

**Project No. NCHRP 08-36/
Task 97A**

**Towards Quantitative Safety Planning:
Implementation of PLANSAFE**

FINAL REPORT

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DISCLAIMER

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Dr. Tom Rice, Ph.D., Epidemiologist at SafeTREC, was the Principal Investigator and John Bigham, M.P.H., GIS Project Manager at SafeTREC, was the Project Director. The other author of this report is Julia Griswold, Graduate Student Research at SafeTREC and Ph.D. student in Civil and Environmental Engineering at UCB.

ABSTRACT

This project focused on the pilot implementation of the PLANSAFE software within two MPOs with DOT oversight. The PLANSAFE software is a suite of tools that can be used to predict zonal crashes based on transportation and socio-demographic explanatory variables. It was developed to enable safety forecasting for use during the planning process. The research team developed working PLANSAFE datasets for both MPOs, and solicited feedback on the software. Extensive revisions to the software and user manual were made to improve usability and clarity. The team found that it is difficult for MPOs to direct resources toward implementing PLANSAFE, and that data preparation tasks are more suited to consultants.

EXECUTIVE SUMMARY

SAFETEA-LU reinforced a prominent role for safety in transportation planning by separating safety and security into separate planning factors, enhancing the importance of both, and requiring the states to develop and implement Statewide Highway Safety Plans.

NCHRP project 8-44 resulted in a guidebook for MPOs and DOTs on the explicit consideration of safety in the transportation planning process. A follow on project, NCHRP 8-44-2, developed a suite of software programs (PLANSAFE) to enable safety forecasting for use during the planning process.

This project focused on the implementation of the PLANSAFE software within two MPOs with DOT oversight. The specific project objectives were to:

1. Refine and update the analytical routines and algorithms in the software (and corresponding User's Manual);
2. Test and refine the graphical user interface (GUI) based on user feedback;
3. Form an initial practitioner user group, and identify user issues;
4. Identify the longer-term maintenance requirements of the software; and
5. Prepare the software for wide scale adoption and implementation.

The PLANSAFE software suite consists of three tools; the Main Tool, the GIS Tool, and the Census Tool. The GIS and Census Tools prepare explanatory variables for analysis within the PLANSAFE Main Tool.

The research team recruited two Florida MPOs, Metroplan Orlando and Volusia TPO, to participate in the pilot implementation. In working with the MPOs' data in the software and discussions with other team members and MPO staff, the team was able to compile useful feedback.

- The PLANSAFE safety performance functions require some explanatory variables that are not available or are difficult to forecast.
- There was concern about misuse of the crash reduction factors (CRFs) in the PLANSAFE Main Tool. Some of the mitigation measures available were not appropriate for planning-level analysis and that documentation should be very clear that the CRFs should only be applied based on previous planning analysis
- An output dialog box could be embedded in the PLANSAFE software to show how well safety improvements proposed by an MPO match federal requirements for performance measures.
- There is potential value added to the project if documentation can be provided to show the user how PLANSAFE relates to a Long Range Transportation Plan.
- A promotional brochure for PLANSAFE would be helpful to agencies who want to know about required resources, level of effort, and data needs.
- Government agencies are strapped for resources in personnel, time, and money. Agencies are often driven by other mandated activities.

- The ultimate long-term success of PLANSAFE will depend on how it is funded and how it is managed.
- The deployment and marketing of PLANSAFE could be enhanced if it were tied to a state's Strategic Highway Safety Plan.

The research team made extensive revisions to the PLANSAFE software and user manual based on comments and bug reports from users.

CHAPTER 1.

BACKGROUND

In November 2008, the American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Planning (SCOP) completed a Strategic Plan: 2008-2009 to guide their deliberations and decisions. The mission is to “Provide AASHTO and its members with planning expertise, a forum for collaborative policy development and problem solving; and be the catalyst for innovation and a source of technical excellence. Among other things, the Plan’s goals include developing, sharing, and advancing best practices and new frameworks in multimodal, integrated transportation planning and to provide meaningful information to decision makers to respond to changing transportation needs.

One method for achieving the goals is to identify, develop, implement, evaluate, and refine a tool to enable the explicit consideration of safety in the planning process. The Intermodal Surface Transportation Efficiency Act (ISTEA) along with the subsequent Transportation Efficiency Act for the 21st Century (TEA-21) broadened the issues that be considered as part of the transportation planning process. ISTEA reinforced this change in focus with the requirement for six management systems, one of which specifically targeted safety. Although mentioned prominently in ISTEA and TEA-21, where safety was introduced as a required planning factor for the first time (safety and security), safety received little serious quantitative attention in transportation planning. SAFETEA-LU further reinforced a prominent role for safety by separating safety and security into separate planning factors, enhancing the importance of both, and requiring the states to develop and implement Statewide Highway Safety Plans.

