for before and after the project. Normally, we exclude all crash data for a period from six months before to six months immediately after construction to allow for a period of adjustment. We then perform a simple before and after analysis of the crash rates.*
- *Field reviews of the projects during construction or utility installations*
- *Look at years after to check for type of action addressed.*
- *Number of complaints after improvements is implemented.*
- *Before-After study.*
- *Monitoring location and accidents reports.*
- *We evaluate the highway network to determine overall effectiveness of safety program utilizing number of crashes and overall crash rate per capita.*
- *We did a holistic review and identified these in our 2010 Doral TMP. We need detailed study for improving these intersections. These intersections are mainly under County Jurisdiction.*
- *Post crash data analysis, comparing to the solutions implemented.*
- *Analysis of weather conditions, pavement condition, review measurements with respect to Typical Section Design Elements (Clear Zone, shoulder width, bicycle lanes, delineation, signaling, etc.*
- *Field observations, crash history, condition of improvements.*
- *Comparison of number and severity of crashes before and after.*
- *Pre-post review, qualitative analysis.*
- *Field review, data and field studies in addition to getting public review.*
- *By the time a project gets to our firm, the analysis has already been performed by FDOT or another consultant.*
- *We monitor the intersection, but if the intersection continues to fall into the 4 or more accidents/year we continue to add improvements until we see an improvement.*
- *We monitor the intersection thru our traffic crash data base and see if the number of crashes has been `reduced.*
- *Most of the evaluation was done on intersection & turn lane improvements.*
- *Comparison of pre vs. post crash records*
- *Evaluation of the projects is monitored based on the reduction of the number of accidents once the project is completed to determine if other improvements would be necessary.*
- *Observation of traffic operations following the change.*
- *Track crashes for a representative period - at least three years; visual observations to determine if the behavior has been corrected.*

5.4 Crash Analysis Software Systems

Q15. Please list any commercial software tools you now use for crash analysis.

As shown in Table 5-12, several commercial software tools for crash analysis are being used by each responding agency. The software tools currently being used include the WebCDMS from TOA, the Highway Safety Analysis system, Intersection Magic, ArcMap, tools provided by FDOT (e.g., CAR), MS Excel, MS Access, AIMS, AutoCAD, GIS, PBCAT, and RSAP. Many agencies indicated using WebCDMS for crash analysis.

Table 5-12: Commercial Software Tools for Crash Analysis

- *In the past Lake County use Tindale Oliver Associate Inc Crash Database Management (CDMS) and Intersection Magic.*
- *FDOT provided tools*
- *Highway Safety Analysis (HSA) software - Version 3.0 / Microsoft Office Excel 2007.*
- *Arc Map / Microsoft Access.*
- *We are now using the Web based Crash Data Management System (WebCDMS) developed by Tindal Oliver and Associates in Tampa.*
- *TOA's WebCDMS.*
- *RSAP.*
- *Crash Data Management System (CDM) by Tindale Oliver Associates.*
- *AIMS- Accident Information Management System.*
- *PBCAT.*
- *CARS / FDOT database.*
- *Contract with University of Florida for development of web-based system.*
- *CDMS database. MS Excel for sorting. AutoCAD for site mapping.*
- *None, in house programs only.*
- *Intersection Magic.*
- *GIS.*
- *None at this time. Currently the GEC Consultant obtains the accident reports and summarizes them in an Excel Spreadsheet and writes a quarterly report summarizing the results.*

Q16. Please list any crash analysis software tools your office has developed in-house.

Table 5-13 lists the crash analysis software tools developed in-house by each responding agency. The local transportation agencies have developed the following tools: the Accident Reporting System (ARS) in Manatee County, a system developed in Palm Beach County, a crash mapping system in Alachua County, a system being developed by University of Florida, and a web-based system in the City of Gainesville, and several Excel Spreadsheets.

Table 5-13: Crash Analysis Software Tools Developed In-House

- *Accident Reporting System (ARS).*
- *We use Microsoft Office Excel 2007 to develop crash analysis summary and identify abnormal high crash patterns.*
- *Software developed by a UF professor.*
- *We have developed some Excel spreadsheets for crash and severity rates.*
- *We contracted with the University of Florida to create a crash mapping system for the County. The system ranks intersections and road segments, maps crashes, and allows for querying by any of the data collected on the crash form.*
- *We use GIS with customized applications for automated collision diagrams and spreadsheets for benefit-cost analysis. We use pivot tables to crosstab and correlate data.*
- *Excel.*
- *B-C analysis spreadsheets.*
- *Database and CAD for collision diagrams.*
- *Accident database, accident plots, equation for determining # of accidents per million entering vehicles.*
- *GIS.*
- *None at this time. / OOCEA utilizes the FDOT Crash Analysis Reporting System through coordinated with the proper FDOT staff member.*

Q17. Please describe any crash analysis software tools currently being developed or being considered for development.

As shown in Table 5-14, the following tools were being developed or being considered for development: the Accident Reporting System (ARS) in Manatee County; a crash system in Miami-Dade County; a system for converting the existing database to the new crash report form in Palm Beach County, Alachua County, and the City of Gainesville; a web-based system in Sarasota County; and a revised WebCDMS version for Hernando County.

Table 5-14: Crash Analysis Software Tools Currently Being Developed

- *ARS is a GIS Web Based Crash Data Management System.*
- *Crash Data Base Management System with the University of Florida.*
- *None, though we are converting our existing software to be compatible with the new crash forms.*
- *TOA's WebCDMS.*
- *We are updating our system for to match the 2011 crash form as well as provide improved search functions.*
- *Web-based crash analysis.*
- *System under Q15 is being upgraded to add current data plus convert to current report format.*
- *CDMS revised for Hernando County.*
- *Electronic accident reports. This is presently being used by the Sheriff's Department other law enforcement agencies to come on line at a later date.*

Q18. Can we contact you to find out more about the software tools?

As shown in Figure 5-4, about half of the agencies indicated that they could be contacted to find more about the software tools. Over 43% did not have developed tools and the remaining 8% did not want to be contacted.

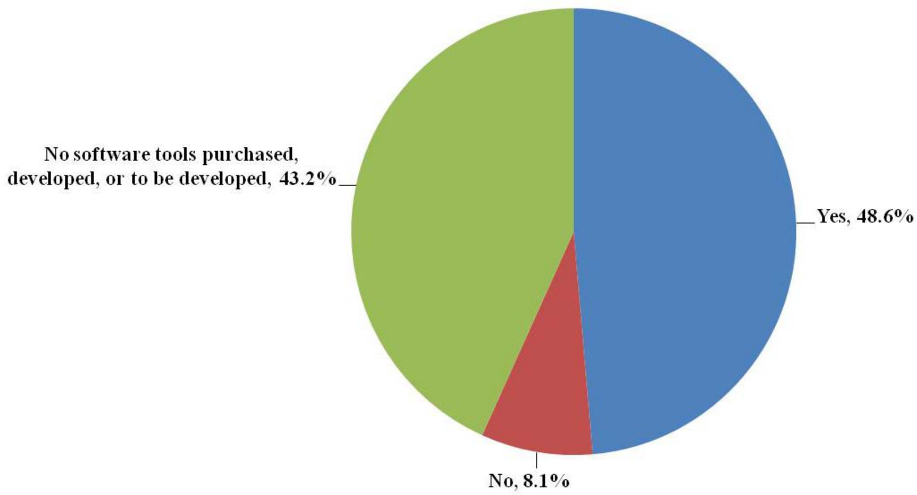


Figure 5-4: Preference of Local Agencies on being Contacted

5.5 Crash Analysis Standardization

Q19. Crash analysis method and procedure should be uniform across the state.

As shown in Figure 5-5, over 70% of the responding agencies either agreed or strongly agreed in standardizing crash analysis procedures across the state. About 25% of the agencies were neutral while the rest disagreed. Therefore, similar to the responses from the districts, there was a general agreement to standardize crash analysis across Florida.

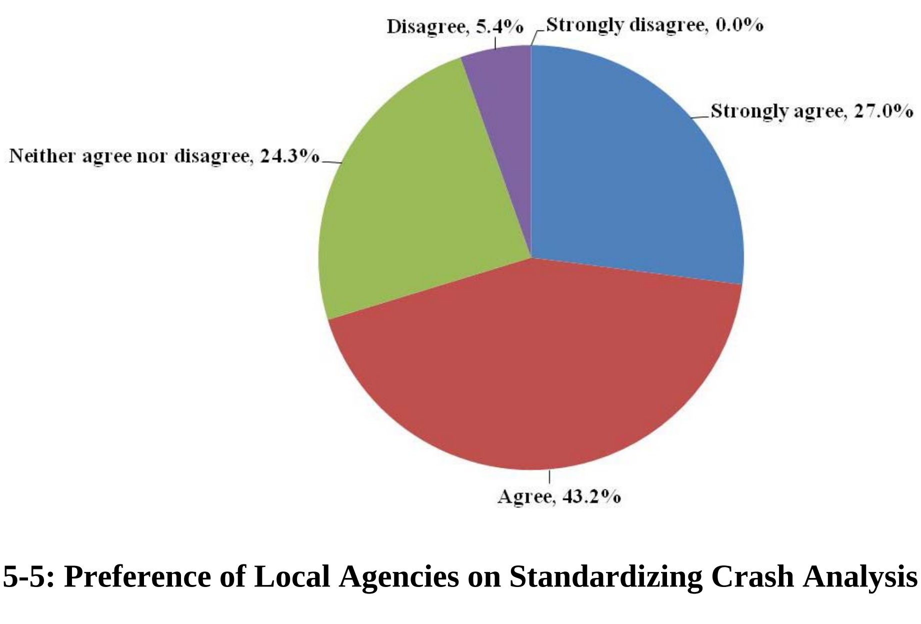


Figure 5-5: Preference of Local Agencies on Standardizing Crash Analysis Methods

Q20. Please qualify your response to the above question.

Table 5-15 provides the local agencies' several notions for the idea of standardizing crash analysis. The following are some of the justifications:

- The uniform process would allow a standard statewide methodology for crash analysis.
- The standardization process would be beneficial when applying for grants.
- The uniform method would help compare the expected and abnormal crash patterns.
- The uniformity of any analysis method allows for someone not related to the analysis to understand the results.
- The standardized methods should be broad enough to encompass most situations.
- Consistent crash analysis methods will provide cost effectiveness, ensure consistency in results, protect analysts from potential liabilities and result in consistent, predictable, and repeatable results.

The following are some of the opinions that discourage the standardization process:

- Determination of the method should be dependent upon the case by case basis and cannot be standardized.
- There is too much inconsistency from agency to agency.
- The same methods and procedures might be very expensive for rural counties compared to urban areas.
- The standard procedure might not work well for all applications/ problem types.
- It is difficult for all agencies to have access to the same data.

Table 5-15: Notions for the Idea of Standardizing Crash Analysis

- *A uniform Crash Analysis System will result in statewide crash tools methodology standard.*
- *I agree there should be standard procedures and tools available; however, the determination of the method should be dependent upon the case by case basis.*
- *It would be beneficial if the method and procedure were uniform to put everyone on a level playing field when applying for grants.*
- *I'm sure there are many methods being used to review crash data that are effective.*
- *Crash analysis standardization is important in order to be able to compare figures and types (expected values 7 abnormal crash patterns).*
- *I feel there is too much inconsistency from agency to agency. FDOT typically reviews only long form crashes when analyzing crash locations.*
- *Since all jurisdictions depend in one way or another on state funds to assist with projects, it would seem equitable if we all evaluated our safety projects similarly and were able to compete for grant funds based on those results.*
- *Our County is a very rural County, and the same methods and procedures may be very expensive for us compared to urban areas.*
- *Sometimes, when an application tries to work for all occasions/situations, it may not use work well for all uses.*
- *I do not believe a specific agency (State) should mandate a specific analysis method or procedure. Local agencies must maintain autonomy.*

Table 5-15 (Continued): Notions for the Idea of Standardizing Crash Analysis

- *When the DHSMV changed the crash reports again as in the past if bought our crash management system to a standstill. We were unable to obtain data or run analysis for months. As no one was addressing the issue, we proceeded on our own to go with the Web based Crash Data Management System (WebCDMS) developed by Tindal Oliver and Associates in Tampa. As this was an unbudgeted item, we had to request funs to resolve the issue so we could again have crash data to support our operations.*
- *Agree.*
- *I think the state should produce guidelines which include analysis methodologies based on statewide data and provide the technical assistance and training to local agencies to help them implement these guidelines but they should not be standardized. There are plenty of standards already.*
- *Would be beneficial for consultants.*
- *As consultants and designers, we must do everything reasonable to provide a safe travel way.*
- *FDOT SPECIFIED PROCESS CAN BE RESTRICTIVE IN IMPLEMENTING NEW IDEAS. HAVE A PROCESS, BUT, DO NOT MANDATE.*
- *Would provide more uniformity and level of confidence of analysis.*
- *Consistent crash analysis methods will provide cost effectiveness, ensure consistency in results, protect analysts from potential liabilities and result in consistent, predictable and repeatable results.*
- *As long as methods and procedures are broad enough to encompass most situations.*
- *I depend on the geographic and human factors.*
- *If state funding is based on crash numbers or rate, the analysis should be uniform. Short form crashes (property damage only) are not typically collect and entered into the data base by the state and that leaves a large description between what the state reports and the actual crashes. Often time the difference between a minor fender bender and an injury crash is a small matter. We need to know what all the crashes are for proper evaluation.*
- *Uniformity will allow us to compare the state accidents per VMT to our local and regional/county accidents for VMT. This gives us an apple to apple comparison as well as helps us establish a goal to develop programs on.*
- *Be nice if it is uniform.*
- *Compliance to a standard provides transparency to the public.*
- *Uniform crash data input and retrieval requirements need to be made uniform in real-time GIS format (i.e. Google Maps) and password protected.*
- *Ability to have better reporting, node assignments, priority of improvements, reduction of crashes due to analysis and implementation.*
- *It would facilitate comparative analysis and allocation of funds.*
- *While uniform could be good, if uniform does not provide the detail the locals want, it may not work.*
- *Having reviewed crash data from both the City of Lakeland, FDOT and Polk County there are wide discrepancies in data collected*
- *The uniformity of any analysis method allows for someone not related to the analysis to understand the results. When different methods are used then implicit instructions are needed to keep user error from becoming abundant.*
- *Every local government needs the ability to implement methods they need for their County/City.*
- *Treating similar situations with similar improvements.*
- *Escambia County of receiving crash data is consistent with FHWP & FDOT.*
- *I don't know enough about crash analysis to form an opinion on this topic*

Table 5-15 (Continued): Notions for the Idea of Standardizing Crash Analysis

- *Generally agree for this would allow for consistency between all the local and state agencies that are affected.*
- *A single analysis method is not valid across all problem types. Fatal crashes are often classified as "all others" and do not lend themselves to uniform evaluation methods and obvious engineering fixes. For example, after exhausting all the typical assessment methods to better understand fatal crashes in Seminole County during my time as a consultant, we found good results with a socioeconomic review of the people involved in the crashes. The identified corrective measure--better driver education in the local high schools--was not identifiable through engineering analysis. The "after" analysis found a 30% reduction in crashes and a 40% reduction in traffic citations among the target audience.*
- *The procedure will need to be based on the information available / needed. Doubt that all agencies will have access to the same data.*

Q21. The newly released Highway Safety Manual or HSM should be adopted as standard for crash analysis for all agencies in the state.

As shown in Figure 5-6, about 43% of the responding agencies were neutral on the proposal to adopt the HSM as a standard for crash analysis. About 46% either agreed or strongly agreed, while the rest disagreed. Therefore, similar to the responses from the districts, a significant percentage of local agencies are reluctant to adopt the HSM as a standard for crash analysis.

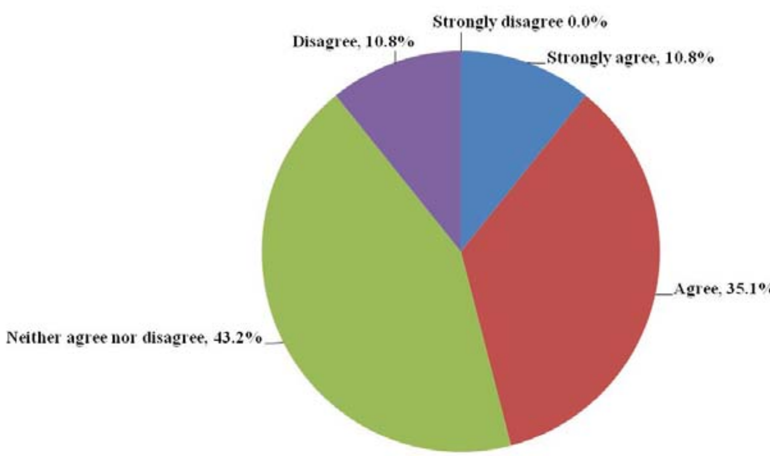


Figure 5-6: Preference of Local Agencies on Adopting the HSM as a Standard

Q22. Please qualify your response to the above question.

As shown in Table 5-16, there were different views about the statewide adoption of the HSM. Some of the responding agencies are supporting the HSM adoption as it provides the guidelines and specific procedures for conducting crash analysis. Another strong reason to adopt the manual is to maintain consistency in the policies and procedures for evaluations. Some agencies prefer to consider the HSM as a standard, mandating its adoption; while some agencies prefer to have the HSM only as a guide as the HSM analysis is too cumbersome for most local agencies. One agency wishes that the HSM adoption will lead to some initiative to set aside local funds to pursue safety projects. If the manual is to be adopted, a few agencies want it to be provided free of charge due to budget constraints.

A considerable number of agencies do not wish to adopt the HSM for several reasons such as the lack of analysis of limited access facilities and the lack of Florida specific crash reduction factors. It is observed that the research foundation for the conclusions in the HSM is hampered by the lack of data. There are also several agencies that are unfamiliar with the manual to provide a response.

Table 5-16: Views about Adopting the HSM

- *Agree with Florida modification to our local need when applicable.*
- *We need guidelines and specific procedures/standards to conduct crash analysis, similar to traffic operations. It gives more value to the crash analysis and it will be better accepted by the industry.*
- *Have not seen the HSM.*
- *As you're aware, the HSM introduces a science-based technical approach used for safety analysis. I've found crash modification factors and the predictive method to be useful. With that said, I'm undecided that the HSM should be an adopted standard.*
- *I think it should be, however, I'm not familiar with the new manual yet.*
- *Don't really know very much about the Highway Safety Manual to agree or not agree.*
- *Having reviewed some parts of the HSM I believe it will be adopted eventually. I only hope it will lead to some initiative to set aside local funds to pursue safety projects.*
- *I have not reviewed it, but as stated above the methods and procedures may be too costly to implement in rural areas.*
- *I have not reviewed it in detail yet.*
- *If this is adopted, it needs to be provide free of charge to local agencies. Our budgets are cut every year and we have no funds to purchase the manual.*
- *Agree.*
- *I like the Highway Safety Manual, but it still has some flaws. Nationally, the manual was developed as only a guideline for safety analysis and not a standard. I worry about repercussions to local agencies that have limited means if they don't implement the HSM if it becomes a statewide standard. I think it should remain as intended which is a guideline for professionals in crash analysis.*
- *HSM provides a good basis for analysis and design.*
- *You cannot make a safety feature which is applicable in the northern climates and also applicable in the southern regions.*
- *Provide as standard, but, do not restrict that has to be only "standard".*
- *Have not read the HSM to form an opinion.*
- *The HSM is lacking in the analysis of limited access facilities. Additional crash reduction factors are needed for Florida. We have requested the Interchange Safety Analysis Tool from FHWA and they use a predictive crash analysis method to test before and after configurations but this tool is very time consuming and we have less confidence in the results. However, use of standardize software and tools cannot replace thoughtful engineering analysis and this needs to be made clear in the guidance that software is one tool, but the most important tool is the space between your ears.*
- *As minimum standard.*
- *I have not had an opportunity to look at it.*

Table 5-16 (Continued): Views about Adopting the HSM

- *The Manual is a good guideline, but should NOT be a mandated process. The HSM analysis is too cumbersome for most local agencies. Local agencies typically do not have the budget or expertise to use the Manual. And full analysis as presented in the HSM is not necessarily needed for most crash evaluation and improvement projects. It is a tool that CAN be used but should NOT be required.*
- *It is a good standard.*
- *Compliance to a standard provides transparency to the public.*
- *Still need to complete review.*
- *Always depends on the environmental /community factors*
- *I have not studied this manual.*
- *Have not used the manual.*
- *It could be the standard or it could not be. I think it should be determined by several well-versed crash analysis engineers and/or statisticians.*
- *Should be left to local government to decide their needs.*
- *This would help with similar situations are treated in a uniform way.*
- *I agree with the above.*
- *I don't know enough about crash analysis to form an opinion on this topic.*
- *Agree. Adopting this manual would maintain consistency in the policies and procedures for evaluation the accidents that have occurred.*
- *I was on the NCHRP panel that developed the HSM, so I understand its limitations, which go beyond the ones noted in my answer to Questions 20. For example, many of the corrective measures routinely taken by traffic engineers to address safety concerns do not have adjustment factors in the HSM because of a lack of data upon which to base such factors, not because they have no impact. For example, there are no research data on the impact of travel speeds or lane width, so these variables in roadway design are ignored by the HSM. However, it would be a stretch to say they have no impact on safety. The fundamental flaw of the HSM is that the research foundation for its conclusions is hampered by the lack of data.*
- *Same as Q20 - an agency may not have access to the required information to use the HSM.*

Q23. FHWA has recently released a new safety analysis software system named SafetyAnalyst and FDOT is one of the sponsors of the development of this system. Do you agree that your agency should take advantage of this system?

As shown in Figure 5-7, about two-thirds of the responding local agencies either agreed or strongly agreed to take advantage of SafetyAnalyst, 34% were neutral, and a minority (i.e., 3%) disagreed. Thus, in contrast to the districts' responses, it can be concluded that there is a motivation to adopt SafetyAnalyst throughout the state.

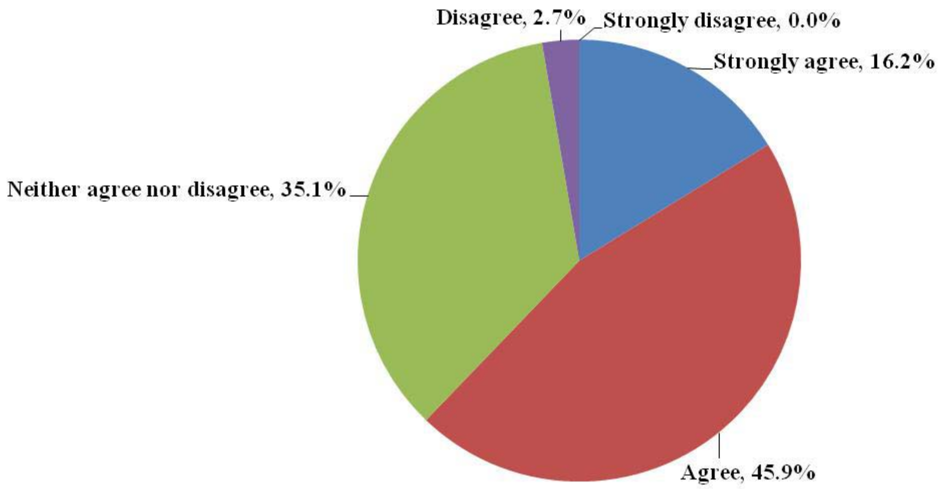


Figure 5-7: Preference of Local Agencies on Adopting SafetyAnalyst

Q24. Please qualify your response to the above question.

Table 5-17 gives the local agencies' views on SafetyAnalyst adoption. Most of the agencies indicated the need to take advantage of SafetyAnalyst for safety analysis while a few mentioned that they did not have the opportunity to go through the software. The system is considered to be too cumbersome for most local agencies which typically have resource constraints (both budget and manpower). For extensive adoption, the agencies wish the software to be provided free of charge along with low cost training tools.

Table 5-17: Views about Adopting SafetyAnalyst

- *Lake County has no knowledge of the software system yet.*
- *It would be helpful.*
- *I would like the county to take advantage of it, if I had access to the data it requires.*
- *Not familiar with SafetyAnalyst. Currently, I'm using HiSafe software (HSM).*
- *I agree, however, I need to know more.*
- *Don't really know much about the program to agree or not agree.*
- *Having a ready-made solution will be very useful in getting safety studies off the ground here.*
- *Have not reviewed the software.*
- *I have not seen any analysis of how well it works.*
- *I am not aware of this.*
- *I cannot have an opinion of software that has not been made available to local agencies.*
- *Agree.*
- *The system needs to be provided free to local agencies and low cost training needs to be provided. But there should be no requirement to use the application.*
- *Consultants doing work for the Department would enjoy also having this software at our disposal.*
- *My office responds to the requirement on our clients.*
- *Another technique to get folks to think!*
- *I am not familiar with the software and therefore cannot offer an opinion at this time, but I support the use of proven, standardized analysis by all agencies.*
- *Have not yet evaluated SafetyAnalyst with sufficient detail to apply in our projects yet. However, use of standardize software and tools cannot replace thoughtful engineering analysis and this needs to be made clear in the guidance that software is one tool, but the most important tool is the space between your ears.*
- *As a safety professional and consultant I would like all agencies using the same software.*
- *Improvements on safety analysis.*
- *However the Safety Analyst system is too cumbersome for most local agencies. Local agene ices typically do not have the budget or the manpower.*
- *I have not had an opportunity to look at it.*
- *Have never used it.*
- *Compliance to a standard provides transparency to the public.*
- *Even if State or Agency has redundant system, use of FHWA system should be used. Further, both/all systems should be compatible at least in some basic data translations (i.e. Location, type of record, fatalities, Dollars). Locations should keep record of existing safety measures (i.e. standard shoulder, guardrail present, posted speed, etc.).*
- *Not familiar with software.*
- *Cost is prohibitive.*
- *Lack of staff and funding in this economy.*
- *Not aware of the program.*
- *There should always be congruence with the FHWA and FDOT on analysis procedures.*
- *Would need to see more information.*
- *This is the first we have heard about this. FDOT needs to do a better job at getting the word out.*
- *We should certainly look into it.*
- *Agree. Adopting this manual would maintain consistency in the policies and procedures for evaluation the accidents that have occurred. In addition, being able to have access to this system would eliminate some of the problems encountered due to not receiving all the accident report forms from the respective agency.*
- *SafetyAnalyst is a good tool for identifying system-level issues but is probably too coarse for smaller cities.*
- *Any tool should be considered if it will help identify safety issues and potential solutions.*

Q25. A standard web-based GIS application should be adopted for crash analysis for all agencies across the state.

As shown in Figure 5-8, about 62% of the responding agencies either agreed or strongly agreed on the state-wide adoption of a standard web-based GIS system for crash analysis, 27% were neutral, and about 11% either disagreed or strongly disagreed on adopting a standard web-based GIS application. Therefore, similar to the responses from the districts, local agencies are keen on adopting a state-wide standard web-based GIS application for cash analysis.

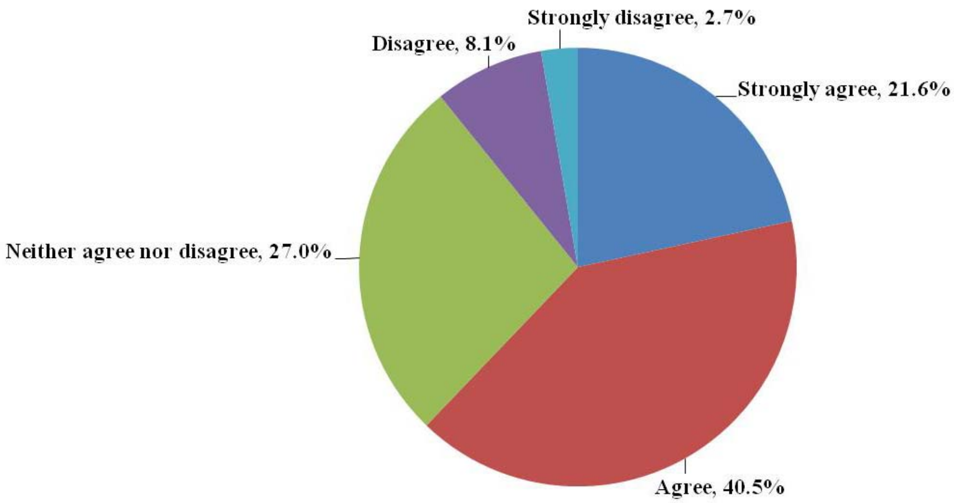


Figure 5-8: Preference of Local Agencies on Adopting a Standard Web-Based GIS System

Q26. Please qualify your response to the above question.

Table 5-18 provides the agencies' views on adopting a standard web-based GIS system. Agencies consider GIS applications to be efficient, accurate, and manageable than the existing non-GIS methods. Many agencies indicated that the GIS system would enable engineers to spatially map crashes, spatially identify crash locations, and produce reports showing traffic crash statistics. A web-based GIS system is believed to increase the accuracy of crash data and the speed with which crash data can be obtained. To be more useful to local agencies, adequate training has to be provided. Moreover, the data within the GIS system must include both short and long report forms.

Supplementing the adoption of a GIS system, a statewide standard template with additional flexibility to local agencies is recommended. A few agencies recommended that all applications should have compatible GIS format and a standard system would streamline the crash analysis procedures. Even though most agencies embrace the idea of a standard GIS application, many agencies do not want to make its adoption mandatory. A couple of agencies questioned the need to have a web-based GIS system as opposed to an application on local server. The agencies are concerned about the costs associated with the tool in addition to the resources to be allocated. One agency felt that a standard GIS system could restrict some of their employees. Further, the non-uniform nature of data being collected and analyzed is considered to be a hurdle to standardize the GIS applications.

Table 5-18: Views about Adopting Standard Web-Based GIS System

- *Yes, Yes please.*
- *GIS based application will help to identify the hot spot locations, also, will help in the analysis. / St. Lucie TPO is currently working on developing an on-line Crash Database System, which will help to identify the crash locations and act as a crash data clearing house for this area.*
- *Web based is a good idea.*
- *Manatee County has a web-based GIS application. Unfortunately, due to budget restraints we may or may not be able to implement the program.*
- *GIS is a good tool for spatially identify, record and monitor crash locations / patterns / numbers.*
- *I work with GIS and like the program. It will enable engineers to see crashes in aerials. Produce reports showing traffic crash stats. Allow different users access to the crash data. I am currently collecting data in a shape file using XY coordinates from FHP and manually creating XY coordinates from reviewing the crash reports.*
- *This is the way things are headed because it is more efficient, accurate, and manageable than the methods in place now. Just a matter of time.*
- *I don't think a web-based application would be beneficial to see everything for surrounding areas. I don't think it would benefit the local agency to do their job any better.*
- *I do not see the advantage of being web based versus on our local server, except that we will need to pay someone to maintain/host our data.*
- *Based on the short time we have been using the Web based Crash Data Management System (WebCDMS) developed by Tindal Oliver and Associates this would appear to be the best method if it was a state wide system that all agencies could use.*
- *Agree.*
- *We have a system that already works for us. It included local and short from crashes. Most local agencies use both. I know the state is working on a statewide system but it may only include long form crashes. Any statewide system needs to include both local and short form crashes to be useful to local agencies. Also, no agency should be required to use it.*
- *This would stream line our analyses.*
- *The actual location of the crash can be better defined and investigated when they can be accurately located.*
- *We have smart folk in "agency" transportation jobs that do not need to be restricted.*
- *For standardization of analysis.*
- *It would be helpful to have a standard template, but also to have flexibility to modify as needed to explain data and create custom thematic maps. However, use of standardize software and tools cannot replace thoughtful engineering analysis and this needs to be made clear in the guidance that software is one tool, but the most important tool is the space between your ears.*
- *No experience.*
- *Who is going to fund this? And will it include ALL crash data? If it doesn't use short form data, it will not be much use to counties.*
- *This would make it easier to identify locations of accidents and be able to analyze trends and identify hot spots.*
- *Convenient.*
- *Not all agencies would have staff to operate.*
- *All applications should have compatible/universal GIS format.*
- *But all agencies may not have the funding to accomplish the adoption within a set time period.*
- *As a visual representation of crashes can be most beneficial for reviewing corridors.*

Table 5-18 (Continued): Views about Adopting Standard Web-Based GIS System

- *Need additional information; it may be helpful if it includes all crashes reported in the municipality not just long-forms on State roads.*
- *Some companies do not use GIS applications. This would be a good implementation if training was also provided.*
- *Should be left to local government to decide their needs and what they can afford.*
- *There should be a standard for using traffic crashes to determine the need for safety improvements.*
- *A standardized application, if simple enough to use, would help in crash analysis.*
- *GIS would be OK but would need to make sure the database is compatible with the Agencies software version and license agreements.*
- *Data are not uniform, or is uniformly bad. It would be useful to have such a tool, of course, but not sufficient to meet all needs.*
- *A web-based GIS system will increase the accuracy for identifying where crashes have occurred and will increase the speed with which crash data can be obtained.*

Q27. A shared, standard software system for crash analysis across the state can help:

As shown in Figure 5-9, there was an agreement that a shared, standard software system for crash analysis could allow statewide training. However, there was less agreement on the following: potential to save on software development, licensing, and maintenance costs; ability to provide better control of crash data; and ability to protect agency from legal liability. Moreover, minimizing software development and maintenance costs received greater agreement from the local agencies than minimizing licensing cost. These findings are very similar to the conclusions from the districts survey.

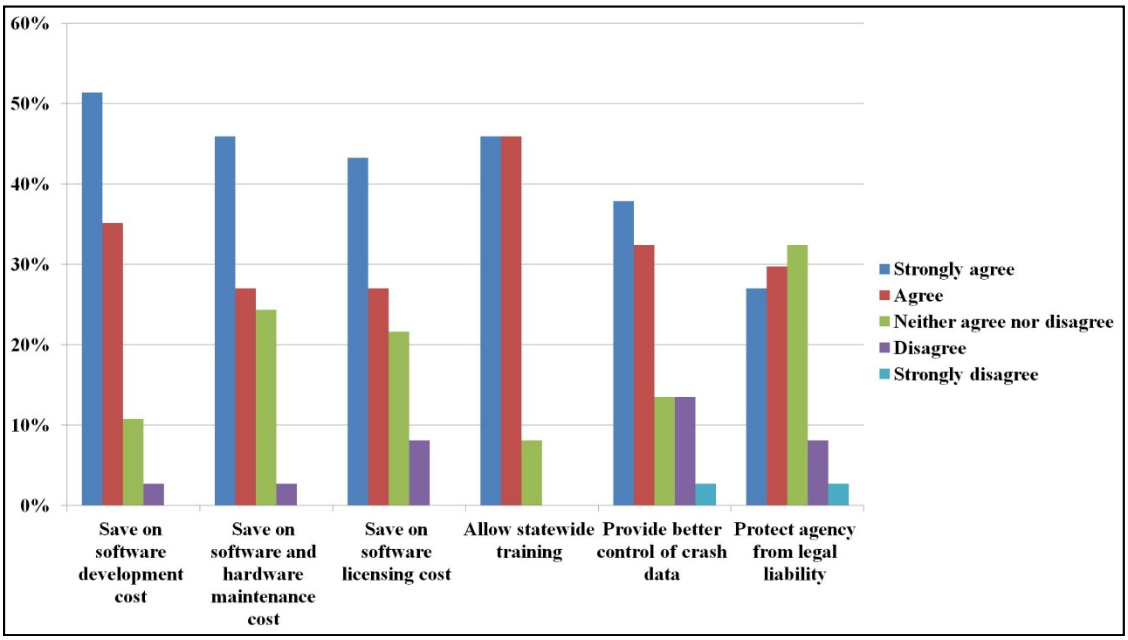


Figure 5-9: Preference on Having a Shared, Standard Crash Analysis System

Q28. Please list any conditions unique to your area that may require special consideration in a standard crash analysis procedure.

Table 5-19 lists the conditions unique to each agency that require special consideration in a standard crash analysis procedure. These specific conditions include:

- lower traffic volume and crash rates in rural and agricultural areas,
- analysis of crashes involving elderly people, bicyclists, and pedestrians,
- querying crashes by weather conditions and time of day,
- lack of short-form crash reports,
- differences between the County Sheriff's and City's systems as to the new crash data form,
- identification of location clusters with aggressive driving or DUI. Such enforcement tend to be more demographic and land use driven,
- maintenance of a coordinated database as multiple police jurisdictions provide crash reports,
- need for a comprehensive data that includes crashes on local roads, and
- need for special attention on horizontal curves that do not receive nodes.

Table 5-19: Conditions Requiring Special Consideration in Standard Crash Analysis Procedure

- *This area is semi-agricultural in nature. The volumes are not very high and have a low crash rate too at many locations.*
- *We don't have any special considerations.*
- *Elderly / Bicycles.*
- *Rural Agricultural community.*
- *Number of older age drivers exceeds the normal parameters.*
- *Any standard crash analysis system needs to use long form and short form data. Also, if local agencies have sufficient data and resources to develop their own crash analysis methodologies specifically suited to their locale they need to be allowed to do so.*
- *Weather conditions and time of day*
- *Spatial analysis tools to identify clusters of crash data that are attributed to aggressive driving or alcohol related crashes. Enforcement to discourage these behaviors tend to be more demographic (younger drivers and transient populations) and land use driven (close proximity to bar districts).*
- *Rural and Industrial (phosphate mine, Orange grow and farming).*
- *1. Include all crashes, including short forms. 2. Provide funding for personnel salaries.*
- *Can't think of any at this time*
- *Multiple police jurisdictions providing crash reports throughout the county require a coordinated data base.*
- *Protection or limited liability should be extended to all professionals who use system correctly (NOT just the Agency).*
- *Special events*
- *Same as Q26; would like to see all crashes included. Local area with high incidence of bike/pedestrian crashes. Mutlimodalism is high in the City; need comprehensive data that includes crashes on local roads.*
- *Many horizontal curves that do not receive nodes. Crashes may show at intersection instead of curve 1000 feet away.*
- *Differences currently exist between the county sheriff and City as to a new crash data system and who has authority in controlling how the data will be entered.*
- *Every intersection is different and should be allowed Engineering Judgment by the local agency.*

5.6 Crash Analysis Documentation

Q29. Please list any safety related documents your agency has developed.

As shown in Table 5-20, local agencies have developed several safety related documents. Three local agencies (Lake County, the City of Petersburg, and the Orlando-Orange County Expressway Authority) shared their documents and are discussed in Section 5.10.

Table 5-20: Developed Safety-Related Documents

- *Lake County traffic calming device guideline; Golf Cart Community guideline; TOA Crash Database user manual*
- *We, St. Lucie Transportation Planning Organization (TPO), are developing an on-line Crash Database System for the entire St. Lucie County. During the process of development, we will be inviting the law enforcement agencies' staff related to crash data to provide their input. The state of the art website will be a clearing house for all the crash data needs in Port St. Lucie, Fort Pierce and unincorporated St. Lucie County area and will help us to identify crash hot spots. After the completion of the on-line Crash Database, we will be conducting workshops to provide hands-on training on the St. Lucie TPO's on-line Crash Database System. We will also provide privileged access to our local partners and local law enforcement agencies to utilize our database for their crash data needs.*
- *Safety study reports for high crash locations.*
- *Fatality Review Form.*
- *2007 Countywide Crash Report.*
- *Not aware of any at this time would need to check with police department.*
- *Not sure about how many from other division. We have standard requirement for MOT.*
- *Number of students crossing the roadway to and from school. Warrant to determine which traffic control device is to be installed.*
- *OOCEA has developed Quarterly Accident Reports. OOCEA includes a section in the OOCEA Traffic and Statistics Manual that summarizes the accidents for the entire year.*
- *Pedestrian Safety Action Plan.*

Q30. Can we contact you to obtain these documents?

About 38% of the agencies agreed to share their safety related documents. A summary of the received documents is given in Section 5.10.

5.7 Training

Q31. FDOT should provide statewide training on crash analysis for local agencies.

As shown in Figure 5-10, over 90% of the responding local agencies either agreed or strongly agreed to provide statewide training on crash analysis, while the remaining were neutral. Therefore, there was an agreement to provide statewide training on crash analysis.

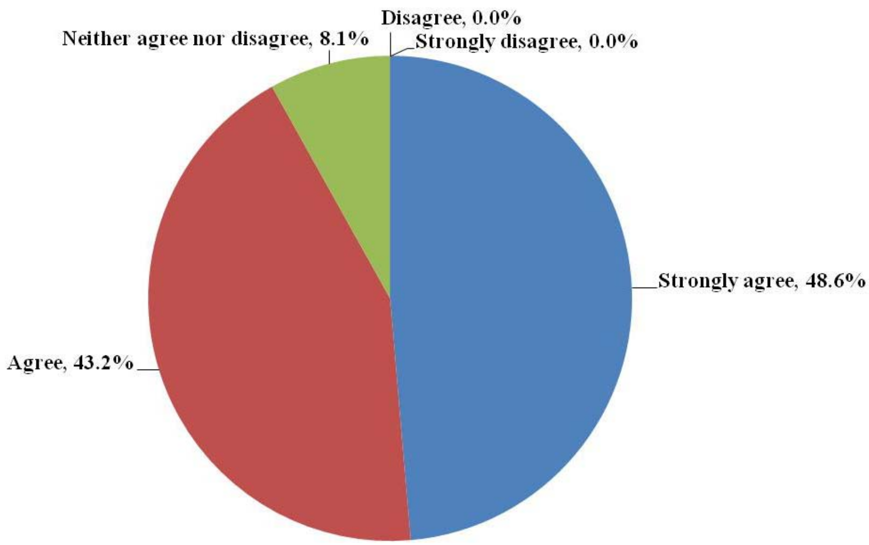


Figure 5-10: Preference on Having a Statewide Training on Crash Analysis

Q32. If FDOT is to provide statewide training, in which specific areas of training would you like to see included?

Table 5-21 lists the specific areas of statewide training that were of interest to the agencies. The following specific areas could be included in the statewide crash analysis tools:

- filling out the crash reports (for e.g., crash types and first harmful event),
- generate site specific reports and view actual crash reports,
- include hands on training courses,
- use new crash analysis software tools,
- provide a thorough evaluation and engineering solutions,
- interpret data using statistical methods and applications of crash reduction factors,
- use of HSM, IHSDM, and SafetyAnalyst,
- conduct field reviews,
- an overview on the type of data to be collected by the local agencies, benefit/cost analysis,
- use of GIS applications for crash analysis, and
- methods to improve safety of bicyclists and pedestrians.

Table 5-21: Suggested Areas of Statewide Training

- *Statewide Crash Analysis tool used for local govt.*
- *Crash Analysis. Question is not very clear, may be needed to elaborate a little.*
- *Crashes involving bicyclists and pedestrians.*
- *1. How to produce site specific reports? 2. How to view the actual crash reports?*
- *Hands on training courses.*
- *How to use the new software and provide a thorough evaluation.*
- *Mitigation measures.*
- *It will depend on the system used.*
- *Software, engineering, solutions.*
- *Use of the HSM; Use of IHSDM; Use of Safety Analyst.*
- *All areas.*
- *Training will provide more uniform reporting.*
- *Webinar best.*
- *Analysis of data and use of software.*
- *Interpretation of data using statistical methods / appropriate application of crash reduction factors / use of short and long forms to determine contributing causes in site specific crash studies.*
- *Data analysis, discerning patterns to identify safety issues, selecting cost effective solutions/counter measures.*
- *Studies and field reviews.*
- *Use of the HSM.*
- *At FDOT Fort Lauderdale district offices (I believe District 4).*
- *Safety improvement procedure.*
- *Highway Safety Manual or HSM.*
- *Yes.*
- *Crash reports.*
- *Selection and application of counter-measures.*
- *Law Enforcement, Garbage in-Garbage out. Especially crash types.*
- *Establish standards as to what type of data should be collected by all agencies.*
- *Definitely benefit/cost analysis.*
- *Would need to see more information.*
- *Traffic Crash Analysis.*
- *To make usage of GIS application.*
- *Crash analysis and remediation.*
- *Process and Procedures to evaluate the accidents.*
- *Filling out the crash report.*

Q33. Please rank your preferred mode of delivery for such training from 1 for the most preferable to 4 for the least preferable.

As can be seen in Table 5-22, a majority of the responding local agencies prefer face-to-face meeting over other modes of delivery for statewide training. Next to face-to-face meetings, web based training and webinars are of equal preference to the local agencies. A few agencies also prefer instructional materials for training.

Table 5-22: Ranking of Preferred Mode of Delivery for Statewide Training

Face-to-Face Meetings	Webinars	Online Web-based Training	Other (please specify)
1	2	3	4
2	3	1	4 (Documents)
3	1	2	4
1	2	3	4
1	3	2	4
1	3	2	4
3	1	2	4
3	1	2	4
2	1	3	4
1	3	2	4
1	2	3	4
1	2	3	4
1	3	2	4
3	1	2	4
1	2	4	3 (Mailed out training material)
4	1	2	3 (Printed distribution)
3	2	1	4
1	3	2	4 (Print materials)
3	1	2	4
3	1	2	4 (Classroom)
1	3	2	4
3	2	1	4
1	3	2	4
1	2	3	4
4	1	2	3
1	3	2	4
3	1	2	4
2	4	3	1 (Workbooks)
1	2	3	4
2	1	3	4
1	3	2	4
1	3	4	2 (Seminar)
1	2	3	4
1	3	2	4
1	2	3	4
1	3	2	4 (Book)
3	2	1	4

5.8 Working with FDOT

Q34. The following would characterize our working relationships with FDOT District Office in efforts to improve traffic safety:

As shown in Figure 5-11, about 68% of the responding local transportation agencies work with the FDOT District Office only when a situation arises, about 22% hold regular meetings with FDOT for coordination of efforts, 8% hold meetings with CTST, while about 3% could not recall a case in the past six months. The majority of local agencies were observed to respond reactively to safety related problems.

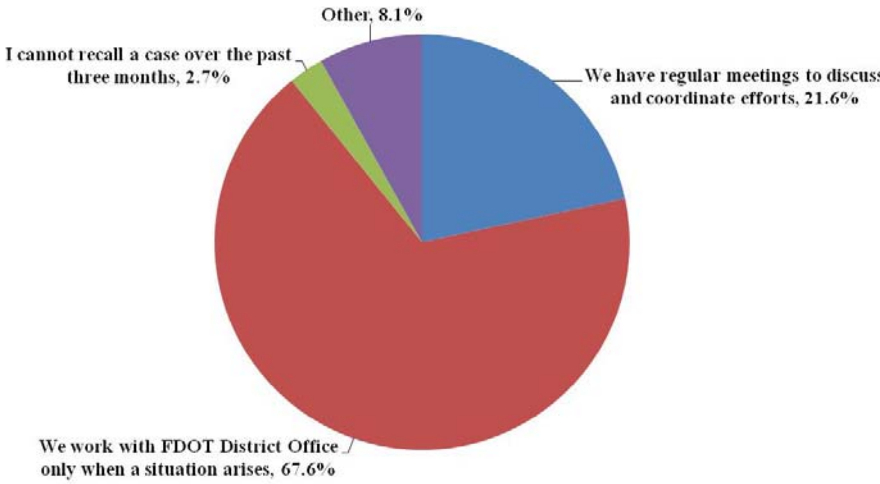


Figure 5-11: Working Relationships between Local Agencies and FDOT District Office

Q35. To improve traffic safety in our area, I believe our agency should:

As shown in Figure 5-12, over 62% of the agencies were already working closely with the FDOT District Offices, 13.5% wish to work more closely with FDOT district offices, 13.5% would like to get trained by FDOT, and the remaining 11% desire to work much more closely. Thus, the majority of local transportation agencies either collaborates or wishes to collaborate with the FDOT District Office.

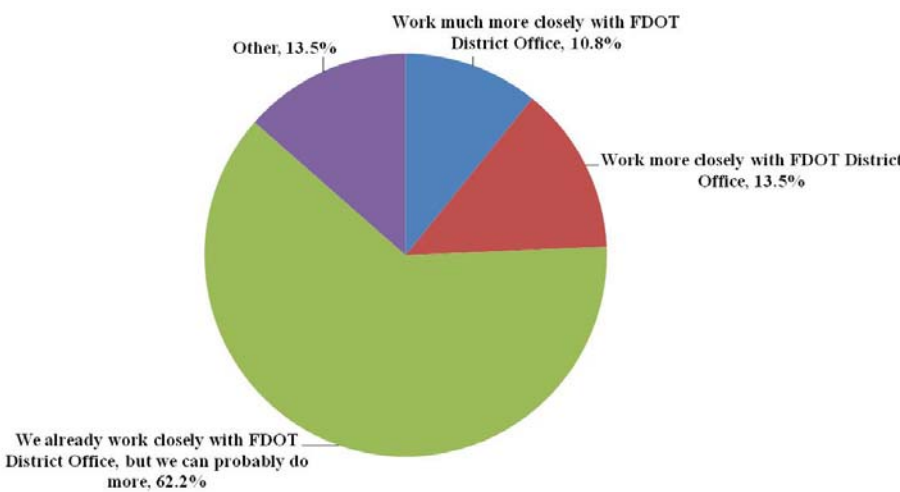


Figure 5-12: Ways to Improve Traffic Safety in Local Agencies' Area

Q36. What are some of the barriers, if any, that have prevented your agency from working more closely with FDOT District Office to improve traffic safety in your area?

As shown in Table 5-23, there are several barriers that prevented the agencies from working closely with FDOT. The following are the main barriers: the physical distance (i.e., the central FDOT location is far away from some local agencies), staff limitations, restricted access to state-wide tools and training, lack of funding, differences in priorities and concerns, source of most safety money being federal, and time constraints.

Table 5-23: Barriers Preventing Agencies from Working Closely with FDOT

- *FDOT District Office (safety division) is too far. We are located in St. Lucie and FDOT office is in south Broward.*
- *1. Physical Distance - Bartow FL. 2. Busy work schedules - Both County & State's.*
  3. Different Priorities and Concerns. 4. Jurisdictions. 5. Staff Limitations.
- *Lack of funding and personnel.*
- *Staff resources. We are so short-staffed that we cannot successfully provide the basic services requested by the community.*
- *No major problems.*
- *Most safety money is Federal, and Federal moneymakers project more difficult to administer. Also, FDOT data is only long form crash data.*
- *Limited staff and budget.*
- *Regulations and adopted policies and procedures by FDOT. Very inflexible.*
- *Lack of staff, lack of funds.*
- *None. We meet at least once a month with the District office, the local maintenance office and our municipalities to discuss traffic safety and operational issues. We also work with FDOT as the need arises on specific issues.*
- *They tend to handle it and we only become involved at their request.*
- *Too lazy to communicate!*
- *Time and funding.*
- *Funding and training personnel.*
- *Distance of Travel - 130 miles one way (260 mile round trip).*
- *There are no state roads immediately within Doral. we are bordered by SR826, SR836 and the Turnpike as well as US27. when we identify some issue such as striping needs we forward it to someone at the State such as Kim Samson.*
- *FDOT District has only lately started looking and funding off system facilities, but more could be done.*
- *Access is restricted. Once professional is recognized, access and training should be made available to all, particularly professionals.*
- *Lack of local agency staff and time.*
- *We are a small private consulting office. We only get about one project a year and most of them are in very rural areas where crash quantities are not high.*
- *Staff and Money.*
- *To receive notices in training in NWFL.*
- *Distance between our office and District office.*
- *None - we have a very good working relationship with District Seven.*

Q37. I believe the following activities with FDOT District Office will help to improve traffic safety in our area:

As shown in Table 5-24, several activities with FDOT were suggested to help improve traffic safety. More specifically, these activities include: more funding to local agencies, more communication and coordination, training courses, road safety audits, less restrictive policies and procedures, information exchange, pedestrian and bicyclists' safety concerns, Americans with Disabilities Act (ADA) concerns, use of GIS applications, CTST meetings, continuation of the safety summit meetings, development of a localized highway safety plan, and grants to purchase safety related devices.

Table 5-24: Suggested Activities with FDOT

- *Sure with more funding too.*
- *More communication and coordination.*
- *Prioritization of safety-related projects.*
- *More frequent communications regarding local concerns.*
- *Training courses.*
- *A staff-level group with funding. Current groups have the desire but no funding and therefore are not effective in addressing traffic safety problems.*
- *Road safety audits are a great tool to improve safety. However, our limited staff and budget keep us from doing more at this time.*
- *FDOT should be open to suggestions. Adopted policies and procedures should be less restrictive.*
- *In staff and funds.*
- *Coordinated development and production of a localized highway safety plan.*
- *Training.*
- *Make the law enforcement agencies respond with detailed problem notices.*
- *Implementation of crash analysis software that all agencies (small and large) can use.*
- *Better communication and greater coordination.*
- *Marketing thru media campaign.*
- *Quarterly meetings with safety office.*
- *Sign inspections; Pavement Marking Inspections; the ITS signs.*
- *Exchange information / Meeting.*
- *Remove the web based funding applications. These systems are cumbersome and take far too long to input the data required for application.*
- *Training.*
- *D7 Safety Office is very good in offering assistance. Consultant assistance for lane departure crashes is a good example. HSIP funding is a big help.*
- *More of an emphasis on public suggestions. Most citizens don't know how to go about getting in touch with the correct departments when a suggestion/problem arises.*
- *Grants to purchase safety related devices*
- *1. Pedestrian safety. 2. Bike lane usage. 3. ADA. 4. GIS applications.*
- *CTST meetings; continue the safety summit meetings.*

Q38. What assistance from FDOT would help you in your crash analysis?

As identified in Table 5-25, there are several areas within crash analysis where FDOT could assist the local transportation agencies. More specifically, assistance was requested in the following areas: state-wide crash analysis for local government, safety analyses, engineering evaluation, data collection and understanding of data usage, data sharing, updated data of the expected values and abnormal crash patterns, availability of crash reports in a timely manner, funding, crash analysis software availability, training, and support, and training of law enforcement officers to correctly code the crash forms.

Table 5-25: Desired Assistance from FDOT

- *Statewide Crash Analysis for local govt.*
- *Guidance and technical assistance.*
- *Data collection and understanding how to use the data.*
- *Improved Data Sharing - We provide crash data consistently to the FDOT representatives; which require labor and materials. I can't recall the last time FDOT provided Manatee County with similar information.*
- *Updated data of the expected values and abnormal crash patterns.*
- *Assist with the purchase of crash analysis software.*
- *Training, partnering.*
- *Engineering assistance would help to review crash data and identify corrective measures.*
- *Safety analyses.*
- *Training and production of technical manuals with methods specific to the State of Florida to assist in crash analysis.*
- *Guidance on their needs or wants.*
- *Availability of Crash Report in a timely manner.*
- *Require response from fdot if deficiency report on a state road.*
- *Software availability, training and support.*
- *Easy/greater availability of crash data and analysis software & training.*
- *Database and central server for state and local roadways.*
- *Training.*
- *Fund.*
- *Funding to hire consultants to conduct detailed analysis.*
- *Assigned professional to assist in access, training and general use.*
- *Reliable crash record system with reliable data. Consultant assistance for crash analysis and mitigation.*
- *Financial.*
- *Training.*
- *Funding - send $$.*
- *Provide some funding for this analysis.*
- *Sorting GIS crash data applications.*
- *Having access to the current FDOT Crash Analysis Reporting System and Report Printouts would be very helpful in comparing statistics that are reviewed and received to make sure all reporting statistics are accurate and correct.*
- *Training of law enforcement officers in the reporting of crashes and identifying corrective actions.*
- *Assistance is already provided.*

Q39. Please use the box below to provide any additional comments you have.

Table 5-26 provides some additional comments. For example, an agency emphasized the lack of uniform procedures in crash analysis and the need for standardization. Other responses highlighted the issue caused by the newly released crash report form. Data inaccuracy, budget constraints, lack of dedicated staff, and poor coordination were reiterated.

Table 5-26: Additional Comments

- *Thank you for providing the opportunity to participate in the survey. I think right now, the main issue is the lack of standard procedures in crash analysis and we need more guidance.*
- *The Florida - Alabama Transportation Planning Organization is developing a crash tool that seems very useful. It plots the crashes within a certain radius. I believe it distinguishes those involving pedestrians and bicyclists from auto crashes only. Use of the crash tool in developing the TPO's bicycle/pedestrian plan might be a good way to go. Making it available for local governments to use for grant application benefit-cost analysis, for instance, would be helpful.*
- *The new information in FLHSMV's 2011 crash report is causing major problems with our web-based GIS application. Our existing system will need major modifications and may need to be redesigned to process the new crash data. Currently, we're considering commercial software and/or consultants to provide the necessary crash data. Due to budget constraints we may have limited options.*
- *This is a good effort to enhance traffic safety and improve coordination with the State.*
- *I am working to try and improve crash analysis of our traffic data however funds are tight. The problem I have seen with working with DHSMV in regards to reports and data is that they don't make corrections to the reports as needed.*
- *I think FDOT staff has done a great job in working with the local governments on any issues we bring up. In my opinion it is up to the local governments to make this a priority for their citizens and fund a program to deal with traffic safety problems. Until they do so it will be difficult to make any headway in reducing our traffic safety problems.*
- *Thank you for this opportunity.*
- *There needs to be more cooperation with the Cities, Counties, and FDOT is sharing areas of concern on roadway safety issues.*
- *When will the results of this survey be published by FDOT?*
- *I'm not sure if I'm the proper participant to the survey as a whole but have provided response to parts of it that did apply to me. Good Luck.*
- *Thank you for contacting me. Have a safe weekend.*
- *Provide guidelines but do not mandate programs.*
- *Thanks.*
- *The City of St. Petersburg has dedicated staff, funding and commitment to address public safety. However we have not been able to keep up with Police enforcement, even with dedicated funding. Staff time is limited and enforcement operations are conducted on an overtime volunteer basis. We are not however able to get officers to volunteer for OT to conduct operations on a recurring basses. Special attention needs to be directed in this area that would address provisions of dedicated officers for speed, red light running, pedestrian and bicycle enforcement. This would help to directly reduce crashes.*
- *Good interview. Good luck.*
- *This is a new age for government. Less money, staff, and time. Remaining staff works on known, assigned projects; and is afforded little time to analyze crashes to mitigate as new projects.*
- *Standardization statewide should be established for crash reporting to verify the same data is true everywhere*
- *There is a great relationship with our Community Traffic Safety Teams and FDOT. With the cut backs in the funding FDOT needs to find a way to fund safety projects.*

5.9 Key Findings from the Local Agencies Survey

The following are the key findings from the survey of local transportation agencies in Florida. The findings are based on the responses from the 37 local agencies that had completed the survey and might not be representative of the opinions of other agencies.

- The majority of local agencies use 3 years of crash data for performing safety studies.
- The majority of local agencies indicated that in-house staff investigated high crash locations.
- Speeding-related, distracted driving, and intersection-related crashes were of highest safety concerns to the majority of local agencies.
- The majority of local agencies agreed in standardizing the crash analysis method and procedure across the state.
- The majority of responding local agencies use the B/C ratio to select safety improvement projects.
- Funding is often considered as a deciding factor in selecting and prioritizing safety projects.
- Some agencies prefer to consider the HSM as a standard, mandating its adoption; while some agencies prefer to have the HSM only as a guide as the HSM analysis is considered to be too cumbersome for most local agencies.
- Local agencies are interested in adopting SafetyAnalyst. For extensive adoption, the responding agencies wish the software to be provided free of charge along with low cost training tools.
- The majority of local agencies agreed that a statewide standard web-based GIS system should be adopted for crash analysis.
- The majority of local agencies strongly agreed that FDOT should provide statewide training on crash analysis.
- Similar to the opinions of the FDOT districts, face-to-face meetings are by far the most preferable mode of providing training on crash analysis.
- The majority of local agencies work with the FDOT District Office only when a situation arises.
- The majority of local agencies work closely with the FDOT District Office to improve traffic safety.
- More funding to local agencies, more communication and coordination, more training courses, and training of law enforcement officers to correctly report the crash forms are the most important requirements of the local agencies from the FDOT.

5.10 Safety Related Documents

As a follow up to the survey, the local agencies that were willing to share their safety related documents were contacted once again. The following sections give an overview of the documents received from Lake County, the City of St. Petersburg, and the Orlando-Orange County Expressway Authority.

5.10.1 Documents Received from Lake County

The following documents were received from Lake County:

1. *A document highlighting the user's guide for the county's Crash Data Management System.*

2. *A document highlighting the proposed Lake County Board of County Commissioners' Golf Cart Communities Guidelines for the establishment of golf cart communities in Lake County.* The objective of these guidelines was to ensure that the residents and visitors in a designated golf cart community within Lake County have a safe, efficient, effective, and convenient multi-modal transportation system. Another objective was to ensure that the road network provides efficient internal travel connections while providing multi-modal access within the golf cart community.

3. *A document on the traffic calming procedures in Lake County.* The recommended manuals included the Florida Green Book (FGB) and the Institute of Transportation Engineers (ITE) manual "Traffic Calming – State of the Practice". Note that the FGB is the common name for the "Manual of Uniform Minimum Standards for Design, Construction, and Maintenance for Streets and Highways".

5.10.2 Documents Received from the City of St. Petersburg

The City of St. Petersburg has sent a document about St. Petersburg's Intersection Public Safety Program. In fact, the City of St. Petersburg has undertaken numerous efforts, including engineering, education, and conventional enforcement, to enhance safety along its corridors. The conducted efforts could have successfully reduced the overall crashes within the city, but crash statistics showed that intersection crashes (both injury and total) were neither increasing nor decreasing. The reason for this trend was found to be red-light violations. Due to the ineffectiveness of countermeasures in reducing these violations, the Intersection Public Safety Program for automated enforcement of traffic signals was released. The program was developed using the guidance from two relevant sources: "Guidance for Using Red Light Cameras", a joint publication by FHWA and the National Highway Traffic Safety Administration (NHTSA); and "Focus on Safety: A Practical Guide to Automated Traffic Enforcement" published by the National Campaign to Stop Red Light Running.

The released Public Safety Program aimed to achieve three primary goals: enhance safety at St. Petersburg's signalized intersections by reducing the frequency and/or severity of crashes caused by red-light running, provide an additional method of violation enforcement, and raise awareness of safe driving practices in St. Petersburg. The Public Safety Program also provided the methodology and results of the analysis conducted to identify intersections for inclusion in the Intersection Public Safety Program.

5.10.3 Documents Received from the Orlando-Orange County Expressway Authority (OOCEA)

The Orlando-Orange County Expressway Authority has provided several reports, including the traffic data and statistics manual for several years, the quarterly crash summary report for various years. The purpose of the traffic data and statistics manual is to provide a set of data covering traffic volumes, traffic characteristics and toll plaza, and interchange lane configurations for the OOCEA system which includes the toll SRs 408, 414, 417, 429, and 528. The manual also includes important facts such as crash statistics, system lane miles, toll rates, distances between interchanges, and number of toll plazas. The quarterly crash summary report details summarized crash statistics along the OOCEA system roads.

CHAPTER 6
LAW ENFORCEMENT AGENCIES SURVEY RESULTS

An online survey was sent to law enforcement agencies across the state; responses were received from 46 agencies. The survey includes a total of 25 questions covering the following four areas of interest:

1. Selection of enforcement locations.
2. Traffic violations and safety campaigns.
3. Crash reports.
4. Working with transportation agencies.

The following sections summarize the survey results of the questions included in each of these four areas, respectively.

6.1 Selection of Enforcement Locations

Q1. Does your agency regularly focus on specific locations for enforcement of traffic violations?

The majority of the responding law enforcement agencies (about 83%) regularly focused on specific locations for enforcement of traffic violations. This could indicate that most officers monitor locations with relatively high prior records of violations/citations.

Q2. Does your agency analyze crash records to identify locations for enforcement?

About two-thirds of the responding law enforcement agencies analyzed crash records to identify enforcement locations. This indicates that crash analysis was performed to identify enforcement locations, e.g., selecting locations with relatively high frequency of crashes.

Q3. If "Yes", please describe the method you used in the analysis.

As listed in Table 6-1, several methods were used for identifying locations for enforcement.
The law enforcement agencies use one or more of the following methods to identify locations for enforcement.

- citizen complaints
- crash reports compiled weekly, monthly, or annually
- crash analysis mainly based on crash frequency and traffic
- CAD reports
- GIS program
- surveys conducted annually to identify high crash locations and time periods
- review of dispatched calls
- FDOT list of high crash locations

Table 6-1: Used Method in Crash Analysis for Enforcement Locations Identification

- *We take the data received for the Districts and compile them into a crash analysis*
- *Excel spread sheet*
- *Crash data is analyzed by the Neptune Beach Records division*
- *Yearly review of crash reports. Analysis of locations and cause of crashes*
- *Dispatch prints me out a monthly cad report of reckless vehicle complaints, citizen complaints and high traffic area's*
- *Reviewing reports*
- *Manual look up and data collection form previous crash reports, citizen complaints.*
- *Computer aided dispatch system on calls for service locations. Florida Department of Transportation traffic crash locations.*
- *Crash data analysis of data received from FDOT.*
- *Our Crime Analysis Unit tracks crash data and provides a list of crash locations which become the focus of enforcement activities.*
- *Small department so all officers know where most of the wrecks occur and when to monitor or enforcement. we recently began putting maps up with crash locations for review by all.*
- *Through our CAD reporting system.*
- *Unable to answer this question. This is done by our accreditation unit.*
- *Number of crashes per intersection weekly/ monthly/ yearly and year to date.*
- *Review*
- *Primarily citizen complaints and high volume of traffic areas.*
- *Top 10 crash intersections identified monthly, causation examined, enforcement conducted to reduce infractions causing crashes.*
- *Look for areas with high number of crashes*
- *CAD*
- *Every month the traffic unit looks at every crash report and charts the day, time, cause and location. Our work hours and days change to meet the needs of the identified problem areas. Manpower to readjusted depending on last month’s numbers. At the end of every year a much larger survey is conducted. Doing this has made the traffic officers well aware of where to be depending on the time of day and time of year. For example during snow bird season we know to be in a certain section of the city during lunch hours due to the number of parking lot crashes. In the off season we don't see nearly as many so enforcement is conducted during these hours. The surveys done over the years have produced such a vivid picture that many times we are just a minute away from a crash scene because we know the area and hour they are happening. We have even adjusted our lunch hour to coincide with the peak crash hours to make sure a full staff is available.*
- *Use traffic crashes to see where enforcements needs more attention*
- *By monitoring crash accounts through Dispatched Calls we can further target areas of concern for increased enforcement.*
- *Review past traffic crash reports/data to determine locations and causes, look for similarities in regards to causes and/or actions of parties involved.*
- *Crash reports by PD*
- *We are Accredited through CFA and conduct annual crash analysis as a requirement. We research the types and locations of crashes and guide our enforcement activities accordingly.*
- *We review crash reports and Cisco records to determine the top 10 locations.*
- *All crash data is mapped using a GIS Program. These crash locations are sent to the traffic unit weekly to be analyzed for enforcement.*
- *Computer statistics program.*
- *County crash records.*

Table 6-1 (Continued): Used Method in Crash Analysis for Enforcement Locations Identification

- *We pull a monthly quarry of crashes. Information includes crash area, crash frequency days of the week and times of crashes. We finish this with maps.*
- *If there are repeated traffic crashes or complaints in a given area, the traffic unit will focus enforcement in that area.*
- *once or twice a year they make a printout of the top 10 accident intersection and top 10 speeder location*
- *We run weekly reports to determine where the high volume of crashes is occurring.*

Q4. Please rank the reason that a location is selected for enforcement from 1 for the most common to 5 for the least common.

Table 6-2 gives the reasons (in the order of priority) for selecting locations for law enforcement. For the majority of the responding law enforcement agencies, location selection was commonly based on the analyzed crash records and citizen complaints. Requests from local elected officials were among the least common reasons for selecting locations for enforcement.

Table 6-2: Ranking on Why a Location is Selected for Enforcement

Received complaints from citizens	Received requests from local elected officials	Observed frequent violations by patrolling officers	Analyzed crash records to identify locations with a high number of crashes	Other (please specify)
3	4	2	1	5
2	3	1	4	5
3	4	2	1	5
3	2	1	4	5
5	2	4	1	3 (Roads that have high citation stats)
1	4	3	2	5
1	3	2	4	5
1	4	2	3	5
2	4	3	1	5
2	4	3	1	5 (85% surveys)
1	3	2	5	4
2	5	1	3	4 (Routine Patrols)
2	1	3	4	5
2	4	3	1	5 (Traffic homicides)
2	5	1	3	4 (Ability to observe a location)
4	3	2	1	5

Table 6-2 (Continued): Ranking on Why a Location is Selected for Enforcement

Received complaints from citizens	Received requests from local elected officials	Observed frequent violations by patrolling officers	Analyzed crash records to identify locations with a high number of crashes	Other (please specify)
1				5
1	3	2	5	4 (High traffic volume areas)
2	3	1	4	5
2	4	3	1	5
1	3	4	2	5 (Web site/hotline complaints)
4	1	2	3	5
3	4	2	1	5
1	4	2	3	5
2	3	1	4	5
1	2	4	5	3 (Random selection)
1	2	3	4	5
1	3	2		5
2	4	1	3	5
1	2	3	4	5
2	3	1	4	5 (Event specific - i.e., shuttle launch, art show, other heavy traffic/pedestrian event(s))
3	2	1	4	5
1	3	2	4	5
1	2	3	4	5 (None)
3	4	1	2	5
4	3	1	2	5
1	3	2	4	5
1	2	3	4	5
4	3	1	2	5
2	3	1	4	5
1	3	2	4	5
2	4	1	3	5
1	2	3	5	4 (All Other Reasons)
1	4	2	3	5
2	4	3	1	5
2	3	1	5	5

Q5. If the Florida Department of Transportation (FDOT) can provide you with maps showing the crash locations in your area, how likely will your agency make use of this information to focus on identified locations for enforcement?

As shown in Figure 6-1, if high crash location maps are provided by FDOT, about 87% of the responding law enforcement agencies indicated that they would use them.

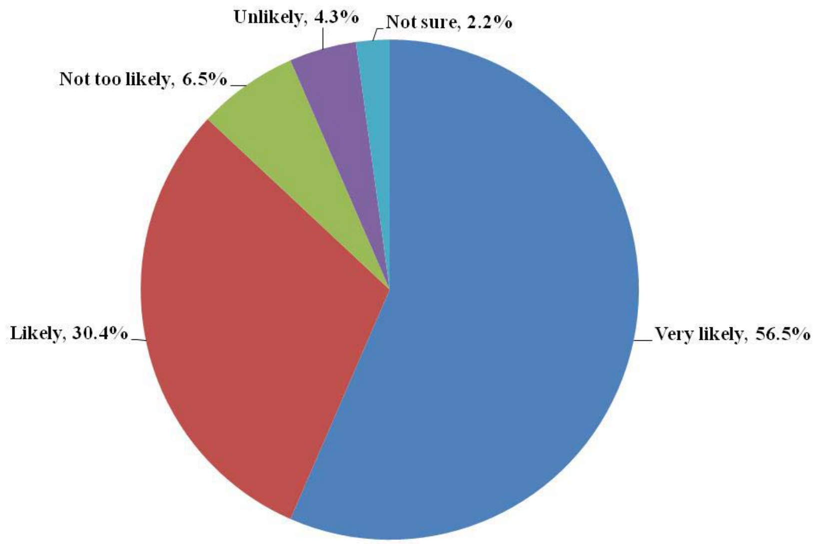


Figure 6-1: Likelihood of Using High Crash Location Maps

Q6. If you prefer to receive crash location maps from FDOT, what would you like for these maps to include?

As shown in Figure 6-2, if crash location maps are to be provided by FDOT, crashes from the previous year and quarter received the highest preference (i.e., 37% each). On the other hand, crashes from the previous month received about 11% preference. Over 15% would like to receive these maps from the previous year, month, and quarter, all together.

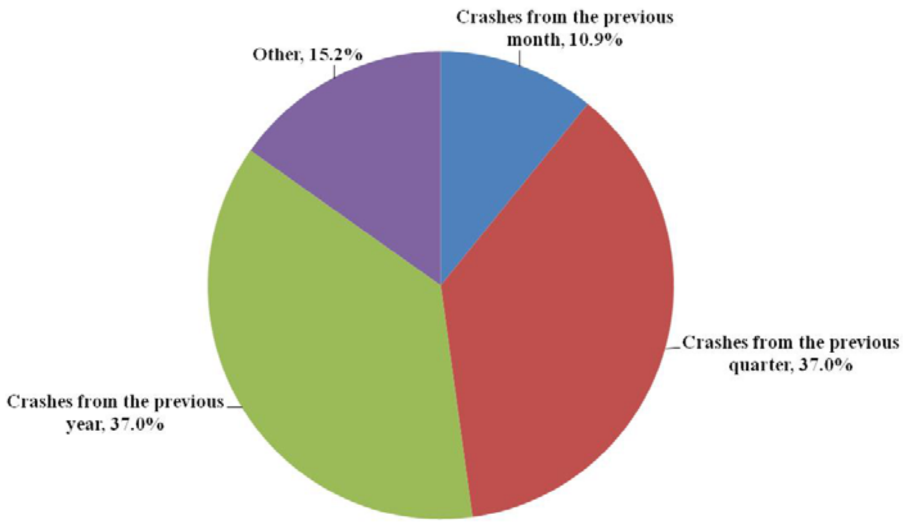


Figure 6-2: Information To Be Included with FDOT Maps

6.2 Traffic Violations and Safety Campaigns

Q7. How common are the following traffic violations targeted for enforcement?

As shown in Figure 6-3, the five most common traffic violations targeted for enforcement were speeding (80%), failing to use safety belts (50%), failing to properly restrain a child (40%), driving under influence (40%), and running red lights (15%). On the other hand, the five most uncommon violations included blocking traffic (60%), failing to move over (50%), parking illegally (50%), following too closely (50%), and turning illegally (50%).

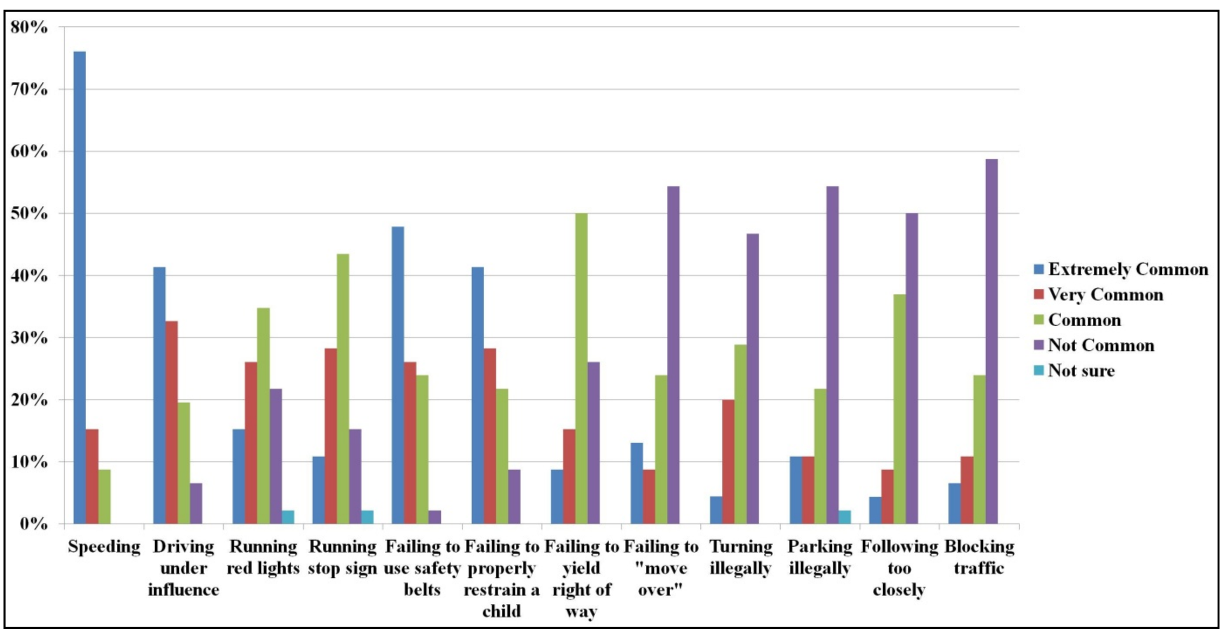


Figure 6-3: Likelihood of Occurrence of Different Traffic Violations

Q8. In your opinion, how serious are the following traffic violations in terms of their potential impacts on traffic safety?

As shown in Figure 6-4, according to the responding agencies, the extremely serious traffic violation was driving under influence (95%). Further, running red lights, speeding, failing to properly restrain a child, failing to use safety belts, and running stop sign were also considered extremely serious.

On the other hand, the not-so-serious traffic violations included parking illegally (55%), blocking traffic (30%), failing to move over (10%), following too closely (5%), and turning illegally (5%).

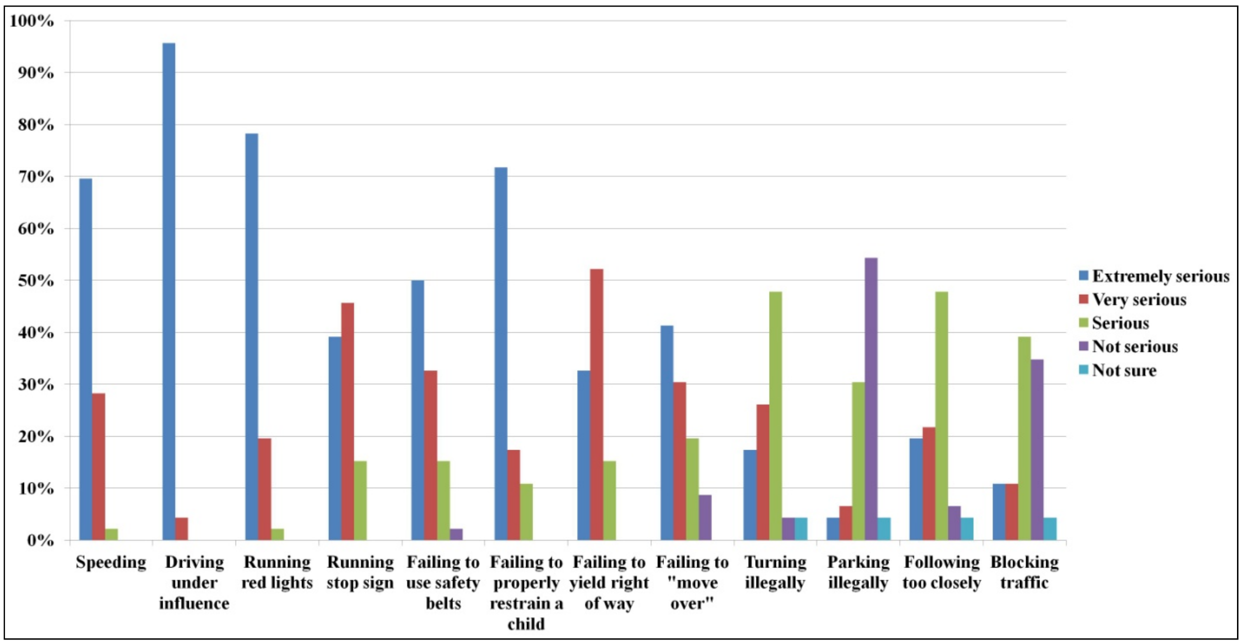


Figure 6-4: Seriousness of Different Traffic Violations

Q9. In your opinion, how effective will enforcement of the following traffic violations help improve traffic safety?

As shown in Figure 6-5, the enforcement of driving under influence and speeding (60% each), running red lights and failure to properly restrain a child (50% each), and running stop sign and failure to use safety belts (40% each) were perceived as extremely effective. On the other hand, enforcement of illegal parking (30%), traffic blockage (20%), following too closely (10%), and illegal turning (10%) were seen as least effective.

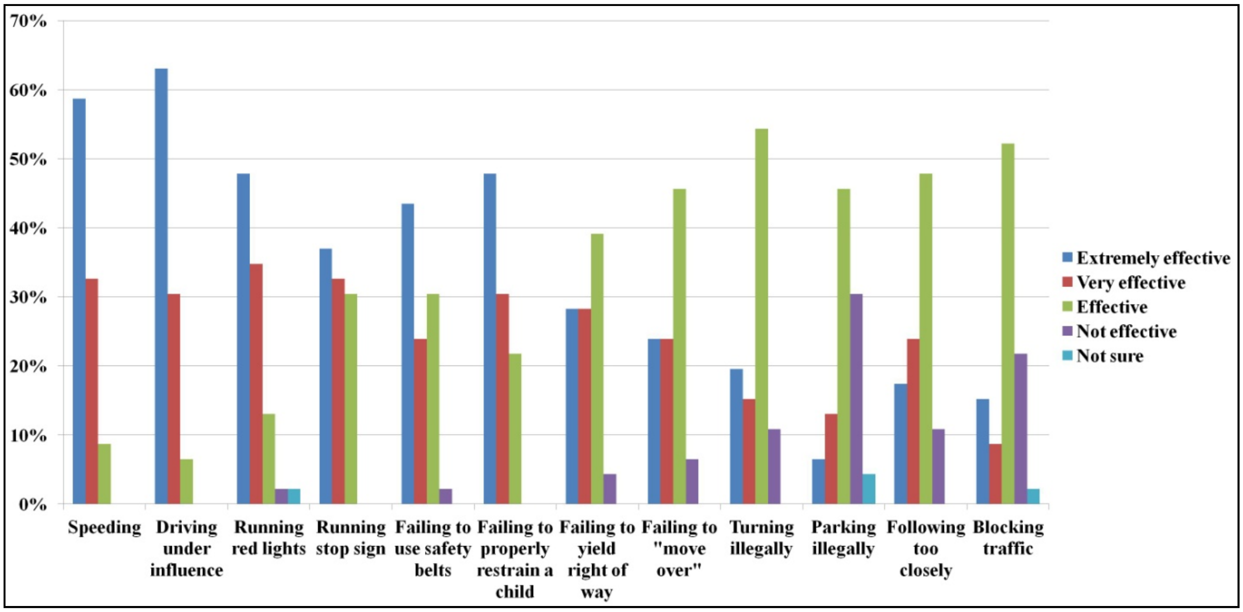


Figure 6-5: Effectiveness of Enforcement of Different Traffic Violations

Q10. To the best of your knowledge, how have the following traffic violations in your area changed over the past two years?

As shown in Figure 6-6, there was an agreement that speeding and driving under influence increased slightly in the agencies' areas over the past two years (25% each). This was followed by running stop sign, running red lights, following too closely, and failing to yield right of way (20% each). Moreover, speeding violation showed the highest dramatic increase (10%). The highest percentage of no change was for traffic blockage and turning illegally (70% each). Interestingly, both failure to use safety belts and failure to properly restrain a child showed a 20% dramatic reduction over the last two years. A possible explanation is the effectiveness of the "Click it or Ticket" campaign.

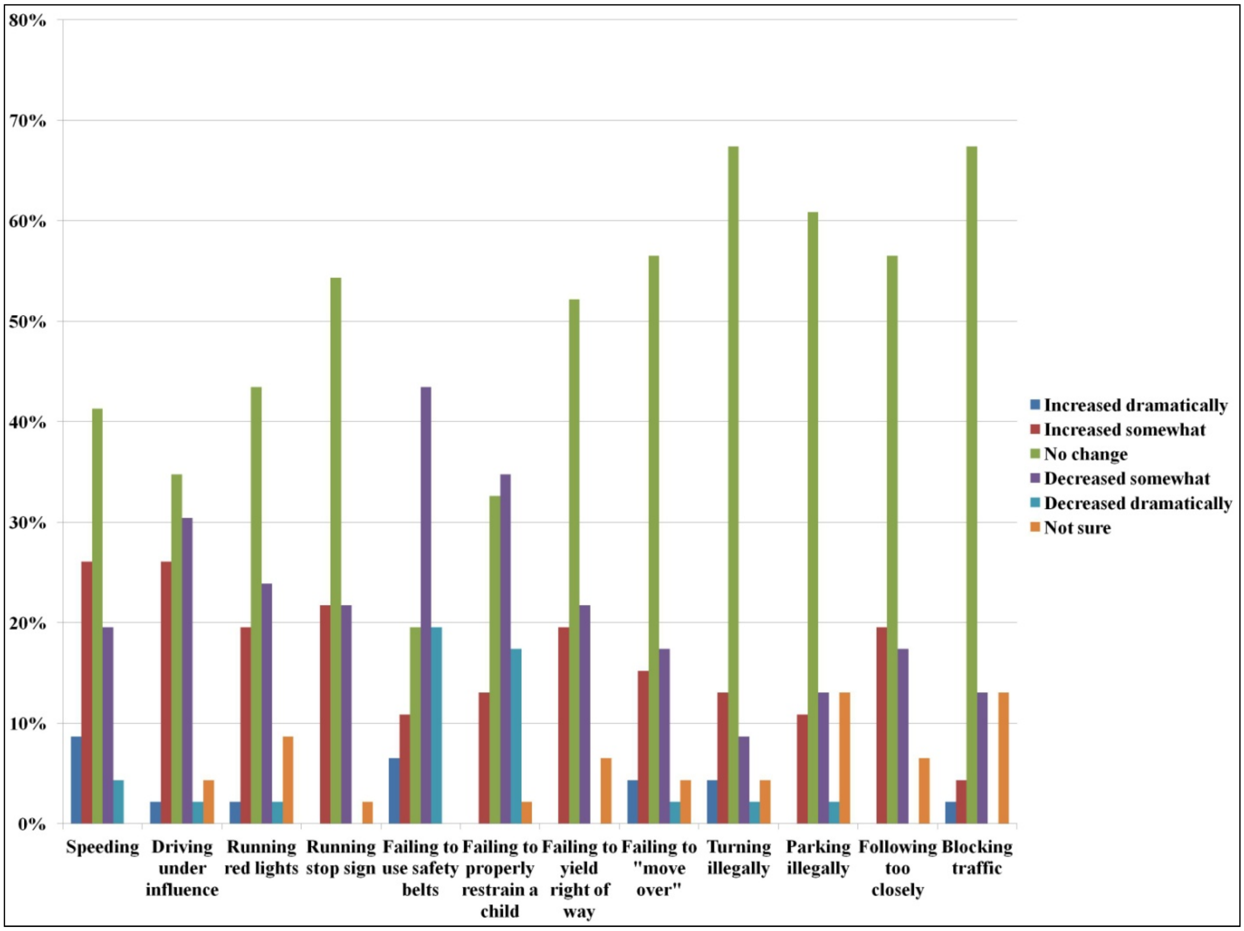


Figure 6-6: Level of Change of Different Traffic Violations over the Past Two Years

Q11. In the previous year, our agency conducted safety campaigns addressing the following traffic problems: (Check all apply)

The highest matching of addressed traffic problems by the conducted safety campaigns was for speeding, driving under influence, failing to use safety belts, and failing to properly restrain a child.

Q12. Does your agency normally follow up with an evaluation to assess the effectiveness of the safety campaigns?

Over two-thirds of the agencies normally follow up with an evaluation to assess the effectiveness of the safety campaigns, while the remaining one-third do not follow up. This shows a high desire to improve safety via the conducted safety campaigns.

Q13. If "Yes", please describe how the evaluations were performed.

As shown in Table 6-3, the law enforcement officers used several methods to evaluate the effectiveness of safety campaigns. The following are the most commonly used approaches.

- perform B/C analysis
- evaluate campaign efforts
- conduct pre and post traffic surveys
- conduct periodic seatbelt surveys
- conduct field observations
- analyze citation statistics
- evaluate traffic data
- evaluate locations with witnessed violations
- address citizen complaints

Table 6-3: Evaluation Methods of Safety Campaign Effectiveness

- *We would take the old data and compare to the new data.*
- *Checking information against previous campaign.*
- *Reports are generated and the campaign efforts are recorded.*
- *Pre and post traffic surveys.*
- *A spread sheet is issued to me about citation stats for the enforcement wave.*
- *On site observations.*
- *Observing traffic.*
- *We conducted pre and post wave surveys for specific violations and compare the data collected.*
- *Comparing statistics of before & after campaign.*
- *Evaluation of traffic crash data.*
- *Completed form sent to North East Florida Law Enforcement Liaison.*
- *The statistics are reviewed and compared to enforcement waves during previous years.*
- *Do seatbelt surveys before and after.*
- *By monthly statistics.*
- *Pre and post safety belt surveys.*
- *Witnessed violations at a specific location.*
- *Surveys.*
- *We participate in the state campaigns; click it/ticket; stop red light turning; child passenger safety week/sustained DUI enforcement; train safety week; etc.*
- *Pre- and post- surveys.*
- *Pre- and post- surveys.*
- *Survey violations before and after / # citizen complaints / # crashes.*
- *Seat belt survey, statistical analysis (DUIs)*
- *Pre- and post- surveys.*
- *Statistics were recorded in specific locations prior to and after a campaign. A percentage was recorded on the effectiveness of the campaign.*
- *Pedestrian surveys were completed along with pre and post seatbelt surveys.*
- *If a safety belt campaign was conducted, a survey at specific locations are performed prior to and after the campaign to determine usage rates.*
- *Again the 10 top 10 spots.*
- *Evaluation is based on the total # of drivers following the law prior to the event based on a percentage of 300 drivers and an evaluation after the event following the same protocol.*
- *Stats are reviewed and overall count is taken of citations or arrests made.*
- *Follow up in the designated areas to see if violations are still occurring.*
- *The only one we conducted were safety belt counts before and after enforcement efforts.*

6.3 Crash Reports

Q14. Our officers currently use the following type(s) of crash report in the field:

As shown in Figure 6-7, about 40% of the responding law enforcement officers use both hardcopy and electronic crash reports in the field, while around 30% work with paper forms alone, and the remaining 30% use only electronic forms.

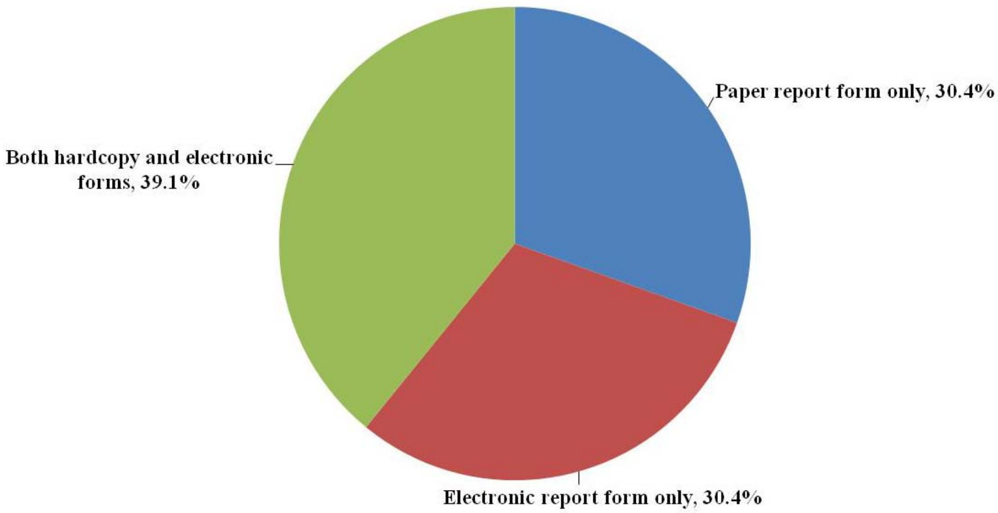


Figure 6-7: Types of Crash Reports Used

Q15. Overall, the new crash report that became effective on January 1, 2011 has been an improvement over the previous crash report.

As shown in Figure 6-8, about 35% of the responding officers either agreed or strongly agreed that the new police report forms has been an improvement over the previous form. On the other hand, about 24% were neutral, and about 42% either disagreed or strongly disagreed.

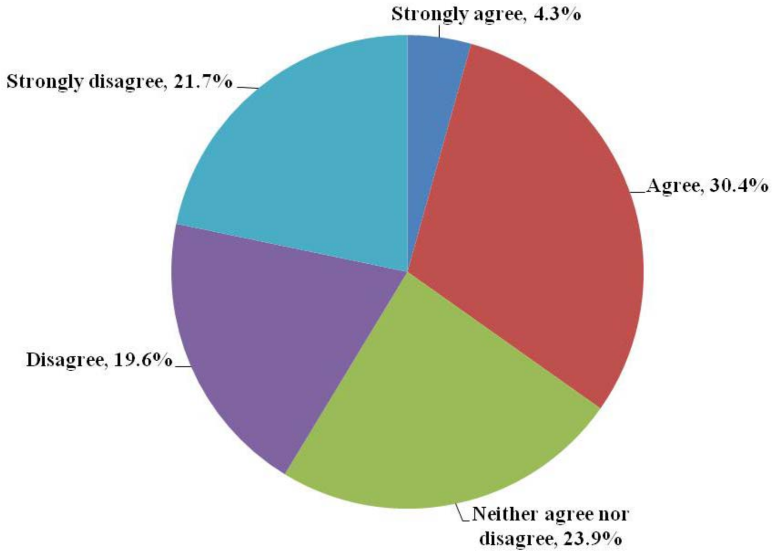


Figure 6-8: Opinions on New Crash Report over Previous Report

Q16. Officers in our office received adequate training in the use of the new crash report.

As shown in Figure 6-9, over half of the responding officers either agreed or strongly agreed that they received adequate training in the use of the new crash report. On the other hand, about 22% were neutral, while over 21% either disagreed or strongly disagreed.

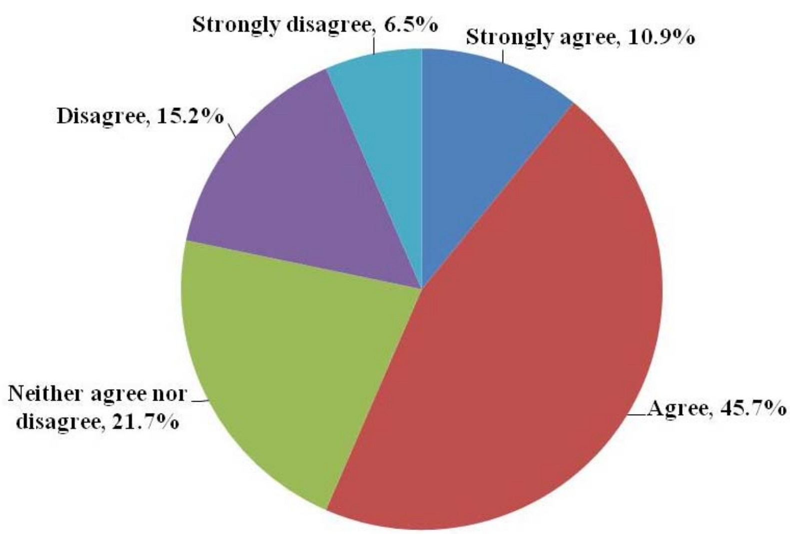


Figure 6-9: Opinions on Obtaining Adequate Training in Using New Crash Reports

Q17. The most useful information to us in the crash report is:

Table 6-4 lists the most useful information in the crash report to the law enforcement officers. Crash location was considered as the most useful information. Much of the respondents' interest was geared toward the thorough fields in the report (e.g., for the vehicle ID), as well as the crash type, crash cause, and manner of collision (or the first harmful event). Further, information on speeding, distracted driving, seatbelt usage, and driving under influence are of interest to the law enforcement officials.

Table 6-4: Views about Most Useful Information in the Crash Report

- *Location.*
- *Address of crash.*
- *Overall most of it.*
- *We use paper reports and the directions make the report to where it is self explaining.*
- *Crash location.*
- *Location of crashes.*
- *A lot more detail in vehicle ID.*
- *Additional Information asked; it allows info to be tracked easier.*
- *Easy to transmit to Tallahassee.*
- *Type of accident; angle etc.*
- *First harmful event and manner of collision.*
- *Type of violation.*
- *Location.*
- *Speed; Influence of alcohol / drugs.*
- *Location of crash.*
- *More thorough data.*
- *The causation of the crash determined by the investigating Deputy.*
- *Location.*
- *Distracted driving.*
- *Location and speed.*
- *Cause of the crash and violations ticketed.*
- *The same information as on the old form.*
- *Amount of information available.*
- *Cause.*
- *Gathered information in regards to driver's actions contributing to the crash, seatbelt usage, sequence of events.*
- *Reason for accident.*
- *Locations, times, causes (citations).*
- *We don't use them for any of the data to use here.*
- *Haven't found anything yet.*
- *Location.*
- *Location, time, cause.*
- *Location and cause of crash.*
- *First page.*
- *Driver and vehicle information.*
- *Location.*
- *The new reporting system is faster.*
- *Driver distractions.*
- *Causation.*

Q18. The biggest challenge in completing a crash report is:

Table 6-5 lists the enforcement officers' biggest challenges in completing a crash report. The new crash report form was considered to be lengthy and time-consuming. A few officers reported that the new additional data per the new crash form were an issue, while others indicated that the report was difficult to understand without adequate training and instructions manual. Another major issue was the time the officers would sit down and do the paper work or fill out the crash report electronically.

Table 6-5: Biggest Challenge in Completing a Crash Report

- *It was getting the officers familiar with the crash zone.*
- *Total number of pages.*
- *The length of the report and new data that needs to be collected.*
- *Bit hard to understand if you are not trained on how to fill it out and what certain words mean.*
- *No being able to fill out and submit the crash report with a computer.*
- *Time.*
- *Time to sit down and do the paper work.*
- *Making sure the officers collect all appropriate data for the report.*
- *More information to gather.*
- *Timeliness; getting a copy to the drivers. Working on getting printers in the cars.*
- *Length.*
- *Our department MAKES OFFICERS write up a report for all crashes we respond to even MINOR parking lot.*
- *Time consuming.*
- *Determining how to complete the form when unique circumstances arise. This is due to a lack of a useful manual of instructions.*
- *Timely and accurate information.*
- *Too much data collection required.*
- *Time.*
- *Learning a new reporting format.*
- *Amount of blocks.*
- *The amount of information. The old forms could be done in just minutes, now it takes way to long to complete. The traffic officers are pretty good about completing these in a timely fashion but road patrol can take more than an hour. Our volume of calls has increased while the City of Port Saint Lucie has laid 24 of us off and cut traffic by 50%. The new forms are horrible.*
- *Making sure the amount of the persons are correct.*
- *Getting the officers to proofread for mistakes.*
- *Receiving different information on the same issue, depending to whom you talk at DHSMV.*
- *Time to complete paper copy.*
- *Time consuming.*
- *Getting Officers to use the crash manual for reference.*
- *Time.*
- *One page per person!*
- *Getting all the new information needed. Officers are used to doing the old form and don't always get the information they need on scene.*
- *Length.*
- *Format.*
- *Too much information requested on the form.*

Table 6-5 (Continued): Biggest Challenge in Completing a Crash Report

- *Time consuming. Agencies use different programs based on budget constraints. When we looked at changing programs to mimic what FHP uses it was going to cost us $48,000 for 20 people to have the program. We adapted to the forms to the program that we are using and instead of four pages we are at seven.*
- *The amount of information required as well as the amount of time required to fill it out.*
- *The complex nature and number of fields.*
- *Lack of auto-fill.*
- *The numerous boxes required to be filled out.*
- *Getting the drivers exchange info to them.*
- *The computer crash report takes longer to fill out and currently we have to return to the Police Department to do it.*
- *The repetitive nature of the new reporting system.*
- *Multiple pages of useless questions.*

Q19. The following improvements are suggested for the current police report form for the reasons stated:

As identified in Table 6-6, several improvements were suggested to the current police report form. Some officers suggested continued training on how to fill out the report to minimize individual interpretations. Another suggestion was to provide agencies with useful instructions on filling out the crash form. Improvements to the crash manual to include how to report additional passengers/witnesses and to combine the owner vehicle/driver data were a few additional suggestions. Other recommendations included adding short-form reports to the TraCS system, ability to use this crash report while transmitting long-forms without the need to fill it out short-forms, and ability to provide a state-funded online system for all law enforcement agencies. A few officials suggested reverting back to the old form due to its simplicity. Feasibility to add third vehicle damage diagram was suggested to be able to completely document multi-vehicle crashes. Having the ability to complete the crash forms electronically would be a welcome change to the officials.

Table 6-6: Suggested Improvements for the Current Police Report Form

- *Improve the crash manual to include how to identify/report additional passengers; witnesses.*
- *Online training on how to fill report out.*
- *There is no problem with our system at this time due to we only work minor accidents Florida Highway.*
- *Less detailed.*
- *Continued training with our officers.*
- *The old form was adequate.*
- *Add the "Short Form" to TRACS.*
- *Have it where only long forms are transmitted. Where there is small or no damage just do a driver's exchange or the OLD Blue copy for driver to fill out.*
- *A state funded electronic system for all Law Enforcement Agencies.*
- *Provide agencies with useful instructions.*
- *Make print larger; print too small.*
- *Streamline.*
- *Owner vehicle / driver data combined to same section.*

Table 6-6 (Continued): Suggested Improvements for the Current Police Report Form

- *Add a third vehicle damage diagram to show all crash damage, not just first point of damage and most damage. Reason being to better document crash damage noted on a vehicle during an investigation, especially important when dealing with a multi-vehicle crash.*
- *Remove some of the blocks.*
- *Let's stop doing the insurance companies job. We need to only document information needed to curb traffic issues.*
- *Should leave the same way they used to be list the persons in each vehicle not counting 1-2-3-4 and so on.*
- *Make it more user friendly so officers don't tie up so much time.*
- *Have DHSMV train at least one officer / deputy from each agency, who in turn train the rest. This would eliminate individual interpretation.*
- *Some blocks require (2) numbers for year and others require (4) numbers, to be more consistent. We need a space for local agency report numbers.*
- *The "Notified By" Box on the events page, should be Submitted by.*
- *Would like to complete the form electronically. Is there a state recognized vendor for this? We are a small agency (10 sworn), do not have a lot of crashes, and cost IS an issue.*
- *It is what it is.*
- *Have the state come up with a program that can be shared with all agencies so that the reports are standardized. Also, stop asking attorney's and insurance companies what they want on the report to make their cases. I have worked as a traffic officer since 1989 and the reports are getting more time consuming.*
- *Too much for Insurance Company. Short forms are not going to County/State authorities, so how are stats being generated.*
- *Having person, passenger and vehicle on the same page.*
- *Go back to using the 2010 form. Only pertinent information was required on this form.*
- *Allow driver and vehicle information to auto populate an electronic form from DAVID pages.*
- *Go back to a simplified form. Most are now computerized so you could separate the commercial part out to reduce time. I expected more going through the workshops.*
- *Auto-fill.*
- *Better shading on the forms to distinguish short / long forms.*
- *Take out the stuff that's not important - color of car, model.*
- *This is an internal problem so I have no suggestions.*
- *More auto population functions.*
- *The old report was fine; it is obvious the new report was designed by someone who has never worked a traffic crash.*

6.4 Working with Transportation Agencies

Q20. The following would characterize our current working relationships with local transportation agencies to improve traffic safety:

As shown in Figure 6-10, it can be observed that law enforcement agencies act pro-actively, as over half of the respondents indicated that they hold regular meetings with local transportation agencies for discussion and coordination of efforts. About 29% indicated to work with transportation agencies only when a situation arises, while 20% could not recall a case in the past six months.

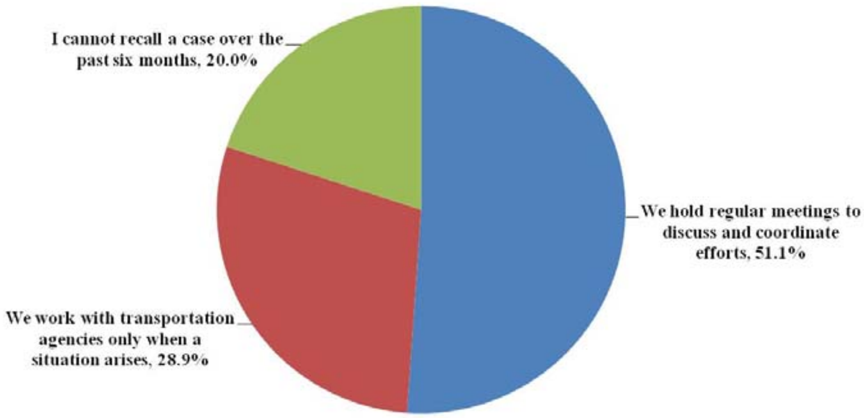


Figure 6-10: Working Relationships between Law Enforcement Agencies and FDOT District Office

Q21. To improve traffic safety in our area, I believe our agency should:

As shown in Figure 6-11, about 56% of the agencies work closely with transportation agencies to improve traffic safety, about 33% wish to work more closely with transportation agencies, and over 11% desire to work much more closely with transportation agencies.

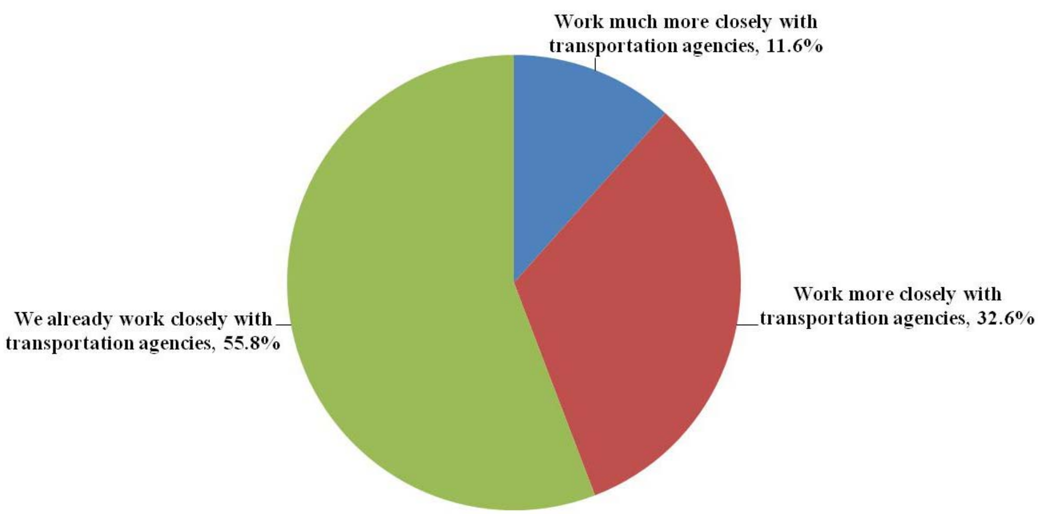


Figure 6-11: Ways to Improve Traffic Safety in Law Enforcement Agencies' Area

Q22. What are some of the barriers, if any, that have prevented your agency from working more closely with transportation agencies to improve traffic safety in your area?

As shown in Table 6-7, there are several barriers that prevent law enforcement agencies from working closely with transportation agencies. Most of the barriers included lack of organized meetings, minimum communication, limited resources (budget, time, and manpower), and politics. A few agencies indicated that there were no barriers.

Table 6-7: Barriers Preventing Law Enforcement Agencies from Working Closely with Transportation Agencies

- *No barriers. Our city is small and there is no other municipality therefore FDOT only deals with the Sheriff's office.*
- *We work great with the Duval County Traffic Safety Team.*
- *Hard to get a hold of.*
- *The local Highway Patrol office was shut down so we no longer have a office here so we don't see them like before. No type of communication within agencies.*
- *Lack of organized meetings in our area.*
- *Time and money.*
- *We have a fairly good working relationship and I can think of any barriers.*
- *None noted; DOT and private contractors communicate very well with the PD.*
- *Politics.*
- *An interest for the east side of Pasco County.*
- *Manpower.*
- *Not sure who to talk with.*
- *Very small agency and no overtime budget.*
- *Traffic safety is not a priority.*
- *Limited resources from a small agency.*
- *We really don't have a need - only local and county roads in our jurisdiction. We are a barrier island community with no through-way.*
- *Not enough man power to take officers off the road to attend meetings.*
- *Basing everything off of statistics instead of listening to what we see every day. What we see may not result in a crash or allow us to do a short form crash report. Since information is not collected from them it is like the crash never happened.*
- *Communication but thru the LEL program and CTST this has improved.*
- *Lack within our agency of having a designated person to liaison with the transportation agencies.*
- *Not local.*
- *We are a 10 street by 3 street town, on an island.*
- *Staff shortage.*
- *None, good working relationship.*

Q23. In my opinion, the following activities with transportation agencies will help to improve traffic safety in our area:

As shown in Table 6-8, several activities with transportation agencies were suggested to help improve traffic safety. More specifically, the following activities were emphasized: organize more meetings with transportation agencies, get more assistance at DUI and safety check points, improve communication, report any changes in the roadway cross-section/design, and provide executive overviews on traffic related issues.

Table 6-8: Suggested Activities with Transportation Agencies

- *More funding.*
- *Assistance in DUI check points.*
- *Work traffic details as a team.*
- *Quarterly meetings.*
- *Safety check points specific target patrol.*

Table 6-8 (Continued): Suggested Activities with Transportation Agencies

- *Being in on any changes to the roadways in our jurisdiction; re-design of roadways; changes to speed; direction; or any other changes that may be made.*
- *Provide executive overviews on traffic related issues. This would help keep traffic issues on the table when decisions are made for budgets; manpower; etc.*
- *We already work well with the other agencies. CTST is a big help.*
- *Form some type of local traffic safety coalition with meetings at least squarely.*
- *An interest for the east side of Pasco County.*
- *Closer working relationship.*
- *We currently work very well together.*
- *Open communication and R.S.A. (Roadway Safety Audits).*
- *More DUI / Safety Inspection Checkpoints. More Drivers' License Checkpoints.*
- *More selective enforcement.*
- *Meeting with representatives in regards to grants available.*
- *Keep them up to date with ever changing traffic laws. Get an insight view on their concerns.*
- *Regular meetings.*
- *More inspections of freight haulers.*
- *Funding to allow education and enforcement in regards to pedestrian / bicyclist.*
- *I'd like to have our guys participate in more multi-jurisdictional task forces (DUI, safety inspections, etc.).*
- *Having meetings.*
- *Continue meetings via Community Traffic safety teams or FDOT meetings.*
- *Quarterly meetings.*
- *More message boards to promote safety.*

Q24. Please list any software tools and technical assistance that you believe the Florida Department of Transportation can provide to assist you in your efforts to improve traffic safety.

Table 6-9 gives the suggested list of software tools and technical assistance to be provided by FDOT. More specifically, the responses mainly focused on the following: side by side training/online training, information on traffic counts and local crash data, funding to purchase items for traffic safety, and electronic ticket writer and printers for crash reporting.

As for the software tools, the law enforcement agencies would like to be provided with online crash database, maps, major traffic reporting/tracking software for smaller agencies, and standard computer program to fill out and retrieve crash reports.

Table 6-9: Suggested Software Tools and Technical Assistance To Be Provided by FDOT

- *Side by side training; online training.*
- *Electronic citations and or funding to purchase items for traffic safety.*
- *Make traffic reporting software available for smaller agencies that cannot afford it.*
- *On line crash data site.*
- *Ability to run location crashes in-house.*
- *Main help would be timely crash data and the ability to review by causation factors or other causes. Example: Specific DUI related crashes, speed crashes, etc.*
- *Information on traffic counts and local crash data.*
- *Electronic Ticket writer and Printers and software for crash reporting.*

Table 6-9 (Continued): Suggested Software Tools and Technical Assistance To Be Provided by FDOT

- *Will have to confer with upper management.*
- *Total Station and software to better investigate the causation of a fatal crash for future enforcement details.*
- *Maps.*
- *Access to traffic cameras and message boards. I would love to periodically be able to place a local message on the board that would greatly help a traffic issue we have. Example: When it rains I would love the boards to say, "Please turn your lights on in the rain. Florida Law. Apparently very few drivers in my area are aware or care even though we enforce this regularly.*
- *Inform the administration about available tools.*
- *D L readers for citations. Traffic crash software for laptops.*
- *Electronic crash reports.*
- *Come up with a standard computer program for all agencies to use to fill in crash reports so that with the click of a mouse we could have access to the information.*
- *Crime and traffic mapping.*
- *Crash statistics within our jurisdiction.*
- *More funds for "white lights" at intersections. Continue grant funding traffic issues.*
- *Up to date traffic crash statistics for our area.*
- *Our software system and the USA software system that we use have problems with the state system.*
- *Provide us a website that tracks crashes in the county*
- *Hy-Star upgrades. Hardware and software. Our system is old and in need of repair, however our current budget situation is not good.*

Q25. Please use the box below to provide any additional comments you have.

No further comments were received from most of the responding law enforcement agencies; however, Table 6-10 provides some additional comments. Mostly, the need of state and federal funding in tough economic times was emphasized. Getting sheriff officers on board with traffic related issues, meetings, or campaigns was also considered as an issue. A few officials reiterated their concerns on filling out the newly released crash report forms and requested for simplified crash reports.

Table 6-10: Additional Comments

- *I personally work with Florida Department of Transportation and have a great working relationship and they try to help fund some of our projects.*
- *Like most public safety departments; state and federal money helps to ease any burdens; but in tough economic times the majority of items really needed is now considered luxury items and are at best on the back burner.*
- *We have a good working position with sheriff's office but have trouble getting them on board with traffic related issues. They have sent deputies to our DUI checkpoints; but can't get them involved in LAN meetings or other campaigns. Some personally feel they cannot enforce traffic because it might UPSET a potential voter OR it's never been done before and are afraid to do so in fear of making waves.*
- *Thank you for your time and your effort to better understand our traffic enforcement issues in our area of enforcement.*
- *I really like that you request local information from local officers rather then assume you know this areas problems. The more you ask the more I will answer. Great Job!*

Table 6-10 (Continued): Additional Comments

- *It is hard for very small agencies to obtain grants for traffic safety equipment due to lack of statistics like larger agencies have.*
- *Our agency took a giant step backwards during the past three years regarding traffic safety. Received Grants were not properly used or not used at all as provided by the Grand.*
- *Need overtime $ for traffic safety programs/campaigns*
- *Our local LEL rep (T. Banks) and our regular LEL meeting attendance keeps us "in the loop" for upcoming state (FDOT) and national enforcement waves.*
- *We need to make the crash reports a little more simplified. There was nothing wrong with the old crash reports that we were using. Understanding that the economy is still in a spiral and will be for the next several years agencies are downsizing and traffic enforcement units are disappearing we will be hard pressed to come up with a lot of enforcement campaigns. the money is just not there to pay for overtime for these types of special functions. FHP receives grant monies to pay overtime for enforcement but we are handling a majority of the crashes. There needs to be more money funded to agencies for enforcement operations as well.*
- *Our department, over the past three years, has greatly improved our program. Through the LEL, CTST, Palm Beach County Traffic Office and continued cooperation with our bordering agencies we have developed a comprehensive education, engineering and enforcement approach. We recently participated in a DDACTS conference and would like to implement such a program. Our financial resources have provided limitations and are interested in finding funding and/or partnerships in order to achieve our goals.*
- *In my opinion, if more incentives are available there would be more agencies who will participate in safety campaigns.*
- *The accident reports have to many boxes of information to fill out.*

6.5 Key Findings from the Law Enforcement Agencies Survey

The following is a list of key findings from the law enforcement agencies survey:

- Most agencies regularly focused on specific locations for enforcement of traffic violations.
- Location selection for enforcement was commonly based on the analyzed crash records and citizen complaints.
- The majority of agencies would like to receive crash location maps from the previous year or previous quarter from FDOT.
- Speeding, failing to use safety belts, and failing to properly restrain a child were the most common causes of violation enforcement.
- Blocking traffic, failing to move over, and parking illegally were the least common causes of violation enforcement.
- Enforcement of driving under influence, speeding, and running red lights were perceived as the most extremely effective to improve traffic safety.
- Enforcement of illegal parking, traffic blockage, and following too closely were seen as least-effective.
- Most agencies follow up with an evaluation to assess the effectiveness of the implemented safety campaigns.
- The majority of agencies use both electronic and hard copy crash report forms.
- The majority of agencies agreed that the new police report form that became effective on January 1, 2011 has been an improvement over the previous form.

- A few officials considered filling out additional data in the new crash forms to be time consuming and recommended simplified crash reports. Further, additional training on filling out the crash reports was requested.
- The majority of agencies react proactively while holding regular meetings with local transportation agencies for coordination of efforts
- The majority of agencies emphasized the need to organize more meetings with transportation agencies and to get more assistance from them.

CHAPTER 7
GIS-BASED CRASH ANALYSIS SYSTEMS IN FLORIDA

7.1 Crash Analysis Systems

There are two general categories of crash analysis systems: GIS-based systems and statistical-based systems. GIS-based crash analysis systems are mainly used for spatial visualization of crash data on maps to display specific crashes spatially, as well as to generate cross tabulations and frequency distributions (e.g., distribution of crashes by crash type, hour of the day, day of the week, contributing factor, etc.). Examples of this category of systems in Florida include the WebCDMS system developed for District 7 and its counties, the TSAT system developed for District 3, and the S4 system currently being developed by the University of Florida.

Statistical-based crash analysis systems, on the other hand, apply scientifically proven techniques to identify and prioritize problematic sites. The most advanced of such techniques today include those that account for the well-known RTM phenomenon. The IHSDM, HSM, and SafetyAnalyst tools, as previously discussed in Chapter 2, make use of such advanced techniques in improving highway safety. These tools are generally not designed for spatial analyses and they do not have the visualization capabilities typical of a GIS-based system. However, it has also been recognized that these tools can also take advantage of GIS capabilities to facilitate site selection and display of analysis results.

7.2 Existing GIS-Based Crash Analysis Systems

Existing GIS systems for crash analysis in Florida include both desktop and web-based. Older systems have been desktop applications. An example of a GIS desktop application is the system used in District 4. The system performs spatial analysis and clustering of crashes with similar characteristics (e.g., clustering of crashes involving drivers aging 65 years or older). The system is currently both unsupported and outdated.

Recent advances in web-based GIS technologies along with the rapidly increasing internet speed have allowed web-based GIS applications to quickly flourish. Web-based systems enjoy many advantages over desktop systems, not the least of which are the much greater ease of sharing and updating data, and requiring no software installations or user licenses for the general users.

This chapter mainly focuses on highlighting the typical features found in GIS-based crash analysis systems. The features are discussed using three commonly used systems in Florida, which includes WebCDMS, TSAT, and S4. The next section summarizes the GoTo web meetings scheduled with each system developer that helped to initiate a general perspective before delving deeper into the evaluation process. At the end of this chapter, detailed functionalities of each system are shown, followed by identifying systems that adopt the highest desirable crash analysis capabilities.

7.3 Overview of the GoTo Web Meetings for GIS Crash Analysis Systems

7.3.1 Web Crash Data Management System (WebCDMS)

A GoTo web meeting was scheduled for the demonstration of WebCDMS that has been developed and maintained by Tindale-Oliver & Associates (TOA) and being used in District 7. In the past, District 7 used desktop tools developed by TOA for analyzing and mapping traffic crashes, which were implemented in 18 agencies in Florida. In addition to District 7, the current WebCDMS is being used by ten counties in Florida by paying a monthly fee for data management. As the WebCDMS is being shared by all ten counties, its maintenance is quite feasible (as there is only one system to be maintained). In contrast, other web-based developers in Florida are faced with a number of problems because they have to maintain each county's server, in addition to answering many clients' inquiries. A screen capture of the login page of WebCDMS is shown in Figure 7-1.

The WebCDMS application has a built-in ArcGIS map and SQL servers for better visualization of crashes along roadways, as well as for querying the specific crash types to be displayed (e.g., fatal crashes, rear-end crashes, head-on crashes, total crashes, bicycle crashes, pedestrian crashes, etc.). The scanned DHSMV police crash reports are also uploaded to the application to verify crash types if needed. The WebCDMS can show locations with the highest total crashes, fatal crashes, bicycle crashes, etc., and the estimated crash rates can be displayed visually along each major road.

The application uses both the CAR and DHSMV databases and the system includes both on-system and off-system roads, as well as short-form and long-form crash reports. Moreover, the application is compatible with the newly-released crash report form (on January 1, 2011). Within this system, the old crash report forms could successfully be converted to the new form, after postulating some assumptions.

The application has the capability to display detailed information about each crash by clicking on the specific crash. Once clicked, its crash report will be displayed along with the detailed characteristics of the crash (e.g., time and date of the crash, contributing factor, source of the crash information i.e., CAR or DHSMV, etc.). Moreover, the crashes displayed along different roadways can be exported to Google Earth or Bing. The application can also specify the exact total number of crashes for a given intersection using a dynamic buffer distance. A cross-reference for crashes with other important predictors (e.g., driver's age, location, time, and day of the week) can also be performed, and then a graph or plot can be generated for further analysis. The output can also be saved as a "csv format or "xls format".

The WebCDMS can also provide collision diagrams wherein different colors represent different crash counts (similar to contour plots). For example, green refers to the least crash counts, yellow refers to a moderate crash-count range, and violet refers to the highest crash-count range. Please note that there are some cases in which crash types are unknown or could not be specified. In these cases, the user is afforded the luxury of revising the data by accessing the original crash reports and then modifying it in the system.

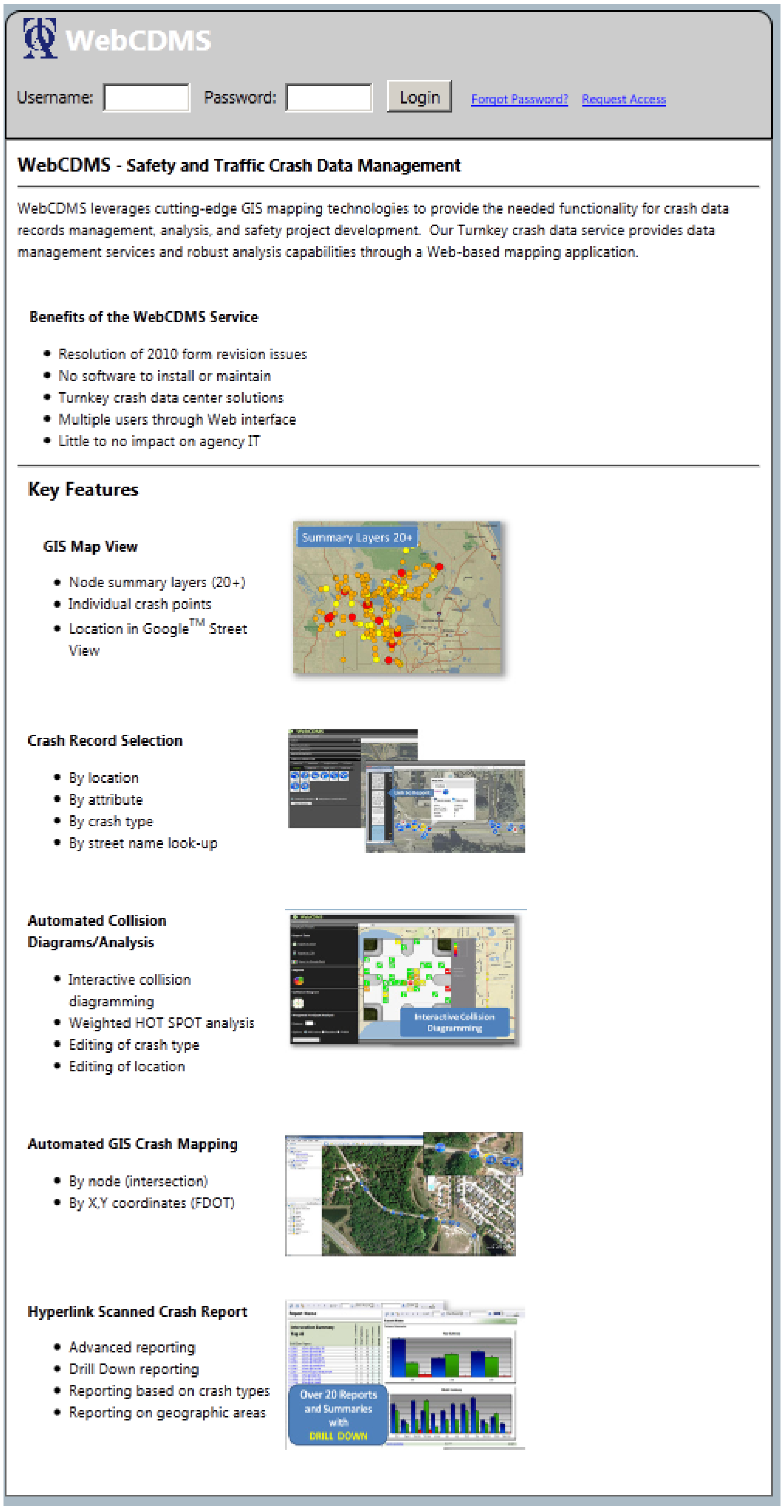


Figure 7-1: Login Page of WebCDMS

The application is also equipped with a help file and tutorial drop-down menu, which incorporates most of the frequently used documentations (for both application and data sources). Furthermore, a two-minute video giving an overview of the application's functionalities is available. The TOA development team is currently in the process of developing example scenarios, as well as a set of FAQs.

Overall, the WebCDMS is a powerful, professional application for performing network screening and crash analysis. Moreover, the output from the analysis is ready-to-use and can be inserted in a report format or Excel spreadsheet for further analysis. This capability is appreciated by most safety engineers working in Florida districts, counties, and cities. These features place the application in high-demand, mainly because of its ability to save time and its superior analytical and visual built-in tools.

7.3.2 Traffic Safety Analysis Tool (TSAT)

A GoTo web meeting was scheduled for the demonstration of TSAT that has been developed and maintained by Metric Engineering, Inc. and used in District 3. A thorough review of the TSAT's capabilities was shown via a Powerpoint presentation, and then followed by a live demo. Figure 7-2 shows a screen capture of the main screen of TSAT.

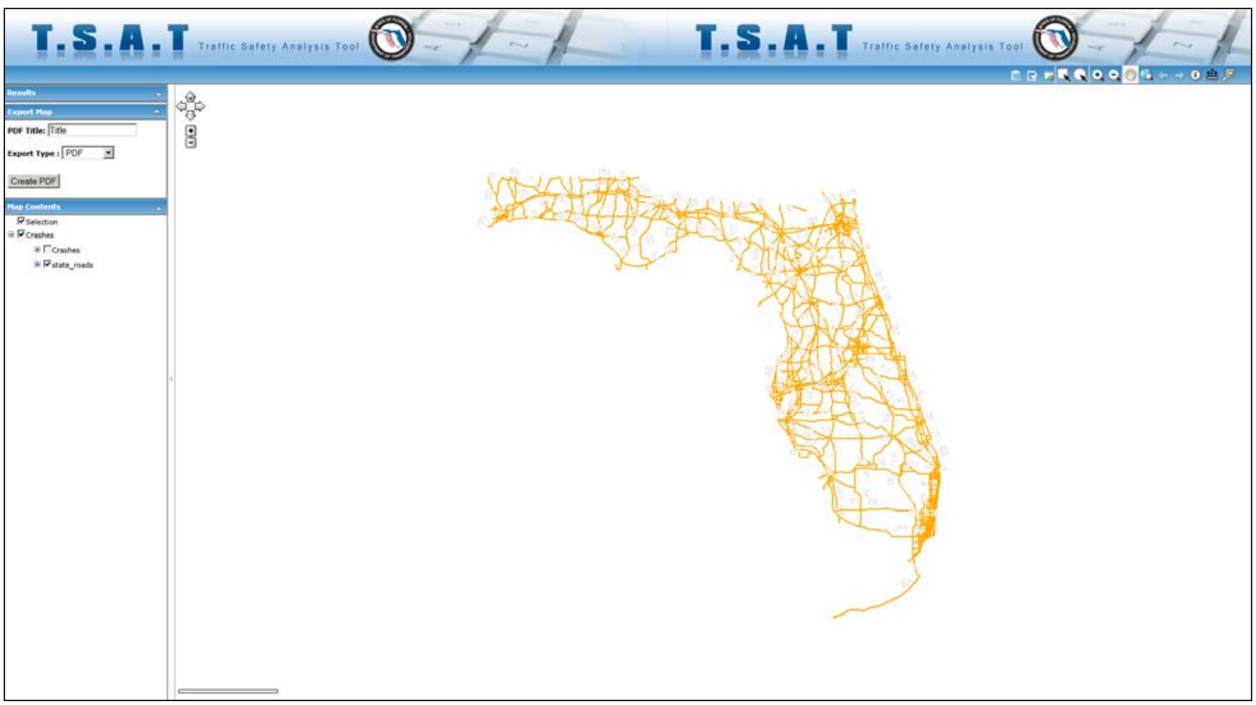


Figure 7-2: Main Screen of TSAT

In addition to TSAT, District 3 has another desktop application for internal use. The desktop version incorporates an automated data cleaning process which is not currently available in the web-based version. TSAT was developed after the desktop version and works with the Bing Map server, while the desktop version runs on FDOT Aerial Map server. The web-based applications can perform district-wide crash analysis. For the scope of the meeting, the demonstration was only focused on the web-based version of TSAT; thus, the summary and evaluation will mainly focus on the same. A demo of the web-based version is available at http://tsat.metriceng.com.

Metric Engineering, Inc. has also developed a supplemental application to TSAT, Fatal Crash Review Reporting Tool. This system is intended to estimate the expected crash predictions and crash patterns as per the Highway Safety Manual and help in better identification of probable causes.

In detailed crash data analysis, two data quality issues are often encountered: errors existent in the crash data and the errors with geo-location of crashes. The crash types in the data are corrected by viewing the harmful events and contributing causes in the downloaded crash summary data. In addition, the district follows certain logic while performing data quality checking, e.g., differentiating between sideswipe and angle crashes. For example, if the coded contributing cause is improper lane change, the district assumes that the crash type is sideswipe (and not an angle crash). Notably, crash reports are not checked for data corrections.

The web-based TSAT has a built-in ArcGIS map and SQL servers for visualizing crashes along roadways and for querying specific crash types for display (e.g., during specified time periods). The query can further display crashes in any district or specific state roads with specified begin and end mile posts. TSAT has the capability to display detailed information about each crash by clicking on the specific crash. Once clicked, detailed characteristics of the crash (e.g., time and date of the crash, contributing cause, source of the crash, etc.) will be displayed. Moreover, the output can also be exported into a “csv format” or “xls format”.

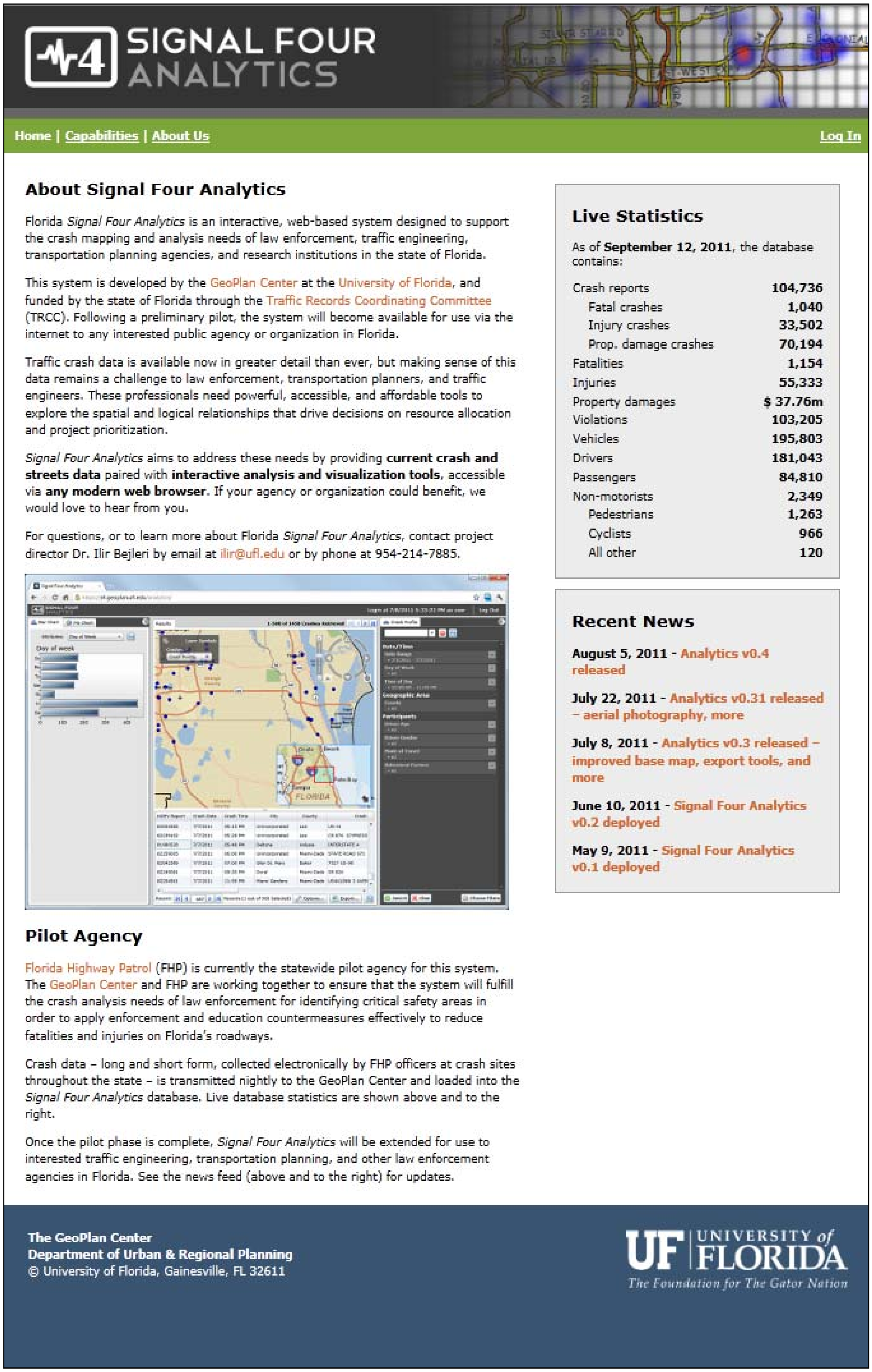
The upcoming versions of TSAT will have the following seven functionalities:

- Automatic data synchronization with CAR.
- Crash locator/Enhanced geo-referencing system.
- Data validation.
- Data correction/Revision tracking.
- More supplementary information integration.
- Intelligent crash pattern recognition.
- Connection with other FDOT systems.

7.3.3 Signal Four Analytics (S4)

A GoTo web meeting was scheduled for the demonstration of UF’s web-based GIS system (S4). A thorough review of the S4’s capabilities was shown via a Powerpoint presentation, followed by a live demo. The main screen of the S4 system is shown in Figure 7-3.

The main objective of the S4 system is to develop a place-based, consistent, and timely interactive crash analysis system that is easy to access. The system includes the most current crash data for both on- and off-system roads in Florida. Since 2006, the system has been helping many counties with their crash analyses. A web-based operational crash reporting system for Florida law enforcement was developed in 2010 which was later enhanced to address the needs of traffic safety professionals. The main target audiences for this system include Florida public agencies, law enforcement department, traffic engineering and transportation planning personnel, school boards and research institutes, and the injury prevention department.


SIGNAL FOUR ANALYTICS

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About Signal Four Analytics

Florida *Signal Four Analytics* is an interactive, web-based system designed to support the crash mapping and analysis needs of law enforcement, traffic engineering, transportation planning agencies, and research institutions in the state of Florida.

This system is developed by the GeoPlan Center at the University of Florida, and funded by the state of Florida through the Traffic Records Coordinating Committee (TRCC). Following a preliminary pilot, the system will become available for use via the internet to any interested public agency or organization in Florida.

Traffic crash data is available now in greater detail than ever, but making sense of this data remains a challenge to law enforcement, transportation planners, and traffic engineers. These professionals need powerful, accessible, and affordable tools to explore the spatial and logical relationships that drive decisions on resource allocation and project prioritization.

Signal Four Analytics aims to address these needs by providing **current crash and streets data** paired with **interactive analysis and visualization tools**, accessible via **any modern web browser**. If your agency or organization could benefit, we would love to hear from you.

For questions, or to learn more about Florida *Signal Four Analytics*, contact project director Dr. Ilir Bejleri by email at ilir@ufl.edu or by phone at 954-214-7885.

Pilot Agency

Florida Highway Patrol (FHP) is currently the statewide pilot agency for this system. The GeoPlan Center and FHP are working together to ensure that the system will fulfill the crash analysis needs of law enforcement for identifying critical safety areas in order to apply enforcement and education countermeasures effectively to reduce fatalities and injuries on Florida's roadways.

Crash data – long and short form, collected electronically by FHP officers at crash sites throughout the state – is transmitted nightly to the GeoPlan Center and loaded into the *Signal Four Analytics* database. Live database statistics are shown above and to the right.

Once the pilot phase is complete, *Signal Four Analytics* will be extended for use to interested traffic engineering, transportation planning, and other law enforcement agencies in Florida. See the news feed (above and to the right) for updates.

Live Statistics

As of **September 12, 2011**, the database contains:

Crash reports	**104,736**
Fatal crashes	**1,040**
Injury crashes	**33,502**
Prop. damage crashes	**70,194**
Fatalities	**1,154**
Injuries	**55,333**
Property damages	**$ 37.76m**
Violations	**103,205**
Vehicles	**195,803**
Drivers	**181,043**
Passengers	**84,810**
Non-motorists	**2,349**
Pedestrians	**1,263**
Cyclists	**966**
All other	**120**

Recent News

August 5, 2011 - **Analytics v0.4 released**

July 22, 2011 - **Analytics v0.31 released – aerial photography, more**

July 8, 2011 - **Analytics v0.3 released – improved base map, export tools, and more**

June 10, 2011 - **Signal Four Analytics v0.2 deployed**

May 9, 2011 - **Signal Four Analytics v0.1 deployed**

The GeoPlan Center
Department of Urban & Regional Planning
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UF UNIVERSITY of FLORIDA
The Foundation for The Gator Nation

Figure 7-3: Login Page of S4 System

The S4 system incorporates a good understanding of the mapping differences between the old and the new crash report forms. The system is currently compatible with the new crash report form. It also has the capabilities to understand the old crash reports. The team is planning to import crash data for the years 2006-2010 (for both on- and off-system roads) into the system.

The S4 team has identified the following as the high-level user requirements:

- Search crashes according to crash profile.
- Visualize crash patterns and concentrations.
- Map crashes in context using street map, aerial photography, land use, etc.
- Identify high crash streets and intersections.
- Graph crash distribution according to various attributes.

The S4 system has the capability to rank high crash locations and to query the network based on several attributes like functional classification, crash severity, etc. Further, the GIS mapping capabilities are worthy of mention. The supporting infrastructure used by the system include Florida's unified base map (i.e., Navteq streets), FDOT road characteristics inventory file (i.e., RCI data), and intersections database. It is to be noted that the batch geocoding of crashes is fully automated and streamlined, even though the non-geocoded crashes are coded manually using an interactive geocoding tool.

Specific capabilities of S4 are as follows:

- *Mapping:* Cartographic base maps, aerial imagery base maps, crash points, and crash clusters could be spatially mapped.
- *Analysis:* Crashes could be queried based on crash profile, geographic boundaries, and attributes. Charts could also be generated as per the user requirements. The high crash locations could be mapped based on crash count, crash rate, and crash severity.
- *Functions:* The developed maps, tables, and charts could be exported. Additionally, queries and filter sets could be saved and shared.

Based on the users' future expectations, the following additional capabilities would be incorporated in the next version of the system.

- Select and interact with query results.
- View individual crash reports.
- Export data to SafetyAnalyst.
- Generate collision diagrams at intersections.

7.4 Typical Features in the GIS Crash Analysis System

This section describes the following seven typical features found in GIS-based crash analysis systems:

1. Apply filters to select specific types of crashes.

2. Generate high crash locations.
3. Generate reports.
4. Generate plots.
5. Generate collision diagrams.
6. Allow visualization of data on GIS maps.
7. Display detailed police reports.

Examples from the three existing web-based GIS systems are given to help with the illustration.

7.4.1 Apply Filters to Select Specific Types of Crashes

This feature includes the ability to select specific types of crashes (such as by crash types, crash severity, weather conditions, lighting conditions, time of day, etc.) using queries (filters). This functionality is available in all the three systems. Two examples from WebCDMS for selecting specific crash types are shown in Figures 7-4 and 7-5. As shown in Figures 7-6 and 7-7, TSAT has a comprehensive query builder to query crashes based on several attributes including crash locations. As shown in Figure 7-8, S4 also has the capabilities to query crashes.

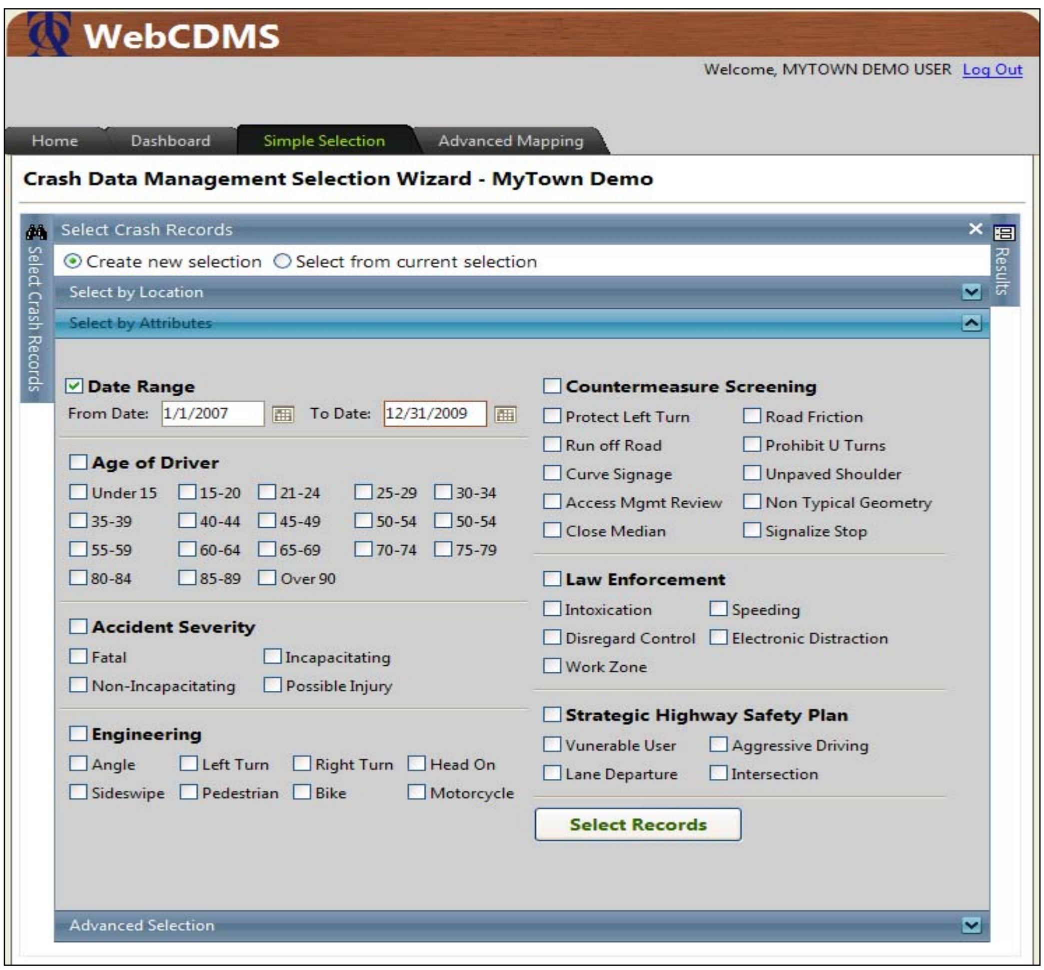


Figure 7-4: Selecting Specific Crash Types in “Simple Selection” Tab in WebCDMS

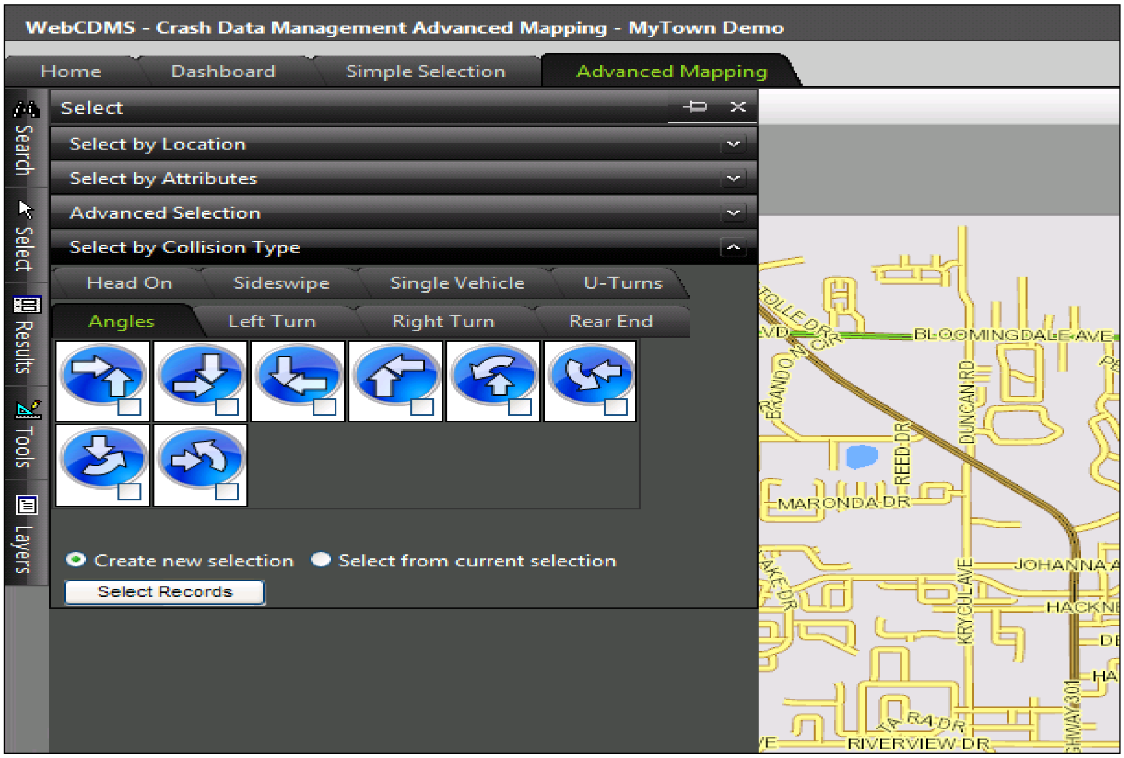


Figure 7-5: Selecting Specific Crash Types in "Advanced Mapping" Tab in WebCDMS

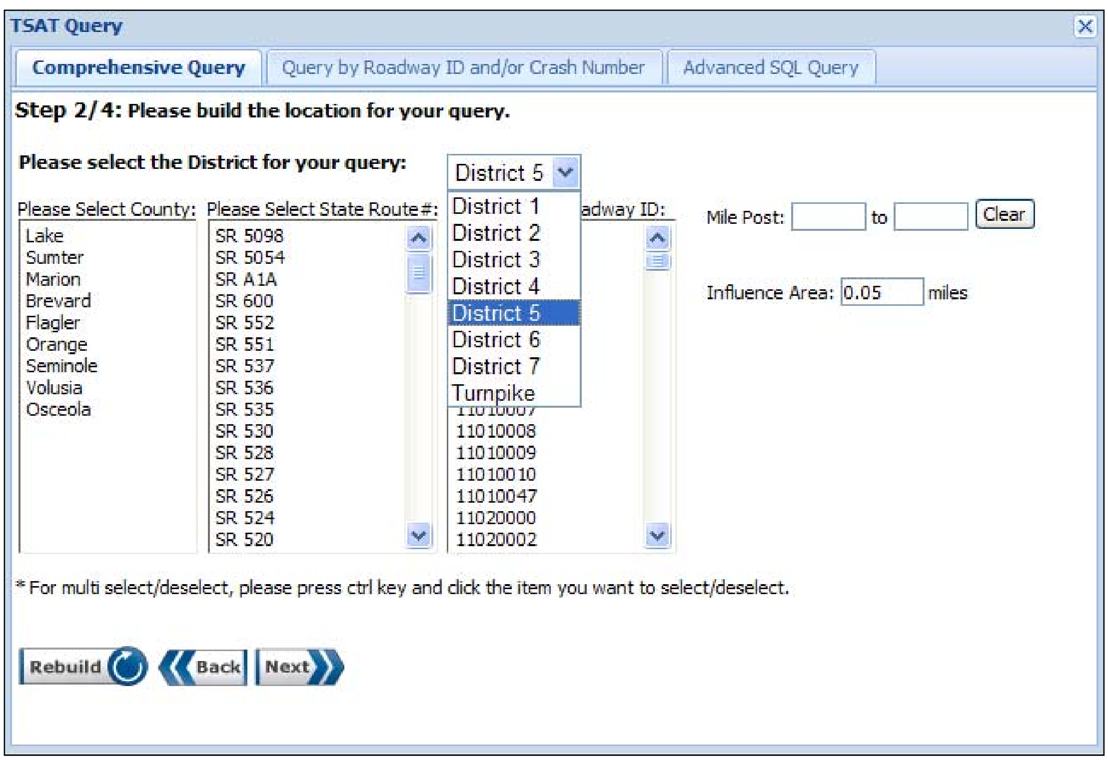


Figure 7-6: Selecting Crashes by Location Using Comprehensive Query Builder in TSAT

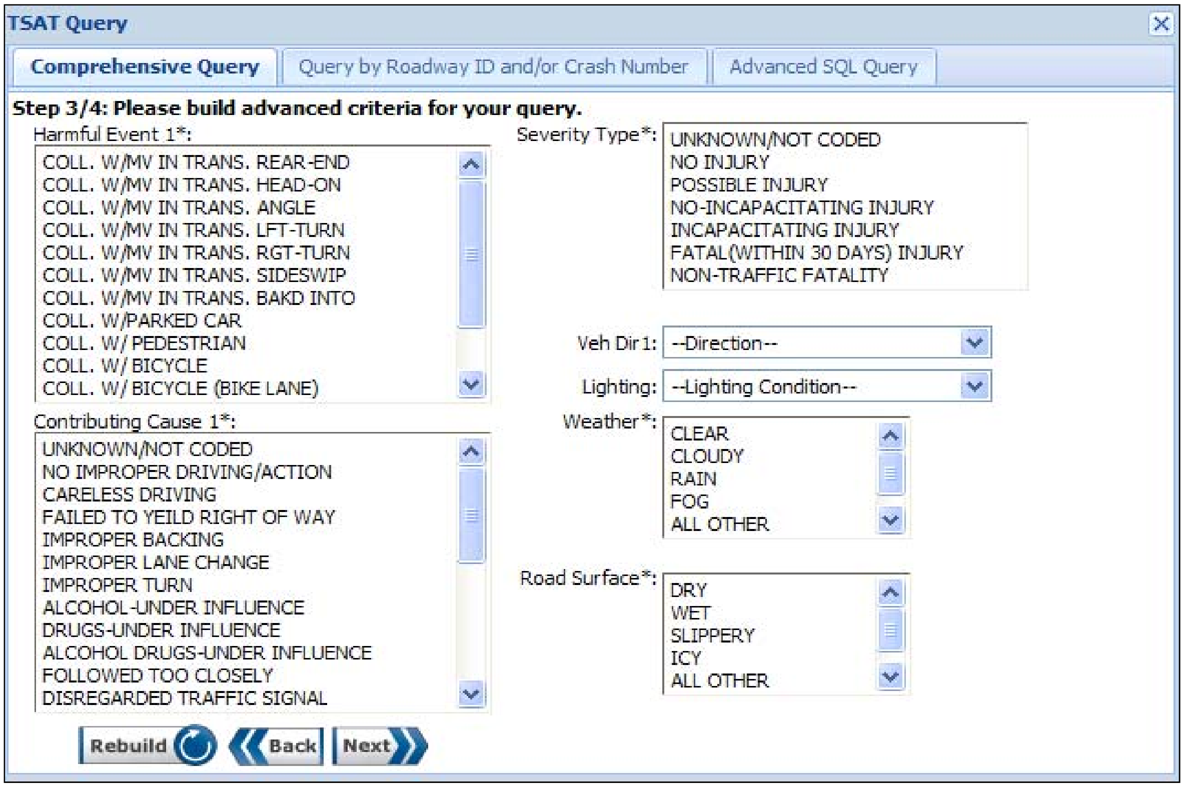


Figure 7-7: Selecting Specific Crash Types Using Comprehensive Query Builder in TSAT

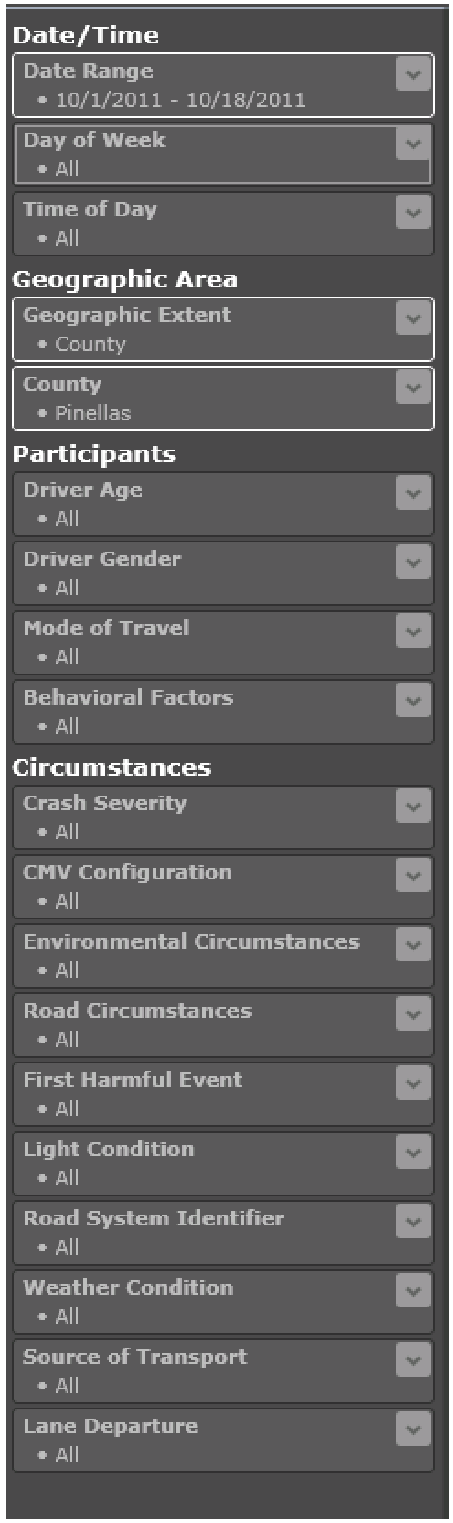


Figure 7-8: Selecting Specific Crash Types in S4

7.4.2. Generate High Crash Locations

The ability to perform network screening by identifying a list of high crash locations is a valuable feature. Only WebCDMS has the capability to select locations based on crash frequency and crash severity. Figure 7-9 shows an example of the identified top 20 intersections in WebCDMS.

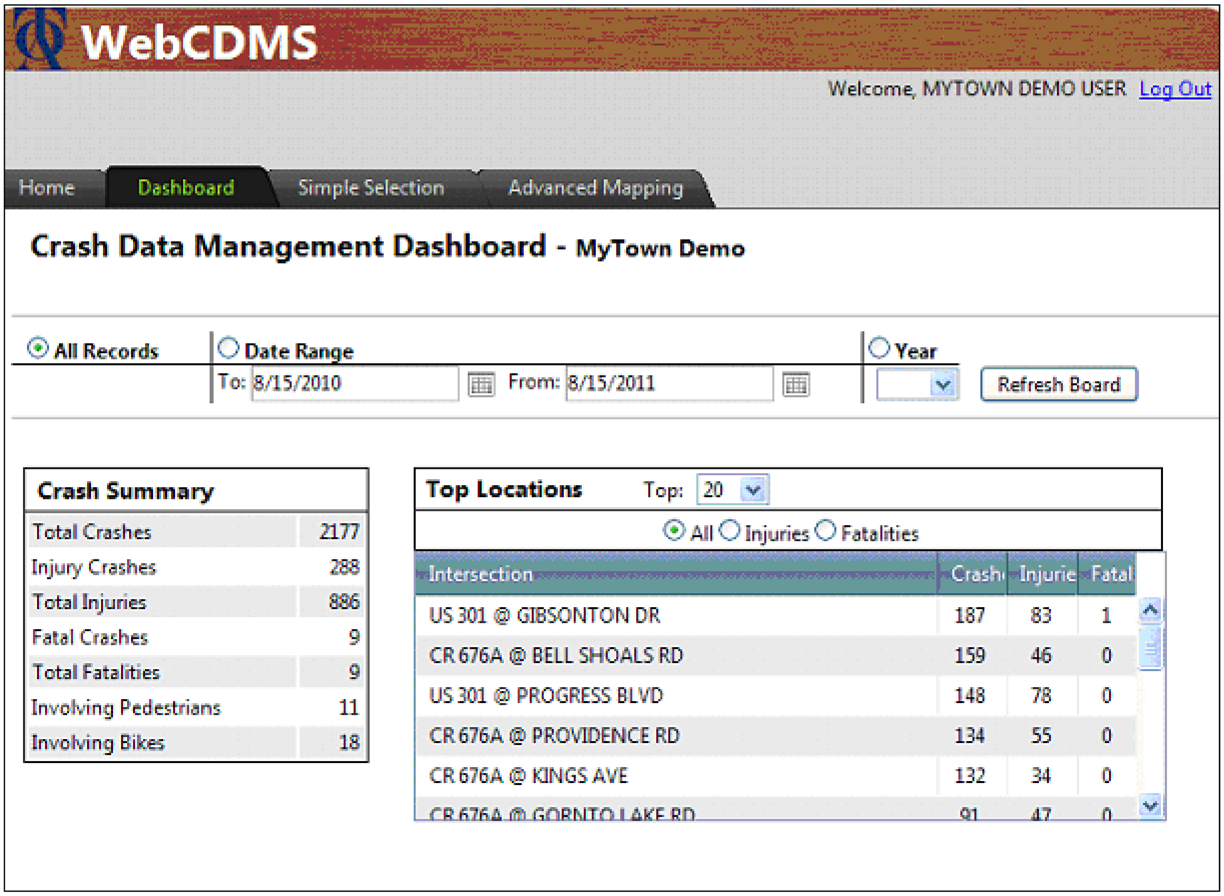


Figure 7-9: Top 20 High Crash Intersections in WebCDMS

7.4.3. Generate Reports

This functionality includes the ability to display output reports summarizing cross tabulations of crashes by important attributes such as crash type, harmful event, hour of the day, day of the week, etc. Figure 7-10 shows a list of different types of reports that can be generated in TSAT. In addition, a screenshot showing the facility to extract reports in different formats is displayed in Figure 7-11, and a summary crash report from TSAT is displayed in Figure 7-12. Similar to TSAT, WebCDMS is also capable of generating reports. The capabilities of WebCDMS are shown in Figures 7-13 through 7-15. This capability is currently unavailable in S4.

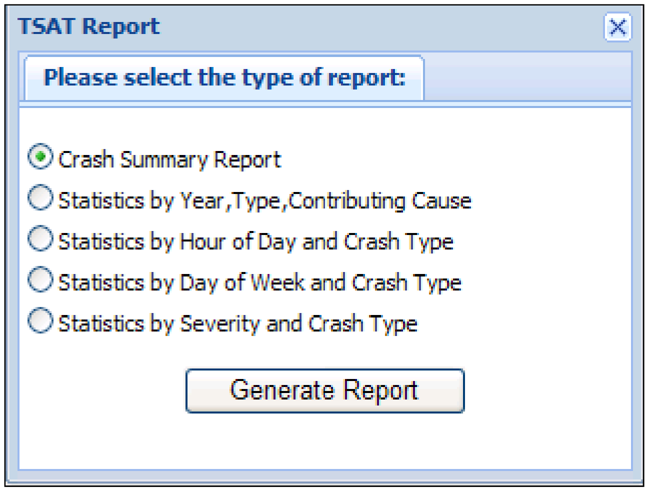


Figure 7-10: Different Output Reports in TSAT

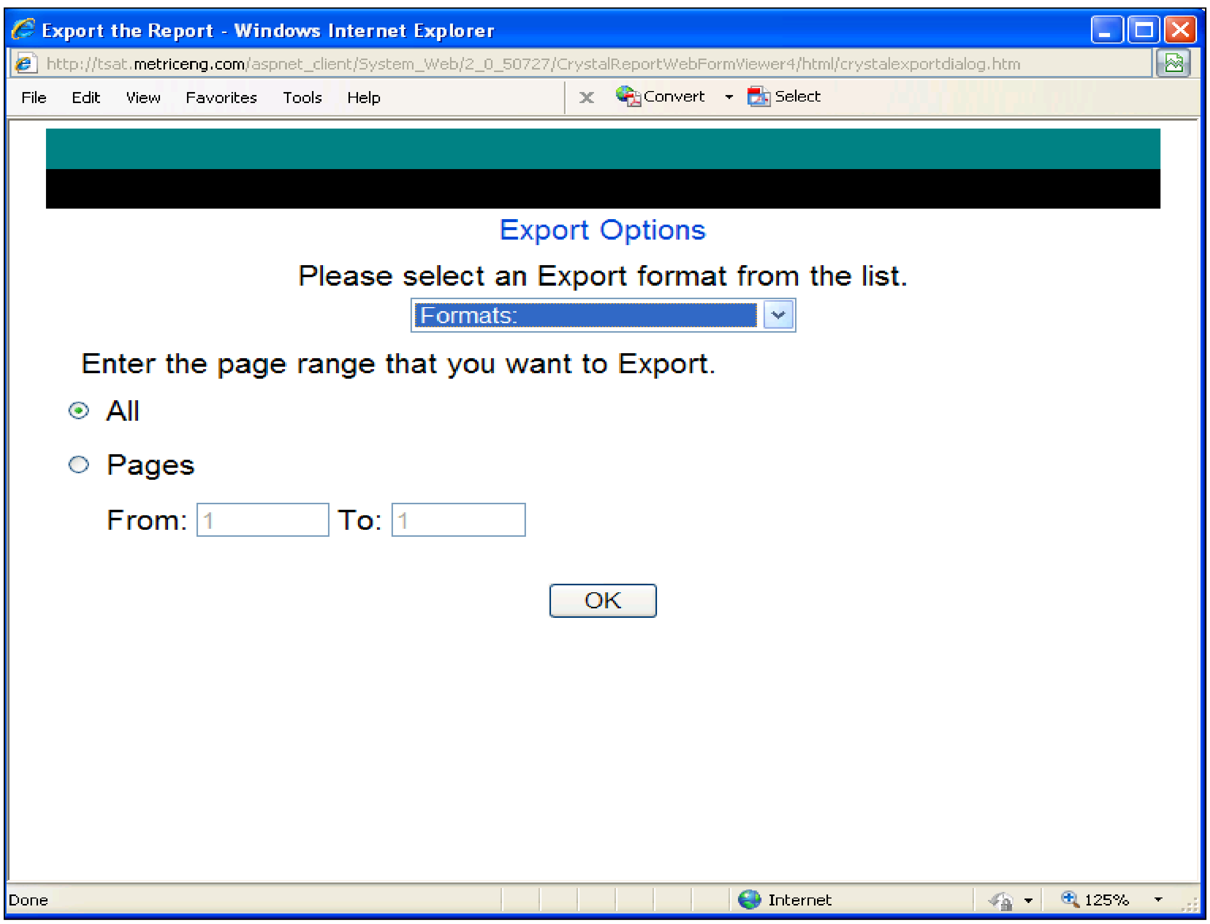


Figure 7-11: Facility to Export Output Reports in Different Formats in TSAT

FLORIDA DEPARTMENT OF TRANSPORTA
CRASH SUMMARY

SECTION: M.P.: n/a TO n/a

LOCATION DESCRIPTION:

#	Crash No.	SR	Mile Post	DATE	Wkday	TIME	TYPE	FATAL	INJURY	PDO?
1	720825120	SR 688	0.00	06/15/2004	Tue	17:15	Collison w/ moving vehicle	0	0	Y
2	720825130	SR 688	0.00	07/07/2004	Wed	15:35	Rear-end	0	0	Y
3	720825150	SR 688	0.00	09/23/2004	Thu	15:20	Left-turn	0	0	Y
4	720825170	SR 688	0.00	10/21/2004	Thu	15:40	Rear-end	0	1	N
5	730578060	SR 688	0.00	02/23/2004	Mon	20:00	Sideswipe	0	0	Y
6	720825960	SR 688	0.00	04/21/2005	Thu	19:40	Rear-end	0	1	N
7	759074910	SR 688	0.00	10/20/2005	Thu	07:30	Pedestrian	0	1	N
8	720809910	SR 688	0.00	02/05/2006	Sun	12:21	Rear-end	0	0	Y
9	730597130	SR 688	0.00	03/23/2006	Thu	02:18	All other	0	1	N
10	759323130	SR 688	0.00	07/29/2006	Sat	15:00	Left-turn	0	0	Y
11	759336740	SR 688	0.00	06/27/2006	Tue	19:10	Rear-end	0	0	Y
12	092239760	SR 688	0.00	07/26/2007	Thu	20:00	Sideswipe	0	0	Y
13	094315480	SR 688	0.00	06/18/2007	Mon	10:25	Rear-end	0	0	Y
14	730349360	SR 688	0.00	02/19/2007	Mon	20:05	Rear-end	0	0	Y
15	759314100	SR 688	0.00	12/06/2008	Sat	20:50	Hit tree/shrubbery	0	0	Y
16	900992010	SR 688	0.00	12/29/2008	Mon	14:25	Rear-end	0	1	N
17	759314130	SR 688	0.00	02/03/2009	Tue	02:15	Hit sign/sign post	0	3	N
18	759314140	SR 688	0.00	07/21/2009	Tue	22:21	Collison w/ moving vehicle	0	0	Y
19	766622180	SR 688	0.00	04/12/2009	Sun	14:59	Rear-end	0	0	Y
20	766646940	SR 688	0.00	10/28/2009	Wed	17:30	Rear-end	0	0	Y
21	766647240	SR 688	0.00	09/29/2009	Tue	16:00	Rear-end	0	0	Y
22	900951490	SR 688	0.00	07/31/2009	Fri	16:27	Angle	0	1	N
23	900992020	SR 688	0.00	03/19/2009	Thu	08:15	Rear-end	0	0	Y
24	805463830	SR 688	0.00	01/01/2010	Fri	15:05	Rear-end	0	0	Y
25	805471480	SR 688	0.00	03/13/2010	Sat	09:55	Rear-end	0	0	Y
26	805480490	SR 688	0.00	05/29/2010	Sat	09:26	Rear-end	0	0	Y
27	805482120	SR 688	0.00	06/12/2010	Sat	22:20	Collison w/ moving vehicle	0	0	Y
28	818800500	SR 688	0.00	09/09/2010	Thu	08:07	Rear-end	0	0	Y
29	759308960	SR 688	0.01	03/09/2005	Wed	13:50	Hit sign/sign post	0	0	Y
30	818805670	SR 688	0.01	11/03/2010	Wed	21:25	Hit tree/shrubbery	0	1	N
31	720825190	SR 688	0.01	08/18/2005	Thu	18:50	Rear-end	0	0	Y
32	759343150	SR 688	0.01	03/03/2006	Fri	00:00	Hit tree/shrubbery	0	1	N
33	069538370	SR 688	0.01	10/31/2008	Fri	17:01	Rear-end	0	0	Y
34	720771790	SR 688	0.01	02/14/2004	Sat	08:45	Pedestrian	0	1	N
35	900978340	SR 699	6.74	08/03/2007	Fri	18:56	Left-turn	0	0	Y
36	818799890	SR 699	6.74	09/04/2010	Sat	16:55	Backed into	0	0	Y
37	720809530	SR 699	6.75	05/30/2005	Mon	21:15	Rear-end	0	0	Y

Figure 7-12: Sample Crash Summary Report in TSAT

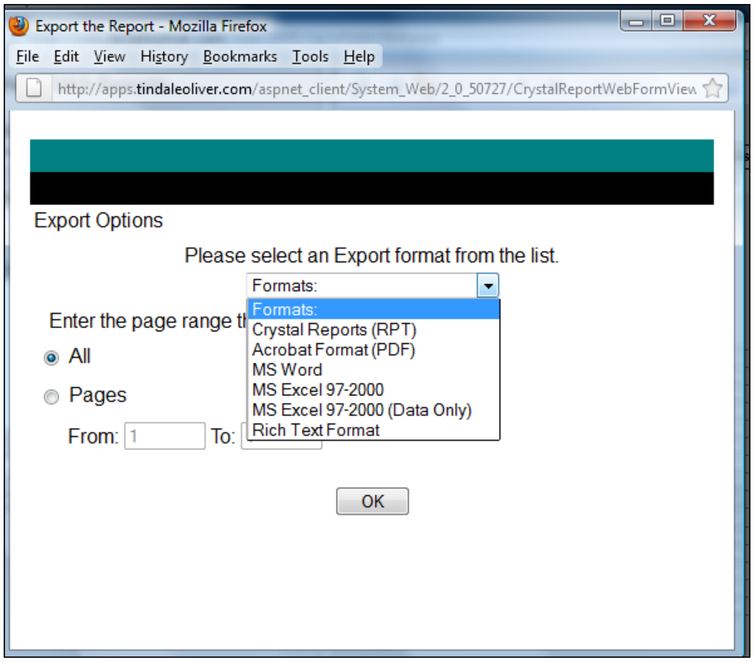
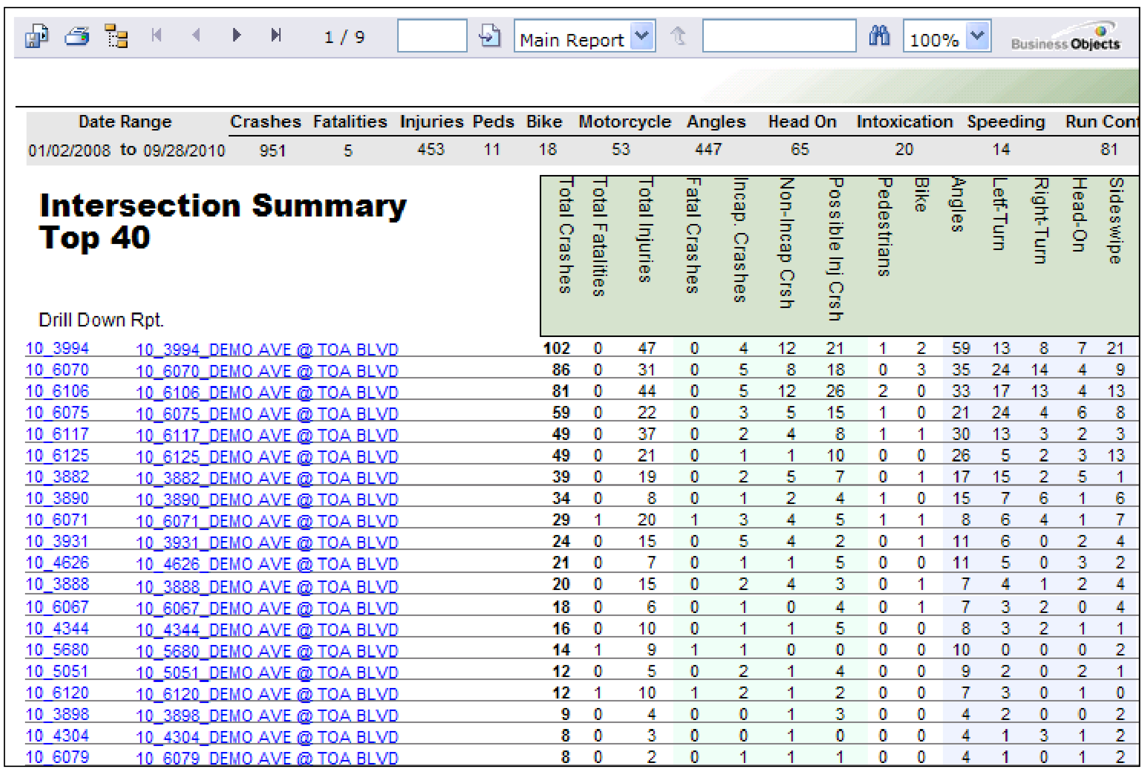


Figure 7-13: Facility to Export Output Reports in Different Formats in WebCDMS



Main Report 1 / 9 100%

Date Range	Crashes	Fatalities	Injuries	Peds	Bike	Motorcycle	Angles	Head On	Intoxication	Speeding	Run Cont
01/02/2008 to 09/28/2010	951	5	453	11	18	53	447	65	20	14	81

Intersection Summary
Top 40

Drill Down Rpt.

		Total Crashes	Total Fatalities	Total Injuries	Fatal Crashes	Incap. Crashes	Non-Incap Crsh	Possible Inj Crsh	Pedestrians	Bike	Angles	Left-Turn	Right-Turn	Head-On	Sideswipe
10_3994	10_3994_DEMO AVE @ TOA BLVD	**102**	0	47	0	4	12	21	1	2	59	13	8	7	21
10_6070	10_6070_DEMO AVE @ TOA BLVD	**86**	0	31	0	5	8	18	0	3	35	24	14	4	9
10_6106	10_6106_DEMO AVE @ TOA BLVD	**81**	0	44	0	5	12	26	2	0	33	17	13	4	13
10_6075	10_6075_DEMO AVE @ TOA BLVD	**59**	0	22	0	3	5	15	1	0	21	24	4	6	8
10_6117	10_6117_DEMO AVE @ TOA BLVD	**49**	0	37	0	2	4	8	1	1	30	13	3	2	3
10_6125	10_6125_DEMO AVE @ TOA BLVD	**49**	0	21	0	1	1	10	0	0	26	5	2	3	13
10_3882	10_3882_DEMO AVE @ TOA BLVD	**39**	0	19	0	2	5	7	0	1	17	15	2	5	1
10_3890	10_3890_DEMO AVE @ TOA BLVD	**34**	0	8	0	1	2	4	1	0	15	7	6	1	6
10_6071	10_6071_DEMO AVE @ TOA BLVD	**29**	1	20	1	3	4	5	1	1	8	6	4	1	7
10_3931	10_3931_DEMO AVE @ TOA BLVD	**24**	0	15	0	5	4	2	0	1	11	6	0	2	4
10_4626	10_4626_DEMO AVE @ TOA BLVD	**21**	0	7	0	1	1	5	0	0	11	5	0	3	2
10_3888	10_3888_DEMO AVE @ TOA BLVD	**20**	0	15	0	2	4	3	0	1	7	4	1	2	4
10_6067	10_6067_DEMO AVE @ TOA BLVD	**18**	0	6	0	1	0	4	0	1	7	3	2	0	4
10_4344	10_4344_DEMO AVE @ TOA BLVD	**16**	0	10	0	1	1	5	0	0	8	3	2	1	1
10_5680	10_5680_DEMO AVE @ TOA BLVD	**14**	1	9	1	1	0	0	0	0	10	0	0	0	2
10_5051	10_5051_DEMO AVE @ TOA BLVD	**12**	0	5	0	2	1	4	0	0	9	2	0	2	1
10_6120	10_6120_DEMO AVE @ TOA BLVD	**12**	1	10	1	2	1	2	0	0	7	3	0	1	0
10_3898	10_3898_DEMO AVE @ TOA BLVD	**9**	0	4	0	0	1	3	0	0	4	2	0	0	2
10_4304	10_4304_DEMO AVE @ TOA BLVD	**8**	0	3	0	0	1	0	0	0	4	1	3	1	2
10_6079	10_6079_DEMO AVE @ TOA BLVD	**8**	0	2	0	1	1	1	0	0	4	1	0	1	2

Figure 7-14: Report on Intersections in WebCDMS

Driver Contributing Cause Roadway

Drill Down Rpt.	Crashe	Fataliti	Injurie	Peds	Bike
Exceeded Posted Speed	1	0	0	0	0
Failed to Keep in Proper	10	0	5	0	0
Failed to Yield Right-of-Way	48	0	27	0	0
Followed too Closely	14	0	1	0	0
Improper Backing	3	0	0	0	0
Improper Passing	2	0	1	0	0
Improper Turn	7	0	4	0	0
No Contributing Action	2	0	1	0	0
No Data	2	0	0	0	0
Operated MV in Careless or	40	0	10	0	0
Other Contributing Actions	6	1	6	1	0
Ran Red Light	4	0	3	0	0
Ran Stop Sign	1	0	0	0	0

Impact Type Summary

Drill Down Rpt.	Crashe	Fataliti	Injurie	Peds	Bike
Angle	31	0	15	0	0
Front to Front	2	0	0	0	0
Front to Rear	49	0	12	0	0
No Data	43	1	19	1	0
Rear to Side	3	0	0	0	0
Sideswipe, same direction	12	0	12	0	0

Figure 7-15: Automated Output Crash Summary Statistics in MS Excel from WebCDMS

7.4.4. Generate Plots

This feature incorporates the ability to display relevant analytical plots such as the distribution of crashes by crash type, contributing cause, year, month, day, etc. Figures 7-16 and 7-17 show two examples from WebCDMS. In Figure 7-16, monthly distribution of crashes, injuries, and fatalities are plotted. Figure 7-17 shows the temporal crash summary plots by year and month. Similar output plots from TSAT are shown in Figure 7-18. The distribution of crashes by study year, crash type, and contributing cause are plotted. Figure 7-19 from the S4 system displays a bar chart of crash frequency by time of day. Similarly, crash frequency by day of week is displayed in a pie chart, as shown in Figure 7-20.

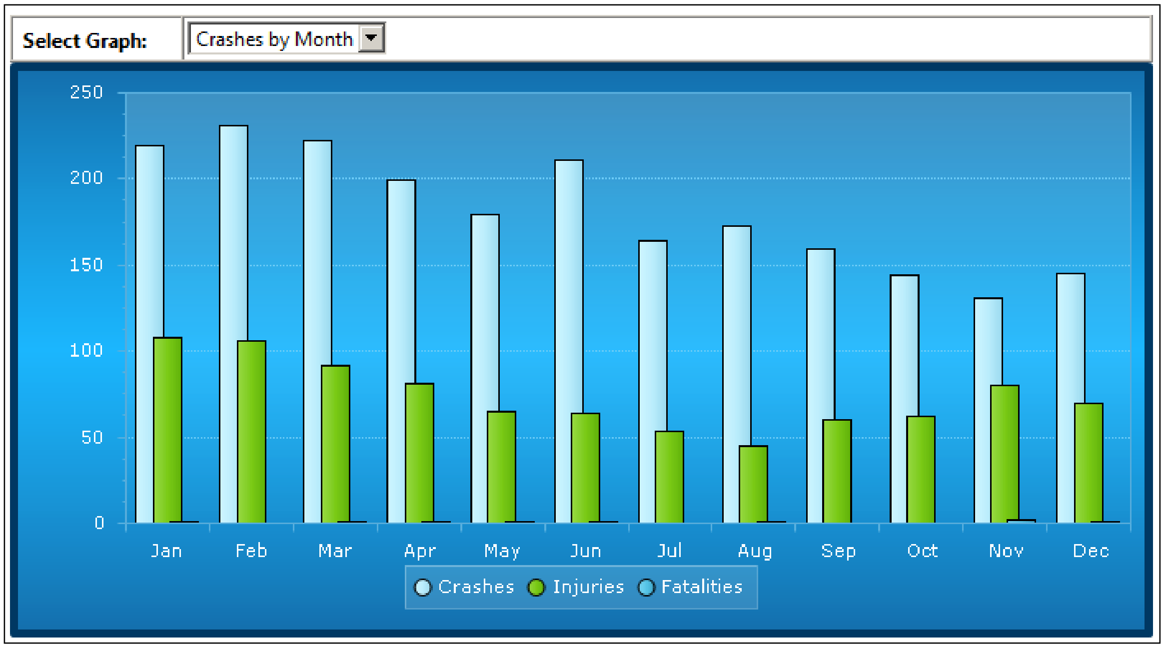


Figure 7-16: Generating Plots in WebCDMS

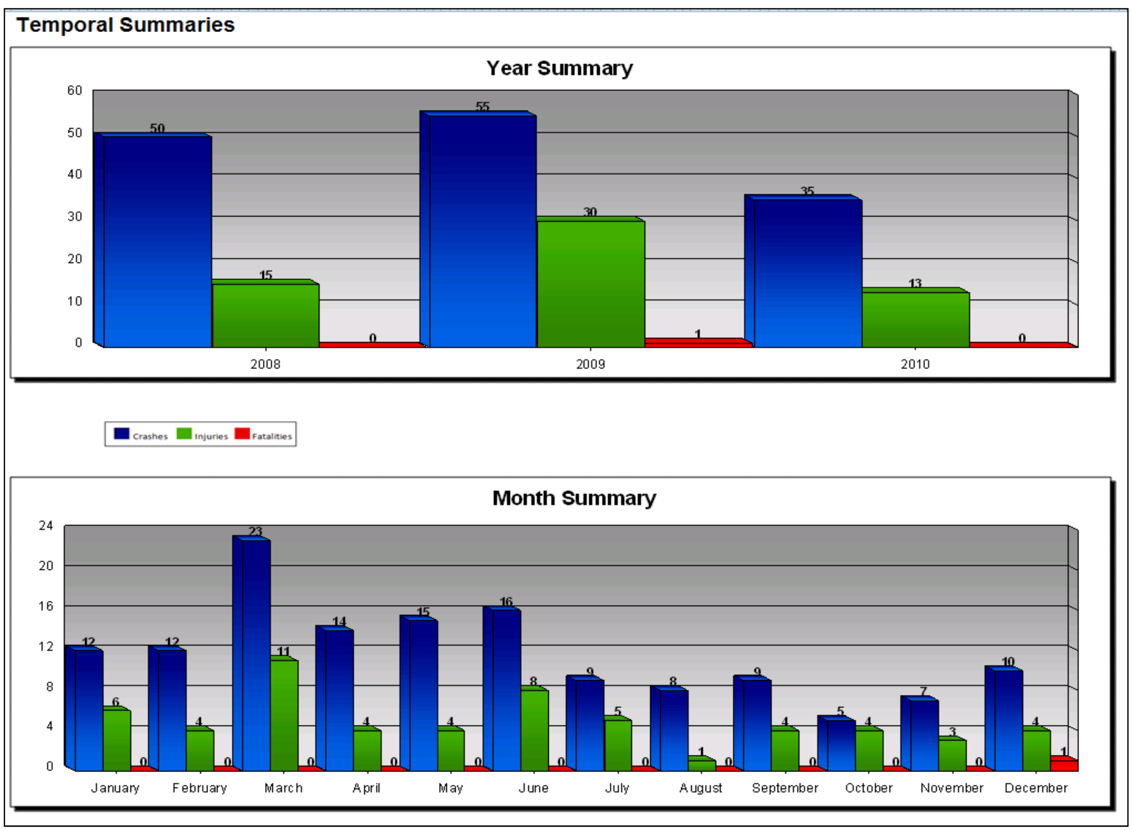


Figure 7-17: Temporal Crash Summary Plots by Year and Month in WebCDMS

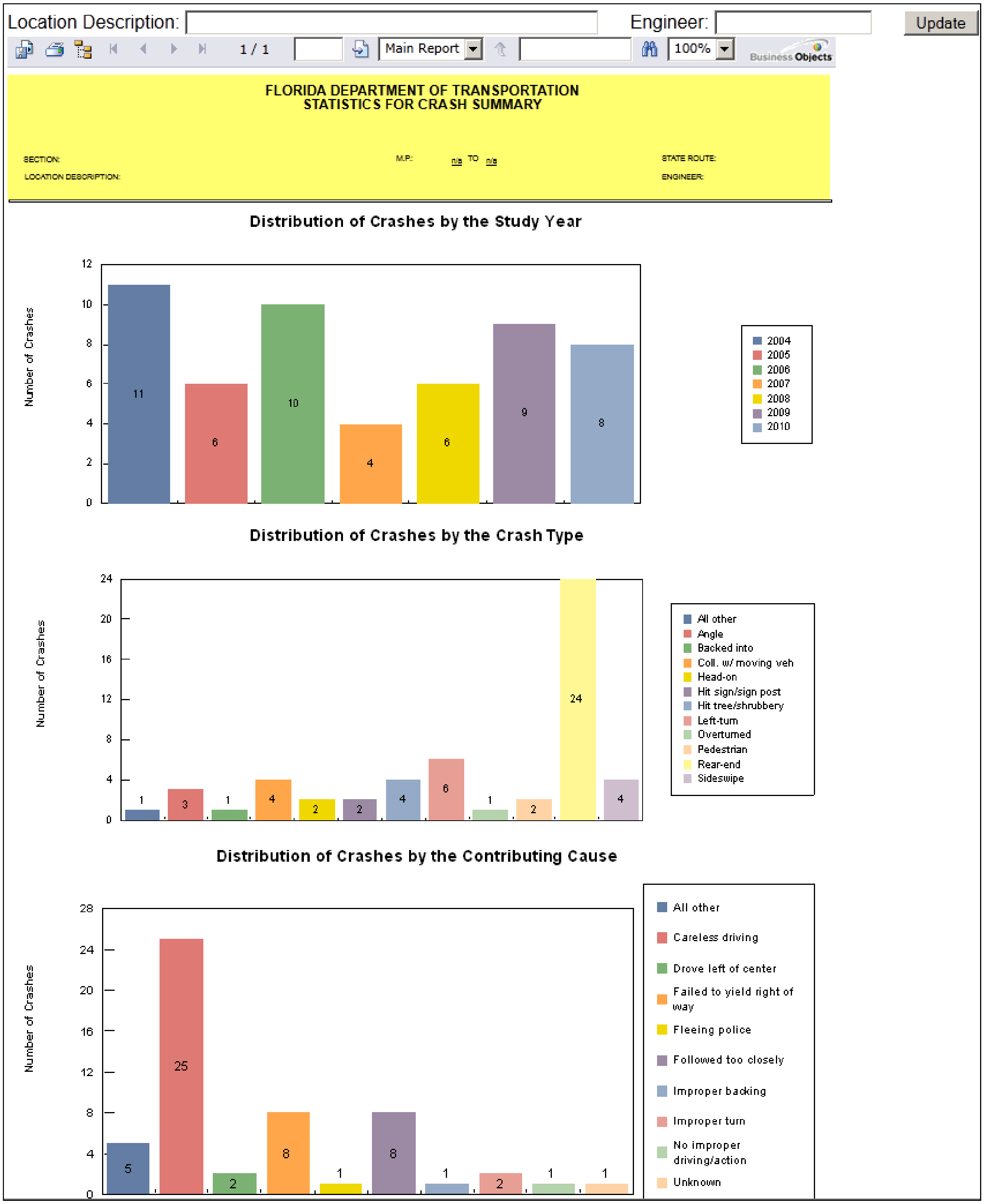


Figure 7-18: Plots of Crashes by Year, Crash Type, and Contributing Cause in TSAT

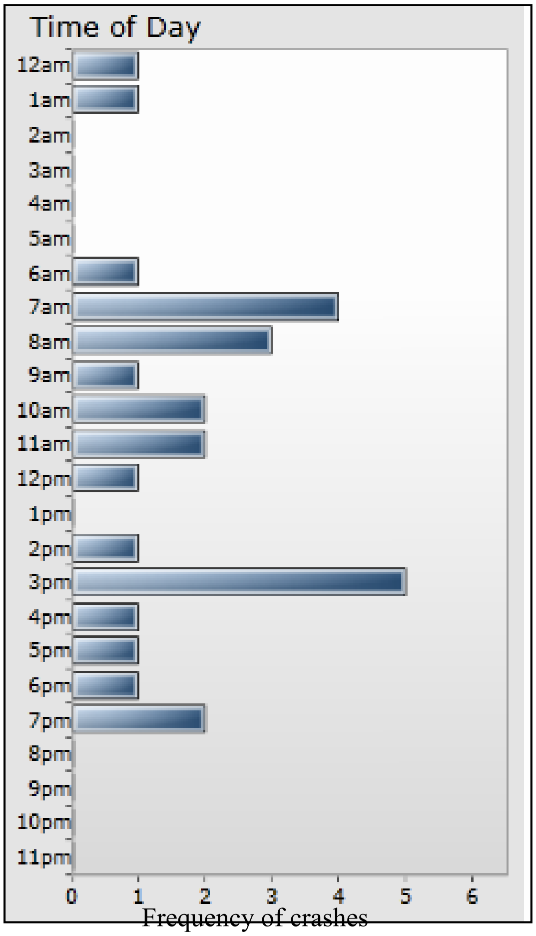


Figure 7-19: Bar Chart Showing Crash Distribution by Time of Day in S4

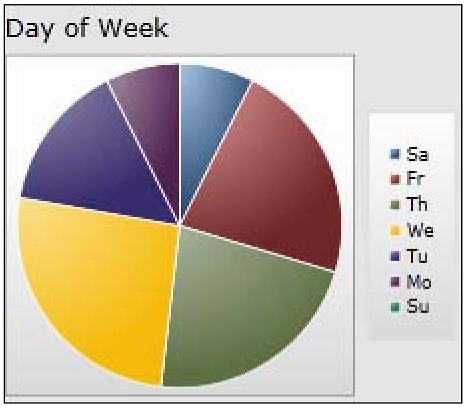


Figure 7-20: Pie Chart Showing Crash Percentages by Day of Week in S4

7.4.5. Generate Collision Diagrams

This feature includes the ability to display collision diagrams for intersections. In other words, different crash types (along with their specific location within the intersection) can be displayed. An example of generating collision diagrams in WebCDMS is shown in Figure 7-21. From the figure, it is noted that there are four crashes that occurred at that specific intersection in a 3-year period. Two of the four crashes involved hitting a fixed object, one crash is angled, and the other is unknown. This feature is currently unavailable in TSAT and S4.

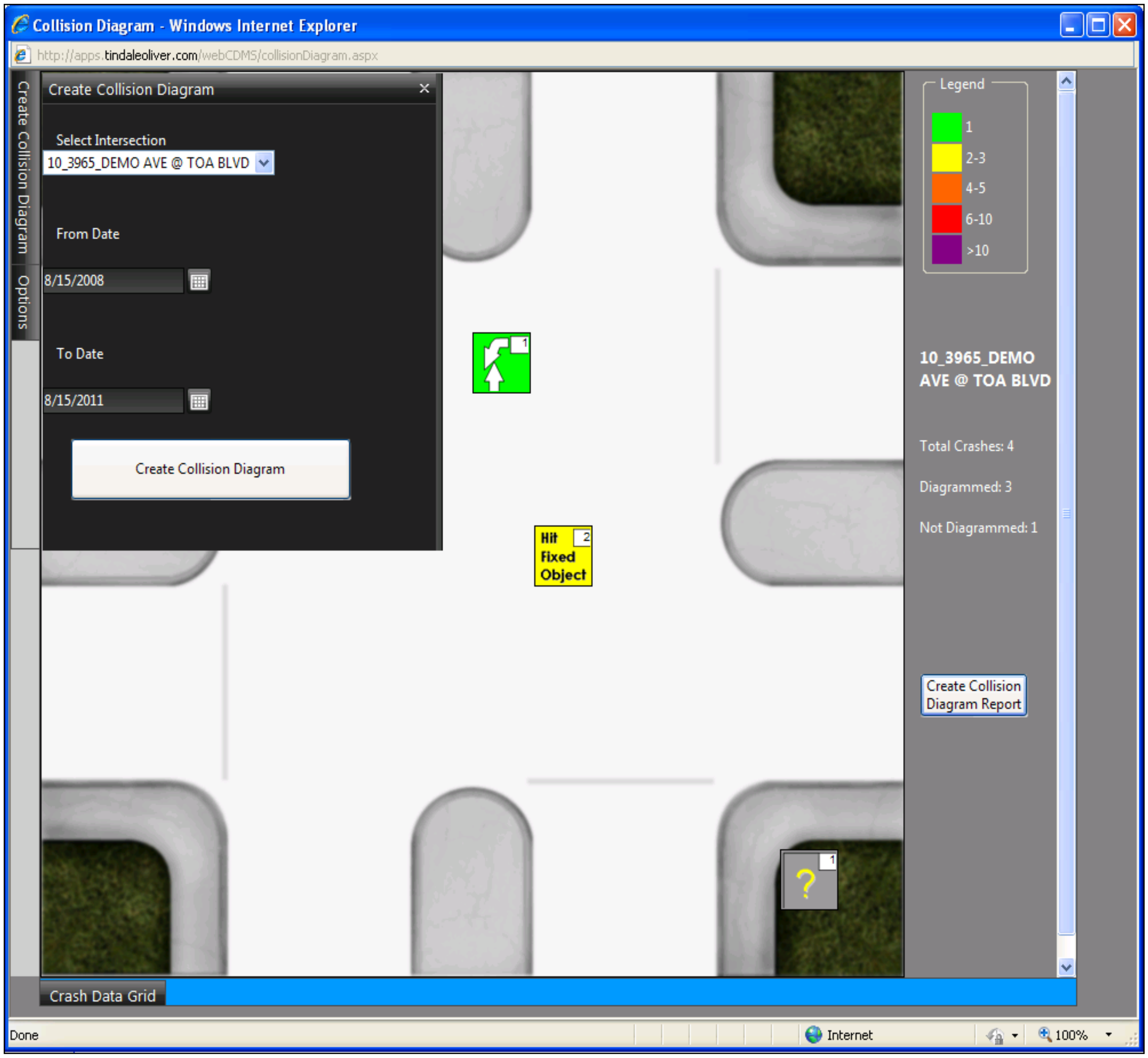


Figure 7-21: Collision Diagrams Generated by WebCDMS

7.4.6. Allow Visualization of Data on GIS Maps

This functionality comprises of the ability to visualize and spatially select crashes on the GIS map along with the ability to display detailed information of each crash. Figure 7-22 shows an example that displays crashes along the routes in WebCDMS. Figure 7-23, from WebCDMS, shows the crash locations with additional details showing the type of each crash. TSAT also has the capability to spatially map crashes. This functionality is shown in Figure 7-24. S4 also locates crashes spatially with detailed information on crashes. Figure 7-25 shows s screenshot that displays crashes in S4. S4 also has the capability to display detailed information of each crash, as shown in Figure 7-26.

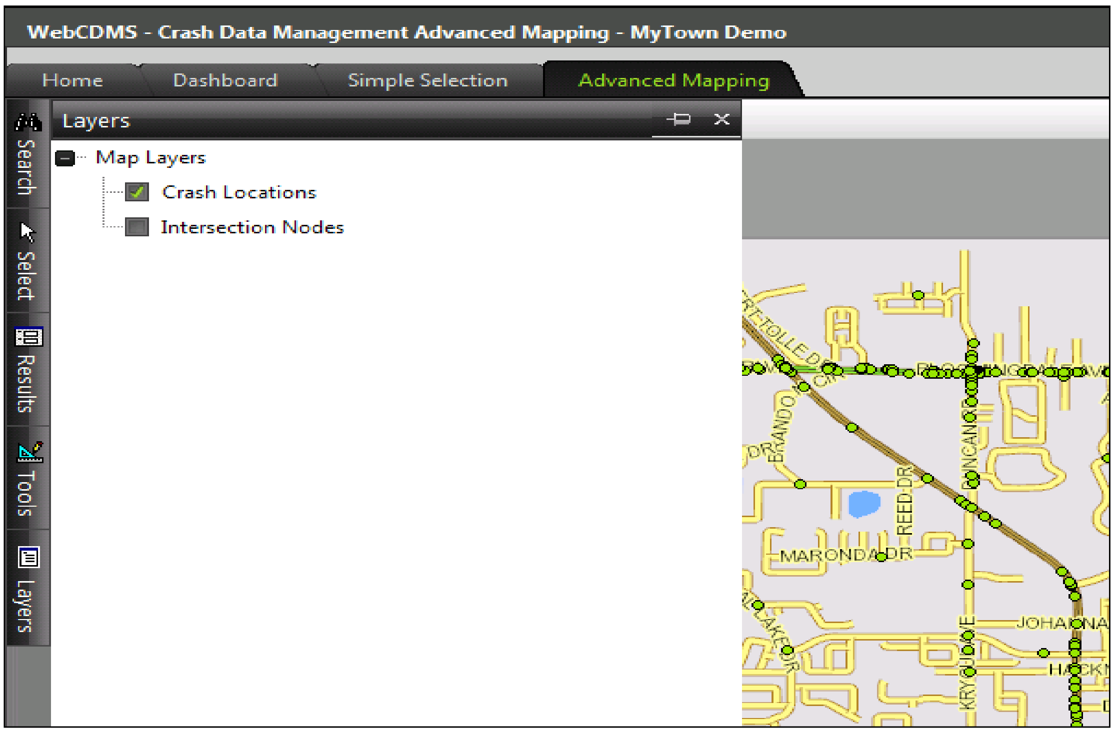


Figure 7-22: Displaying Crash Locations in WebCDMS

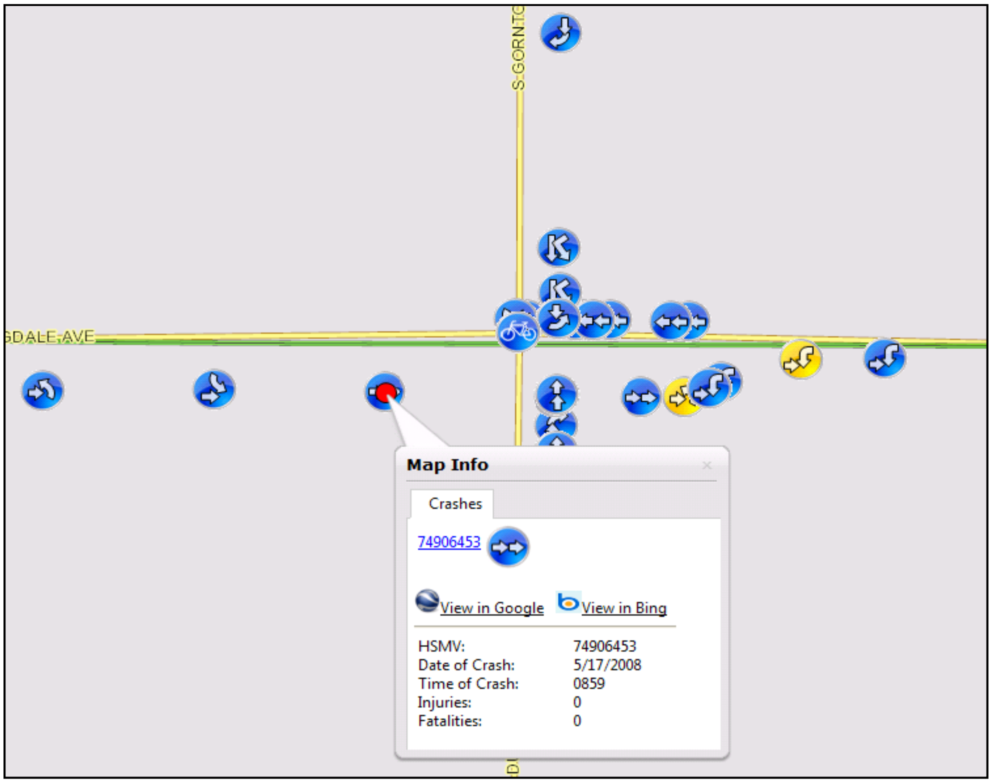


Figure 7-23: Displaying Crash Locations with Crash Information in WebCDMS

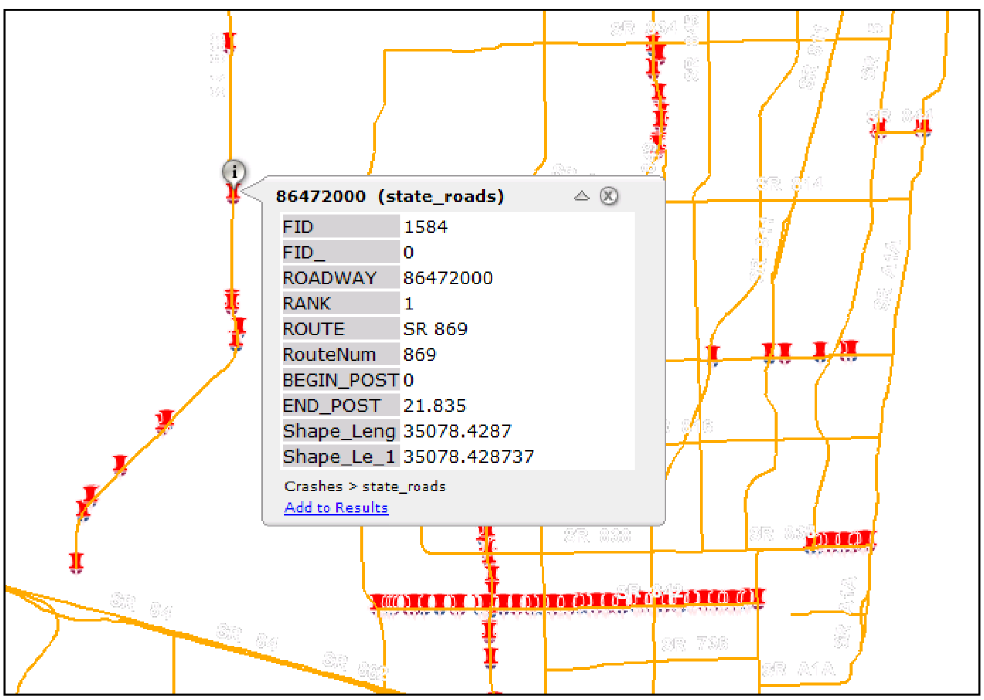


Figure 7-24: Identifying Detailed Information of Crashes in TSAT

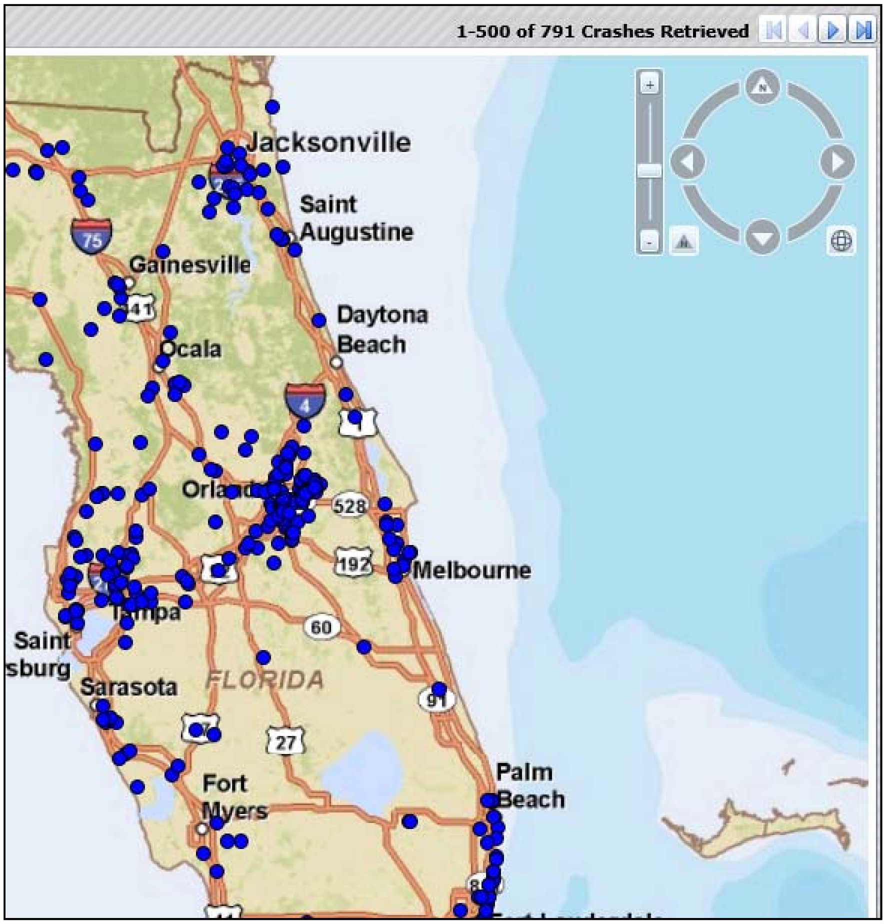
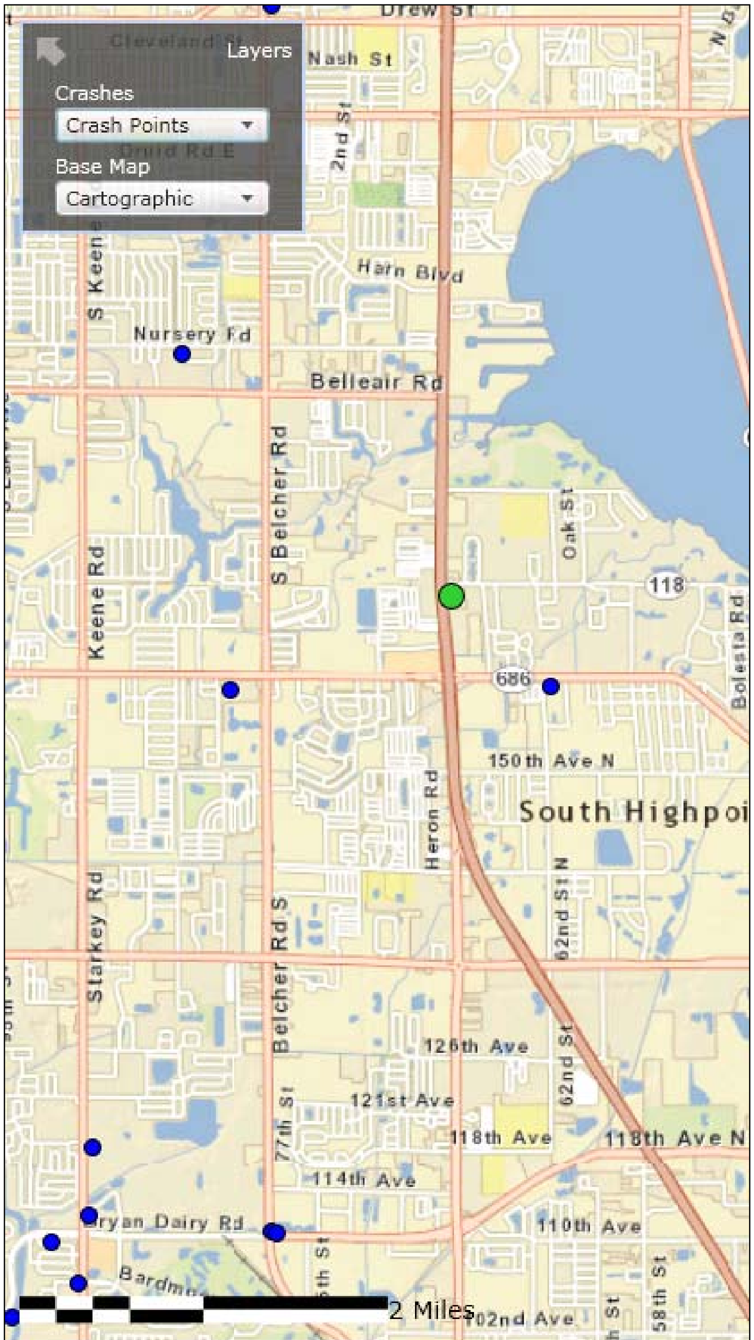


Figure 7-25: Displaying Queried Crashes on the Map



HSMV Report	Crash Date	Crash Time	City	County
82825447	10/2/2011	03:10 AM	Unincorporated	Pinellas
82815520	10/10/2011	09:57 PM	Unincorporated	Pinellas

Figure 7-26: Detailed Information of Displayed Crashes

7.4.7. Display Detailed Police Reports

An important feature in any GIS system is the ability to be integrated with the police crash reports database for displaying the reports whenever needed. A sample police report from WebCDMS is shown in Figure 7-27. This feature is currently unavailable in both TSAT and S4 systems.

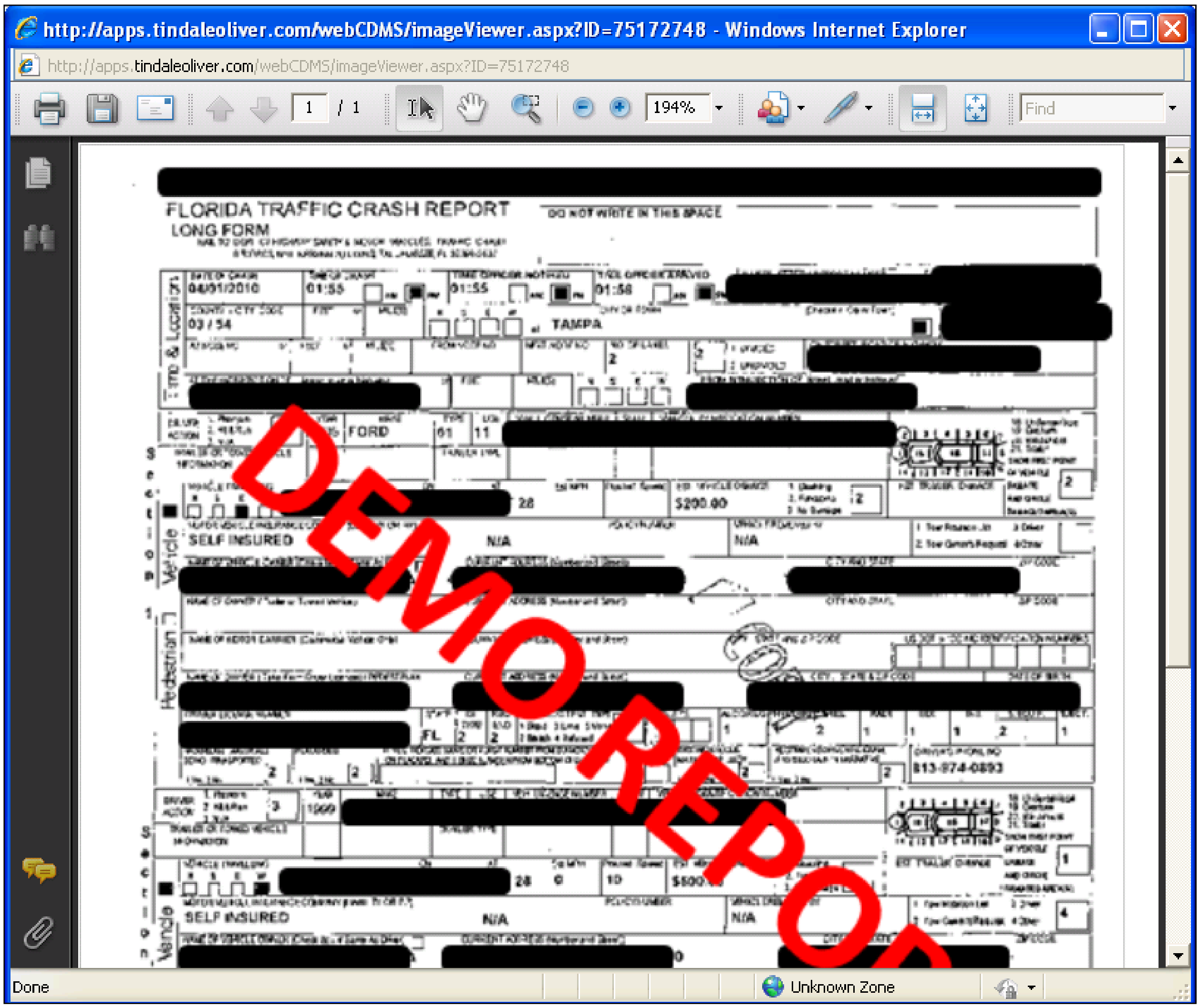


Figure 7-27: Displaying Police Crash Reports in WebCDMS

7.5 GIS Systems Features

After presenting a comprehensive evaluation of the three systems, this section discusses the desirable features for web-based crash analysis systems and their applicability within the three systems. Table 7-1 shows the most required features for GIS crash analysis systems.

Table 7-1: Desirable Features for GIS Crash Analysis Systems

Feature	WebCDMS	TSAT	S4
Generic Characteristics			
a) Availability of desktop or web-based versions	Web-based	Desktop* and web-based	Web-based
b) Easy to load?	Yes	Takes some time to load	Yes
c) Requires user name and password for login?	Yes	No (for the demo version)	Yes
d) User interface	Friendly	Friendly	Friendly
e) Icons and menus easy to follow?	Yes	Yes	Yes
f) Incorporates GIS base maps?	Yes	Yes	Yes
g) Exports GIS base maps?	Yes	Yes	Yes
h) Incorporates FAQs, help documents, and video tutorials?	Yes	No	No
Crash Analysis Functionality			
a) Source of crash data	DHSMV and CAR	CAR	DHSMV
b) Identifies high crash locations?	Yes	No	No
c) Geographic coverage	• Statewide • Districtwide • Countywide • Citywide • Specific locations	• Districtwide • Countywide • Specific locations	• Statewide • Districtwide • Countywide • Florida Highway Patrol (FHP) troop • MPO/TPO Specific locations
d) Applies filters to select specific types of crashes?	Yes	Yes	Yes

Table 7-1 (Continued): Desirable Features for GIS Crash Analysis Systems

Feature	WebCDMS	TSAT	S4
Crash Analysis Functionality (Continued)			
e) Methods of querying crashes	Query with multiple procedures (by location, attributes, advanced selection, and collision type)	Query with one procedure (comprehensive query)**	Query with multiple procedures (by date/time, geographic area, participants, and circumstances)
f) Displays police reports of selected crashes?	Yes	Yes	No+
g) Visualizes crashes on GIS maps?	Yes	Yes	Yes
h) Displays crash information once clicked?	Yes	Yes	Yes
i) Consumes time to run query and display selected crashes?	No, very fast	Yes	No
Output Capability			
a) Generates output reports?	Yes	Yes	No+
b) Exports output reports for further analysis?	Yes	Yes	No+
c) Output extension file types	pdf, rtf, xls, MS Word	pdf, rtf, xls, MS Word	N/A+
d) Generates plots?	Yes	Yes	Yes
e) Types of plots	Bar and pie charts	Bar and pie charts	Bar and pie charts
f) Appeal of the reports/plots:	Good	Good	Good
g) Generates collision diagrams?	Yes	No	No+
h) Exports output data to SafetyAnalyst?	No	No	No

* For internal use only within District 3

** Query by roadway ID or crash number is for intranet use only and advanced SQL query is still under development

\+ Part of the future development phase

Table 7-1 shows that the three GIS systems implement most of the desirable functionalities. One of the questions in the survey to FDOT Districts focused on the features that need to be incorporated in a web-based GIS system. The asked features included seven of the features included in Table 7-1, which are: application of filters to select specific crash types, generation of high crash locations, generation of reports, generation of plots, generation of collision diagrams, visualization of data on GIS maps, and display of police reports.

The Web CDMS and TSAT have the capability to apply crash filters, generate reports, generate plots, visualize crashes on GIS maps, and display police reports. Additionally, WebCDMS could generate high crash locations and generate collision diagrams. Moreover, the future development scope of S4 is projected to have the capability to generate plots and reports, display police reports, and generate collision diagrams. As concluded from the survey of FDOT districts, the capability of GIS systems to apply crash filters and queries is considered extremely important, which is already available in the three systems.

A potential feature that is also recommended to be included in a GIS crash analysis system in Florida is the ability to export output data to the newly-released SafetyAnalyst system. As previously discussed, SafetyAnalyst is a national tool for comprehensive safety management and the compatibility of the standard GIS system with this tool will be highly beneficial to most transportation safety engineers.

CHAPTER 8
CONCLUSIONS AND RECOMMENDATIONS

The effectiveness of crash analysis depends on the proper analysis methods and the availability up-to-date software tools and quality data. There is currently not a standard method and software tool for crash analysis in Florida. An increasing number of FDOT districts and local transportation agencies have either developed or adopted various software systems to meet their crash analysis needs. The current trend of developing individual systems at the local level is cost-ineffective and potentially unsustainable.

Standardization of crash analysis procedures in Florida would ensure that the crash analysis practices are up to the national standards and are applied consistently throughout the state. It would further permit other cost-saving opportunities such as statewide training. However, to succeed in the transition to standardized crash analysis procedures, it is important to ensure that no stakeholder will be made to feel short-changed by the process, and that their needs will not only continue to be met after the transition, but also more efficiently and effectively. It is also expected that some useful district systems may be adopted for statewide application, benefiting other agencies and avoiding the duplication of efforts.

The existing crash analysis methods and the needs of the various local agencies play a significant role in standardizing the crash analysis procedures. To reach the wide spectrum of transportation related agencies in Florida, three comprehensive online surveys were designed targeting the FDOT districts, local transportation agencies, and law enforcement agencies. The on-site visits to FDOT District 4 and District 6, and to Miami Dade County and Broward County Public Works Departments helped in designing the survey questions.

8.1 Major Findings from the Surveys

District safety offices, local transportation agencies, and law enforcement officers are the three most important sectors of the public transportation industry that deal with improving safety and mobility both on day-to-day basis and on long-term basis. The expectations and needs are different for each of these sectors and, therefore, separate questions were developed to focus on each sector individually.

Six of the eight FDOT districts responded to the survey. All the responding districts agreed on standardizing the crash analysis procedure across Florida and that FDOT should provide statewide training on crash analysis. The following are the relevant findings from the survey:

- Most districts use the annual 5-percent transparency report to identify high crash locations.
- All districts agreed that cost information of safety studies should be shared among the FDOT District Offices.
- All districts use the B/C ratio to select safety improvement projects.
- Most districts agreed that the SHSP has well-served the traffic safety needs.

- The districts prioritize projects in the following order of SHSP's four emphasis areas: Intersection Crashes, Lane Departure Crashes, Vulnerable Road Users, and Aggressive Driving.
- All districts agreed to replace the CAR system with a web-based system.
- All districts agreed that a standardized crash analysis method and procedure should be followed across the state.
- Most of the districts are still not confident in implementing the HSM and SafetyAnalyst due to their extensive data requirements and the necessary statistical/software expertise.
  All districts agreed that a standard web-based GIS system should be adopted for crash analysis across the state.
- The majority of the districts would like to update the HSIPG.
- Half of the responding districts preferred to have face-to-face statewide meetings every half a year and the other half preferred to meet only once a year.
- Quarterly web meetings with the Safety Office received the most consensuses among the districts.
- The majority of the districts agreed that FDOT should provide statewide training on crash analysis.
- Face-to-face meetings are the most preferable mode of providing training on crash analysis.
- The districts are interested in FHWA-NHI courses that focus on intersection safety, pedestrian safety, roadway safety audits/assessment, and safety effects of roadway design features.

Similar responses were received from the 37 local transportation agencies that had responded to the survey. The following are the key findings from the survey:

- The majority of local agencies use 3 years of crash data for performing safety studies.
- The majority of local agencies indicated that in-house staff investigated high crash locations.
- Speeding-related, distracted driving, and intersection-related crashes were of highest safety concerns to the majority of local agencies.
- The majority of local agencies agreed in standardizing the crash analysis method and procedure across the state.
- The majority of responding local agencies use the B/C ratio to select safety improvement projects.
- Funding is often considered as a deciding factor in selecting and prioritizing safety projects.
- Some agencies prefer to consider the HSM as a standard, mandating its adoption; while some agencies prefer to have the HSM only as a guide as the HSM analysis is considered to be too cumbersome for most local agencies.
- Local agencies are interested in adopting SafetyAnalyst. For extensive adoption, the responding agencies wish the software to be provided free of charge along with low cost training tools.
- The majority of local agencies agreed that a statewide standard web-based GIS system should be adopted for crash analysis.

- The majority of local agencies strongly agreed that FDOT should provide statewide training on crash analysis.
- Similar to the opinions of the FDOT districts, face-to-face meetings are by far the most preferable mode of providing training on crash analysis.
- The majority of local agencies work with the FDOT District Office only when a situation arises.
- The majority of local agencies work closely with the FDOT District Office to improve traffic safety.
- More funding to local agencies, more communication and coordination, more training courses, and training of law enforcement officers to correctly report the crash forms are the most important requirements of the local agencies from the FDOT.

Compared to the districts and local transportation agencies, the law enforcement agencies are considered to be quite different in their objectives, problems, and needs. This is mainly because the law enforcement officials are geared toward improving safety and mobility through enforcement. Therefore, a different set of questions were designed to address these officials. The following are the relevant findings from the survey of 46 law enforcement agencies:

- Most agencies regularly focused on specific locations for enforcement of traffic violations.
- Location selection for enforcement was commonly based on the analyzed crash records and citizen complaints.
- The majority of agencies would like to receive crash location maps from the previous year or previous quarter from FDOT.
- Speeding, failing to use safety belts, and failing to properly restrain a child were the most common causes of violation enforcement.
- Blocking traffic, failing to move over, and parking illegally were the least common causes of violation enforcement.
- Enforcement of driving under influence, speeding, and running red lights were perceived as the most extremely effective to improve traffic safety.
- Enforcement of illegal parking, traffic blockage, and following too closely were seen as least-effective.
- Most agencies follow up with an evaluation to assess the effectiveness of the implemented safety campaigns.
- The majority of agencies use both electronic and hard copy crash report forms.
- The majority of agencies agreed that the new police report form that became effective on January 1, 2011 has been an improvement over the previous form.
- A few officials considered filling out additional data in the new crash forms to be time consuming and recommended simplified crash reports. Further, additional training on filling out the crash reports was requested.
- The majority of agencies react proactively while holding regular meetings with local transportation agencies for coordination of efforts
- The majority of agencies emphasized the need to organize more meetings with transportation agencies and to get more assistance from them.

Even though different questions were asked to the three different sectors, a few similar opinions were shared. The following are the findings that were emphasized in all the three surveys:

- There is an urging need to standardize the crash analysis procedures across state.
- FDOT should provide statewide training on crash analysis and face-to-face meetings are the most preferable mode of providing training.
- Need for more accurate police reports.

However, conflicting opinions were heard about the adoption of the HSM and SafetyAnalyst. The responding districts believed that the HSM and SafetyAnalyst tools are in their preliminary stages while the majority of responding local transportation agencies are reluctant in adopting HSM as standardized crash analysis procedures. SafetyAnalyst adoption looks encouraging to the local transportation agencies.

8.2 Existing Safety Analysis Tools

Over the last 50 years, there have been many methods, tools, and measures in practice to help in the process of identification and prioritization of sites. These traditional methods use accident counts or their proportions to identify unsafe sites. Today, superior methods are available for use employing advanced statistical methods (i.e., empirical Bayes and full Bayes approaches). These methods were developed over the last decade and have recently been made available through HSM and SafetyAnalyst.

Crash frequencies, crash rates, and safety indices are often termed as traditional (or basic) site selection methods as they require minimum data and expertise. Even though these methods are simpler, they are fraught with problems, issues, and limitations. The following are the issues that exist with most of the traditional methods:

- regression-to-the-mean effect,
- false assumption of a linear relation between traffic and crashes,
- undue influence of shorter segments on crash frequency,
- failure to estimate the future safety performance of a roadway, and
- failure to measure the reliability of safety evaluations.

8.3 Advanced Safety Analysis Tools

The issues and limitations of traditional site selection methods are addressed by the newer safety analysis tools. The HSM and SafetyAnalyst are the two of the many safety analysis tools developed and funded by the federal government. For their complete implementation, these advanced tools require a wide range of data in comparison to the basic methods. These intense data requirements are often deterring states from early adoption. However, states can adopt these tools in phases while simultaneously ramping up the tedious process of data acquisition.

The HSM, released as an AASHTOWare product in July 2010, is a comprehensive safety analysis tool that discusses all the steps in the roadway safety management process. The manual discusses all the available safety analysis methods including the empirical Bayes (EB) approach.

However, the analysis procedures (like Safety Performance Functions and Crash Modification Factors) are available for only three types of roadways: rural two lane roads, rural multilane highways, and urban and suburban arterials. Analysis of other facility types such as freeways is currently unavailable, but, is expected to be released soon. The following are some of the reasons that encourage state-wide adoption of the manual:

- The manual is a product of multiple-decade long research efforts of several nationally and internationally recognized researchers.
- The manual discusses all the steps in the roadway safety management process.
- The manual discusses a variety of traditional and advanced methods including the EB analysis for site selection and prioritization.
- HSM is designed for more site specific analysis as the data requirements are intense.
- The Safety Performance Functions (SPFs) used by the HSM are more robust as segments/ intersections with base conditions were used to develop the base SPFs.
- The variations in roadway characteristics are addressed using Crash Modification Factors (CMFs). Additionally, CMFs are used for countermeasure selection and evaluation.
- A number of supporting documents are currently available to supplement the manual. For example, www.cmfclearinghouse.org provides safety engineers with an up-to-date list of CMFs for various countermeasure treatments.

SafetyAnalyst is a state-of-the-art analytical tool for making system wide safety decisions. The software provides a suite of analytical tools to identify and manage system-wide safety improvements by incorporating all the steps in the roadway safety management process. Even though data requirements are intense, once the data is imported, the analyses are easy requiring minimum statistical expertise. The following are some of the reasons that encourage state-wide adoption of the software:

- SafetyAnalyst automates all the steps in the roadway safety management process.
- SafetyAnalyst uses advanced statistical methods like the empirical Bayes method.
- The software is designed both for system-wide and site specific analysis.
- The data requirements are not as intense as the HSM.
- The import process, even though resource intensive, is a one-time hurdle. Once the data is imported successfully, the software is very useful to the safety engineers.
- The analysis is available for all types of roadways, i.e., segments, intersections, and ramps.
- Minimal statistical expertise is required to work with SafetyAnalyst.
- CMFs are used for countermeasure selection and evaluation.
- Continuous technical and software support is available.
- SafetyAnalyst does a great job in handling the data issues as the software logs a list of errors and warnings during the import, post-process, and calibration steps.

While SafetyAnalyst has been touted as the software complement to the Highway Safety Manual, there are a few fundamental differences that must be understood. The two tools supplement each other and have their own advantages. Therefore, adoption of both the tools would be highly beneficial to the state. SafetyAnalyst could be used for more system wide analysis while the HSM could be geared more toward site-specific analysis. Moreover, the discussion of several network screening methods in the HSM would help in the transition from traditional to advanced methods.

8.4 GIS Applications in Safety Analysis

The HSM and SafetyAnalyst are considered to be comprehensive for statistical analyses. However, there is a missing piece in terms of visualization capabilities. Supplementing statistical analyses, GIS applications are desirable as they help in data retrieval and spatial interpretations to serve both day-to-day operation needs and long-term interests of the agencies. Therefore, for accurate, comprehensive, and standardized crash analysis procedures, adoption of the HSM, SafetyAnalyst, and a GIS tool is recommended.

In this context, three commonly-used GIS crash analysis systems in Florida (WebCDMS, TSAT, and S4) were evaluated. Based on the evaluations, the following are considered as the most desirable crash analysis features that could be incorporated in a GIS application:

- query crashes,
- spatially locate crashes,
- identify high crash locations,
- generate output reports and plots, and
- draw collision diagrams.

8.5 Recommendations

The current safety practice of districts and agencies include indentifying high crash locations by crash frequency, crash rate, and critical rate. These methods are common; however, they are fraught with issues. Additionally, the recent national safety analysis tools such as the HSM and SafetyAnalyst are still in their preliminary stage of implementation. Therefore, stepping up the implementation of both the HSM and SafetyAnalyst in addition to standardizing the GIS applications of crash analysis is expected to yield better results. Further, the implementation strategy must involve districts and local transportation agencies to result in extensive adoption of the newer tools. Although the cost and budget constraints could be an issue, adequate training on how to make use of these tools is expected to yield better and quick results.

Besides the adoption of these tools, improved coordination between FDOT districts and related local transportation agencies, and between the transportation agencies and law enforcement agencies is recommended. More funding for local agencies will also be appreciated. The responding law enforcement officials suggested training of police officers to correctly code the crash report. Moreover, the possibility of replacing the current CAR system (maintained by FDOT) with a web-based system is of interest to all the responding FDOT districts.

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APPENDIX A

FDOT District Survey

Florida Department of Transportation

Survey of District Offices on Crash Analysis Practices and Needs

Thank you for accepting our invitation to complete this survey!

This survey is being conducted by the Lehman Center for Transportation Research (LCTR) at the Florida International University on behalf of the Florida Department of Transportation (FDOT). The main purpose of this survey is to identify the current state of practices and needs within different agencies that deal with traffic safety.

Separate surveys are being conducted for FDOT district offices, city and county transportation agencies, and law enforcement agencies across the state. This particular survey is geared toward FDOT district offices and it includes multiple questions addressing each of the following seven areas of interest:

1. Use of Crash Data
2. High Crash Locations
3. Project Selection, Implementation, and Evaluation
4. Crash Analysis Software Systems
5. Crash Analysis Standardization
6. Crash Analysis Documentation
7. Meetings and Training

Both fact-finding and opinion questions are included. It is intended that this survey be completed by a traffic safety professional who is familiar with the current traffic safety practices and needs in your office. The survey results will be shared with all participants after they are compiled and summarized. It is hoped that through these surveys best practices and common needs in traffic safety in the state can be identified.

The survey should take an average of about 45 minutes to complete. We greatly appreciate your contribution to improving traffic safety in our state. If you have any questions, please do not hesitate to contact us.

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General Information

Please provide the following general information:

First Name:

Last Name:

Position Title:

FDOT District:

Years of Experience in Crash Analysis:

Phone:

Email:

Please use only the **Prev** and **Next** buttons below to move between the survey pages. If you use your browser's **Back** button by mistake, you may need to press the **Refresh** button to return to your current page.

Use of Crash Data

Q1. How many years of crash data do you typically use in your safety studies?

- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ More than 5

Q2. Have you had quality issues while extracting crash data from the CAR system?

- ❍ Yes
- ❍ No

Q3. If "Yes", what did you do to overcome these quality issues?

Q4. How do you suggest that these quality issues can be resolved or alleviated?

Q5. Other than the crash records from the CAR system, please list any other data sources you have used in your safety studies.

High Crash Locations

Q6. Please describe the process you now use to identify high crash locations in your district.

Q7. How many high crash locations were on your list last year?

Q8. Out of these locations, how many were investigated?

Q9. Who performed this investigation? (*Check all apply*)

1. Consultants
2. In-house staff
3. Other (please specify) ____________________

Q10. Please list the top three types of safety concerns at the locations investigated.

Q11. Please list all funding sources and the funding amounts for conducting safety studies for the previous year.

Q12. Safety study information (e.g., study cost) should be shared among the FDOT District Offices.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Project Selection, Implementation, and Evaluation

Q13. Please describe the analysis method your office uses to select safety improvement projects (e.g., benefit-cost analysis).

Q14. Please rank the following four emphasis areas of the Florida Strategic Highway Safety Plan (SHSP) when selecting projects for implementation (from 1 for the *highest* priority to 4 for the *lowest* priority).

_______ Aggressive driving
_______ Intersection crashes
_______ Vulnerable road users
_______ Lane departure crashes

Q15. The SHSP emphasis areas have served the traffic safety needs of our district well.

❍ Strongly agree
❍ Agree
❍ Neither agree nor disagree
❍ Disagree
❍ Strongly disagree

Q16. Please describe any important issues specific to your district that are not directly addressed by the SHSP?

Q17. Do you evaluate implemented safety improvement projects to determine their effectiveness?

- ❍ Yes, we evaluate all implemented projects
- ❍ Yes, we evaluate a sample of the implemented projects
- ❍ No, we assume that the locations have been improved

Q18. If "Yes", please describe how the evaluation was performed.

Crash Analysis Software Systems

Q19. Other than for retrieving crash records, what other functions have you used the CAR system for?

Q20. The Department should replace the CAR system with a web-based system.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q21. If a web-based system is to be developed in place of the CAR system, how important are the following functions, besides for crash data download, be included?

	Extremely Important	Very Important	Important	Not Important	Not Sure
Apply filters to select specific types of crashes	❍	❍	❍	❍	❍
Generate high crash locations	❍	❍	❍	❍	❍
Generate reports	❍	❍	❍	❍	❍
Generate plots	❍	❍	❍	❍	❍
Generate collision diagrams	❍	❍	❍	❍	❍
Integrate with Work Program database	❍	❍	❍	❍	❍
Allow visualization of data on GIS maps	❍	❍	❍	❍	❍
Display detailed police reports	❍	❍	❍	❍	❍

Q22. Please list any commercial software tools you now use for crash analysis.

Q23. Please list any crash analysis software tools your office has developed in-house.

Q24. Please describe any crash analysis software tools currently being developed or being considered for development.

Q25. Can we contact you to find out more about the software tools?

- ❍ Yes
- ❍ No
- ❍ No software tools purchased, developed, or to be developed

Crash Analysis Standardization

Q26. Crash analysis method and procedure should be uniform across the state.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q27. Please qualify your response to the above question.

Q28. The newly released Highway Safety Manual or HSM (learn more) should be adopted as standard for crash analysis in the state.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q29. Please qualify your response to the above question.

Q30. FHWA has recently released a new safety analysis software system named SafetyAnalyst (learn more) and FDOT is one of the sponsors of the development of this system. Do you agree that your office should take advantage of this system?

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q31. Please qualify your response to the above question.

Q32. A standard web-based GIS application should be adopted for crash analysis across the state.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q33. Please qualify your response to the above question.

Q34. A shared, standard software system for crash analysis across the state can help:

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Save on software development cost	❍	❍	❍	❍	❍
Save on software and hardware maintenance cost	❍	❍	❍	❍	❍
Save on software licensing cost	❍	❍	❍	❍	❍
Allow statewide training	❍	❍	❍	❍	❍
Provide better control of crash data	❍	❍	❍	❍	❍
Protect agency from legal liability	❍	❍	❍	❍	❍

Q35. Please list any conditions unique to your district that may require special consideration in a standard crash analysis procedure.

Crash Analysis Documentation

Q36. What is the primary documentation(s) you use for crash analysis?

Q37. Which part of the Highway Safety Improvement Program Guideline (HSIPG) manual you use the most?

- Problem Identification
- Countermeasure Identification
- Project Prioritization
- Project Implementation
- Project Evaluation

Q38. The HSIPG manual should be updated.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Q39. If this manual is to be updated, what new materials do you like to see included?

Q40. Please list any safety related documents your office has developed.

Q41. Can we contact you to obtain these documents?

- ❍ Yes
- ❍ Not available for sharing

Meetings and Training

Q42. How often do you think the Safety Office should hold face-to-face meetings?

- ❍ Annually
- ❍ Semi-annually
- ❍ None is needed; hold web meetings only
- ❍ Other (please specify) ____________________

Q43. How often should the Safety Office hold web meetings?

- ❍ Annually
- ❍ Semi-annually
- ❍ Quarterly
- ❍ Bimonthly
- ❍ Monthly
- ❍ As often as needed
- ❍ Other (please specify) ____________________

Q44. FDOT should provide statewide training on crash analysis.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q45. If FDOT is to provide statewide training, in which specific areas of training would you like to see included?

Q46. Please rank your preferred mode of delivery for such training from 1 for the *most* preferable to 4 for the *least* preferable.

______ Face-to-face meetings
______ Webinars
______ Online web-based training
______ Other (please specify)

Q47. Please select up to five of the following FHWA-NHI courses that you wish to see offered by FDOT.

1. FHWA-NHI-380003 Design and Operation of Work Zone Traffic Control
2. FHWA-NHI-380032A Roadside Safety Design
3. FHWA-NHI-380034 Design, Construction, and Maintenance of Highway Safety Appurtenances and Features
4. FHWA-NHI-380060 Work Zone Traffic Control for Maintenance Operations
5. FHWA-NHI-380063 Construction Zone Safety Inspection
6. FHWA-NHI-380069 Road Safety Audits/Assessments
7. FHWA-NHI-380070 Safety and Operational Effects of Geometric Design Features
8. FHWA-NHI-380071 Interactive Highway Safety Design Model
9. FHWA-NHI-380072 Advanced Work Zone Management and Design
10. FHWA-NHI-380073 Fundamentals of Planning, Design, and Approval of Interchange Improvements to the Interstate System
11. FHWA-NHI-380074 Designing and Operating Intersections for Safety
12. FHWA-NHI-380075 New Approaches to Highway Safety Analysis
13. FHWA-NHI-380076 Low-Cost Safety Improvements Workshop
14. FHWA-NHI-380077 Intersection Safety Workshop
15. FHWA-NHI-380078 Signalized Intersection Guidebook Workshop
16. FHWA-NHI-380079 AASHTO Roadside Design Guide
17. FHWA-NHI-380083 Low-Cost Safety Improvements
18. FHWA-NHI-380085 Guardrail Installation Training
19. FHWA-NHI-380088 Improving Safety of Horizontal Curves
20. FHWA-NHI-380089 Designing for Pedestrian Safety
21. FHWA-NHI-380090 Developing a Pedestrian Safety Action Plan
22. FHWA-NHI-380091 Planning and Designing for Pedestrian Safety
23. FHWA-NHI-380093 Application of Crash Reduction Factors (CRF)
24. FHWA-NHI-380094 Science of Crash Reduction Factors
25. FHWA-NHI-380095 Geometric Design: Applying Flexibility and Risk Management

Q48. Please use the box below to provide any additional comments you have.

Note that this is the last question in the survey. Once you press the **Next** button, the survey will be closed. If you want to review your responses, you can do so by pressing the **Prev** button now.

APPENDIX B

Local Transportation Agency Survey

Florida Department of Transportation

Survey of Local Transportation Agencies on Crash Analysis Practices and Needs

Thank you for accepting our invitation to complete this survey!

This survey is being conducted by the Lehman Center for Transportation Research (LCTR) at the Florida International University on behalf of the Florida Department of Transportation (FDOT). The main purpose of this survey is to identify the current state of practices and needs within different agencies that deal with traffic safety.

Separate surveys are being conducted for FDOT district offices, city and county transportation agencies, and law enforcement agencies across the state. This particular survey is geared toward city and county transportation agencies and it includes multiple questions addressing each of the following eight areas of interest:

1. Use of Crash Data
2. High Crash Locations
3. Project Selection, Implementation, and Evaluation
4. Crash Analysis Software Systems
5. Crash Analysis Standardization
6. Crash Analysis Documentation
7. Training
8. Working with FDOT

Both fact-finding and opinion questions are included. It is intended that this survey be completed by a traffic safety professional who is familiar with the current traffic safety practices and needs in your office. The survey results will be shared with all participants after they are compiled and summarized. It is hoped that through these surveys best practices and common needs in traffic safety in the state can be identified.

The survey should take an average of about 30 minutes to complete. We greatly appreciate your contribution to improving traffic safety in our state. If you have any questions, please do not hesitate to contact us.

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General Information

Please provide the following general information:

First Name

Last Name

Position Title

Agency Name

County or City

Years of Experience in Crash Analysis

Phone

Email

Please use only the **Prev** and **Next** buttons below to move between the survey pages. If you use your browser's **Back** button by mistake, you may need to press the **Refresh** button to return to your current page.

Use of Crash Data

Q1. How many years of crash data do you typically use in your safety studies?

- ❍ 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ More than 5

Q2. What is your source of crash data?

Q3. What are the problems you have seen in your crash data?

Q4. What did you do to overcome these problems?

Q5. How do you suggest that these problems can be resolved or alleviated?

Q6. Please describe the process you now use to identify high crash locations in your area.

Q7. How many high crash locations were on your list last year?

Q8. Out of these locations, how many were investigated?

Q9. Who performed this investigation? (*Check all apply*)

- ☐ Consultants
- ☐ In-house staff
- ☐ Other (please specify) ____________________

Q10. Please list the top three types of safety problems at the locations investigated.

Q11. Please list all funding sources and the funding amounts for conducting safety studies for the previous year.

Project Selection, Implementation, and Evaluation

Q12. Please describe the analysis method your office uses to select safety improvement projects (e.g., benefit-cost analysis).

Q13. Do you evaluate implemented safety improvement projects to determine their effectiveness?

- ❍ Yes, we evaluate all implemented projects
- ❍ Yes, we evaluate a sample of the implemented projects
- ❍ No, we assume that the locations have been improved

Q14. If "Yes", please describe how the evaluation was performed.

Crash Analysis Software Systems

Q15. Please list any commercial software tools you now use for crash analysis.

Q16. Please list any crash analysis software tools your office has developed in-house.

Q17. Please describe any crash analysis software tools currently being developed or being considered for development.

Q18. Can we contact you to find out more about the software tools?

- ❍ Yes
- ❍ No
- ❍ No software tools purchased, developed, or to be developed

Crash Analysis Standardization

Q19. Crash analysis method and procedure should be uniform across the state.

❍ Strongly agree
❍ Agree
❍ Neither agree nor disagree
❍ Disagree
❍ Strongly disagree

Q20. Please qualify your response to the above question.

Q21. The newly released Highway Safety Manual or HSM (learn more) should be adopted as standard for crash analysis for all agencies in the state.

❍ Strongly agree
❍ Agree
❍ Neither agree nor disagree
❍ Disagree
❍ Strongly disagree

Q22. Please qualify your response to the above question.

Q23. FHWA has recently released a new safety analysis software system named SafetyAnalyst (learn more) and FDOT is one of the sponsors of the development of this system. Do you agree that your agency should take advantage of this system?

❍ Strongly agree
❍ Agree
❍ Neither agree nor disagree
❍ Disagree
❍ Strongly disagree

Q24. Please qualify your response to the above question.

Q25. A standard web-based GIS application should be adopted for crash analysis for all agencies across the state.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q26. Please qualify your response to the above question.

Q27. A shared, standard software system for crash analysis across the state can help:

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Save on software development cost	❍	❍	❍	❍	❍
Save on software and hardware maintenance cost	❍	❍	❍	❍	❍
Save on software licensing cost	❍	❍	❍	❍	❍
Allow statewide training	❍	❍	❍	❍	❍
Provide better control of crash data	❍	❍	❍	❍	❍
Protect agency from legal liability	❍	❍	❍	❍	❍

Q28. Please list any conditions unique to your area that may require special consideration in a standard crash analysis procedure.

Crash Analysis Documentation

Q29. Please list any safety related documents your agency has developed.

Q30. Can we contact you to obtain these documents?

- ❍ Yes
- ❍ Not available for sharing

Training

Q31. FDOT should provide statewide training on crash analysis for local agencies.

❍ Strongly agree
❍ Agree
❍ Neither agree nor disagree
❍ Disagree
❍ Strongly disagree

Q32. If FDOT is to provide statewide training, in which specific areas of training would you like to see included?

Q33. Please rank your preferred mode of delivery for such training from 1 for the *most* preferable to 4 for the *least* preferable.

_______ Face-to-face meetings
_______ Webinars
_______ Online web-based training
_______ Other (please specify)

Working with FDOT

Q34. The following would characterize our working relationships with FDOT District Office in efforts to improve traffic safety:

- ❍ We have regular meetings to discuss and coordinate efforts to target specific traffic safety problems at specific locations.
- ❍ We work with FDOT District Office only when a situation arises that requires their assistance, and vice-versa.
- ❍ I cannot recall a case over the past three months during which we worked with FDOT District Office.
- ❍ Other (please specify) ____________________

Q35. To improve traffic safety in our area, I believe our agency should:

- ❍ Work much more closely with FDOT District Office
- ❍ Work more closely with FDOT District Office
- ❍ We already work closely with FDOT District Office, but we can probably do more
- ❍ Other (please specify) ____________________

Q36. What are some of the barriers, if any, that have prevented your agency from working more closely with FDOT District Office to improve traffic safety in your area?

Q37. I believe the following activities with FDOT District Office will help to improve traffic safety in our area:

Q38. What assistance from FDOT would help you in your crash analysis?

Q39. Please use the box below to provide any additional comments you have.

Note that this is the last question in the survey. Once you press the **Next** button, the survey will be closed. If you want to review your responses, you can do so by pressing the **Prev** button now.

APPENDIX C

Law Enforcement Agency Survey

Florida Department of Transportation

Survey of Law Enforcement Agencies on Crash Analysis Practices and Needs

Thank you for accepting our invitation to complete this survey!

This survey is being conducted by the Lehman Center for Transportation Research (LCTR) at the Florida International University on behalf of the Florida Department of Transportation (FDOT). The main purpose of this survey is to identify the current state of practices and needs within different agencies that deal with traffic safety.

Separate surveys are being conducted for FDOT district offices, city and county transportation agencies, and law enforcement agencies across the state. This particular survey is geared toward law enforcement agencies and it includes multiple questions addressing each of the following four areas of interest:

1. Selection of Enforcement Locations
2. Traffic Violations and Safety Campaigns
3. Crash Reports
4. Working with Transportation Agencies

Both fact-finding and opinion questions are included. It is intended that this survey be completed by an officer who is familiar with the current traffic safety practices and needs in your office. The survey results will be shared with all participants after they are compiled and summarized. It is hoped that through these surveys best practices and common needs in traffic safety in the state can be identified.

The survey should take an average of about 20 minutes to complete. We greatly appreciate your contribution to improving traffic safety in our state. If you have any questions, please do not hesitate to contact us.

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General Information

Please provide the following general information:

First Name:

Last Name:

Position Title:

Office/Division Name:

Jurisdiction Name:

Years in This Position:

Duties/Responsibilities:

Phone:

Email:

Please use only the **Prev** and **Next** buttons below to move between the survey pages. If you use your browser's **Back** button by mistake, you may need to press the **Refresh** button to return to your current page.

Selection of Enforcement Locations

Q1. Does your agency regularly focus on specific locations for enforcement of traffic violations?

❍ Yes
❍ No (please skip to Q5)

Q2. Does your agency analyze crash records to identify locations for enforcement?

❍ Yes
❍ No

Q3. If "Yes", please describe the method you used in the analysis.

Q4. Please rank the reason that a location is selected for enforcement from 1 for the *most* common to 5 for the *least* common.

_______ Received complaints from citizens
_______ Received requests from local elected officials
_______ Observed frequent violations by patrolling officers
_______ Analyzed crash records to identify locations with a high number of crashes
_______ Other (please specify)

Q5. If the Florida Department of Transportation (FDOT) can provide you with maps showing the crash locations in your area, how likely will your agency make use of this information to focus on identified locations for enforcement?

❍ Very likely
❍ Likely
❍ Not too likely
❍ Unlikely
❍ Not sure

Q6. If you prefer to receive crash location maps from FDOT, what would you like for these maps to include?

- ❍ Crashes from the previous month
- ❍ Crashes from the previous quarter
- ❍ Crashes from the previous year
- ❍ Other (please specify) ____________________

<u>**Traffic Violations and Safety Campaigns**</u>

Q7. How common are the following traffic violations targeted for enforcement?

	Extremely Common	Very Common	Common	Not Common	Not sure
Speeding	❍	❍	❍	❍	❍
Driving under influence	❍	❍	❍	❍	❍
Running red lights	❍	❍	❍	❍	❍
Running stop sign	❍	❍	❍	❍	❍
Failing to use safety belts	❍	❍	❍	❍	❍
Failing to properly restrain a child	❍	❍	❍	❍	❍
Failing to yield right of way	❍	❍	❍	❍	❍
Failing to "move over"	❍	❍	❍	❍	❍
Turning illegally	❍	❍	❍	❍	❍
Parking illegally	❍	❍	❍	❍	❍
Following too closely	❍	❍	❍	❍	❍
Blocking traffic	❍	❍	❍	❍	❍

Q8. In your opinion, how serious are the following traffic violations in terms of their potential impacts on traffic safety?

	Extremely Serious	Very Serious	Serious	Not Serious	Not Sure
Speeding	❍	❍	❍	❍	❍
Driving under influence	❍	❍	❍	❍	❍
Running red lights	❍	❍	❍	❍	❍
Running stop sign	❍	❍	❍	❍	❍
Failing to use safety belts	❍	❍	❍	❍	❍
Failing to properly restrain a child	❍	❍	❍	❍	❍
Failing to yield right of way	❍	❍	❍	❍	❍
Failing to "move over"	❍	❍	❍	❍	❍
Turning illegally	❍	❍	❍	❍	❍
Parking illegally	❍	❍	❍	❍	❍
Following too closely	❍	❍	❍	❍	❍
Blocking traffic	❍	❍	❍	❍	❍

Q9. In your opinion, how effective will enforcement of the following traffic violations help improve traffic safety?

	Extremely Effective	Very Effective	Effective	Not Effective	Not Sure
Speeding	❍	❍	❍	❍	❍
Driving under influence	❍	❍	❍	❍	❍
Running red lights	❍	❍	❍	❍	❍
Running stop sign	❍	❍	❍	❍	❍
Failing to use safety belts	❍	❍	❍	❍	❍
Failing to properly restrain a child	❍	❍	❍	❍	❍
Failing to yield right of way	❍	❍	❍	❍	❍
Failing to "move over"	❍	❍	❍	❍	❍
Turning illegally	❍	❍	❍	❍	❍
Parking illegally	❍	❍	❍	❍	❍
Following too closely	❍	❍	❍	❍	❍
Blocking traffic	❍	❍	❍	❍	❍

Q10. To the best of your knowledge, how have the following traffic violations in your area changed over the past two years?

	Increased dramatically	Increased somewhat	No change	Decreased somewhat	Decreased dramatically	Not sure
Speeding	❍	❍	❍	❍	❍	❍
Driving under influence	❍	❍	❍	❍	❍	❍
Running red lights	❍	❍	❍	❍	❍	❍
Running stop sign	❍	❍	❍	❍	❍	❍
Failing to use safety belts	❍	❍	❍	❍	❍	❍
Failing to properly restrain a child	❍	❍	❍	❍	❍	❍
Failing to yield right of way	❍	❍	❍	❍	❍	❍
Failing to "move over"	❍	❍	❍	❍	❍	❍
Turning illegally	❍	❍	❍	❍	❍	❍
Parking illegally	❍	❍	❍	❍	❍	❍
Following too closely	❍	❍	❍	❍	❍	❍
Blocking traffic	❍	❍	❍	❍	❍	❍

Q11. In the previous year, our agency conducted safety campaigns addressing the following traffic problems: (*Check all apply*)

- ☐ Speeding
- ☐ Driving under influence
- ☐ Running red lights
- ☐ Running stop sign
- ☐ Failing to use safety belts
- ☐ Failing to properly restrain a child
- ☐ Failing to yield right of way
- ☐ Failing to "move over"
- ☐ Turning illegally
- ☐ Parking illegally
- ☐ Following too closely
- ☐ Blocking traffic
- ☐ Bicyclist safety
- ☐ Pedestrian safety
- ☐ Motorcyclist safety
- ☐ Other (please specify) ____________________

Q12. Does your agency normally follow up with an evaluation to assess the effectiveness of the safety campaigns?

- ❍ Yes
- ❍ No

Q13. If "Yes", please describe how the evaluations were performed.

Crash Reports

Q14. Our officers currently use the following type(s) of crash report in the field:

- ❍ Paper report form ONLY
- ❍ Electronic report form ONLY
- ❍ Both hardcopy and electronic forms

Q15. Overall, the new crash report that became effective on January 1, 2011 has been an improvement over the previous crash report.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q16. Officers in our office received adequate training in the use of the new crash report.

- ❍ Strongly agree
- ❍ Agree
- ❍ Neither agree nor disagree
- ❍ Disagree
- ❍ Strongly disagree

Q17. The most useful information to us in the crash report is:

Q18. The biggest challenge in completing a crash report is:

Q19. The following improvements are suggested for the current police report form for the reasons stated:

Working with Transportation Agencies

Q20. The following would characterize our current working relationships with local transportation agencies to improve traffic safety:

- ❍ We hold regular meetings to discuss and coordinate efforts to target specific traffic safety problems at specific locations.
- ❍ We work with transportation agencies only when a situation arises that requires their assistance, and vice-versa.
- ❍ I cannot recall a case over the past six months during which we worked with a local transportation agency.
- ❍ Other (please specify) ____________________

Q21. To improve traffic safety in our area, I believe our agency should:

- ❍ Work much more closely with transportation agencies
- ❍ Work more closely with transportation agencies
- ❍ We already work closely with transportation agencies
- ❍ Other (please specify) ____________________

Q22. What are some of the barriers, if any, that have prevented your agency from working more closely with transportation agencies to improve traffic safety in your area?

Q23. In my opinion, the following activities with transportation agencies will help to improve traffic safety in our area:

Q24. Please list any software tools and technical assistance that you believe the Florida Department of Transportation can provide to assist you in your efforts to improve traffic safety.

Q25. Please use the box below to provide any additional comments you have.

Note that this is the last question in the survey. Once you press the **Next** button, the survey will be closed. If you want to review your responses, you can do so by pressing the **Prev** button now.