NCHRP project 8-44 resulted in a guidebook for MPOs and DOTs on the explicit consideration of safety in the transportation planning process. A follow on project, NCHRP 8-44-2, developed a suite of software programs to enable safety forecasting for use during the planning process. The PLANSAFE software suite consists of three tools; the Main Tool, the GIS Tool, and the Census Tool. The GIS and Census Tools prepare explanatory variables for analysis within the PLANSAFE Main Tool. The software is robust, incorporates the latest quantitative knowledge in road safety, and is fully functional. Implementation was the next critical step.

This project focused on the implementation of the PLANSAFE software within two MPOs with DOT oversight. The specific project objectives were to:

1. Refine and update the analytical routines and algorithms in the software (and corresponding User’s Manual);
2. Test and refine the graphical user interface (GUI) based on user feedback;
3. Form an initial practitioner user group, and identify user issues;
4. Identify the longer-term maintenance requirements of the software; and
5. Prepare the software for wide scale adoption and implementation.

CHAPTER 2.

RESEARCH APPROACH

Accomplishment of the project objectives consisted of completing the following tasks:

- Task 1: Identify and recruit two MPOs of different size and one Department of Transportation (DOT) for adoption of PLANSAFE software.
- Task 2: Implement PLANSAFE within the DOT and MPOs (data preparation and software calibration).
- Task 3: Train MPO and DOT staff on operation of PLANSAFE (familiarize users with functionality).
- Task 4: Assess functionality of PLANSAFE (through iterative feedback from users).
- Task 5: Refine PLANSAFE software and update user manuals based on Task 4.
- Task 6: Finalize software and User's manual to reflect all refinements, modifications, and enhancements.

This chapter describes the work completed for these tasks.

MPO RECRUITMENT

Metroplan Orlando, Volusia County TPO, and Florida DOT were recruited as the agencies to adopt the PLANSAFE software. Metroplan Orlando is a large Metropolitan Planning Organization (MPO) covering Orange, Osceola, and Seminole Counties in Florida. Volusia County TPO, a smaller MPO in Florida, is responsible for Volusia County and the cities of Flagler Beach and Beverly Beach. An implementation kick-off meeting was held on January 6, 2010 to present the objectives and provide an overview of PLANSAFE to the MPOs.

The research team also provided support to the Sacramento Area Council of Governments (SACOG) in their effort to implement PLANSAFE. SACOG had a member of California Department of Transportation (Caltrans) staff on loan to perform the analysis tasks.

TRAINING

The PLANSAFE team held four on-site training sessions and one web-based training session.

The first session, held in February 2010, was the initial project kick-off. The project introduction and work plan were presented at Florida DOT headquarters in Tallahassee, Florida and the following day in Orlando for Metroplan Orlando and Volusia County TPO. PLANSAFE software and manuals were distributed to meeting participants.

The second session, held in May 2010 in Orlando, was intended to present a summary of the basic data requirements for the implementation of PLANSAFE. The meeting focused on preparing census, crash, and street network data for the use in the PLANSAFE main application by Volusia County and Metroplan Orlando.

The third session, in August 2010, was a PLANSAFE analysis workshop in Orlando to demonstrate the PLANSAFE Main Tool functionality to the MPOs. Both MPOs participated, but software demonstrations were performed using Metroplan Orlando data because Volusia County TPO had not provided data.

A fourth session, in January 2011, was intended to be an on-site working session with each MPO, but MPO staff was unavailable to meet. The purpose of the working sessions was to provide METROPLAN Orlando and Volusia County Traffic Engineering a hands-on demonstration of the PLANSAFE tools using data collected previously by the agencies. Two staff members from Volusia County Traffic Engineering were able to view a partial demonstration of the PLANSAFE tools, specifically the pre-processing and loading of Volusia County data.

The web-based session was held in March 2011, and consisted of a demonstration of the PLANSAFE Main Tool using Volusia County data.

These six sessions provided training in all the PLANSAFE tools and processes, and with the User Manual, should be more than sufficient for an analyst to produce useful results.

IMPLEMENTATION

The PLANSAFE team developed a brief outline of the minimum data requirements to run the basic PLANSAFE functions and provided this document to the MPOs following the May 2010 working session. Metroplan Orlando submitted data in June 2010 which the research team was able to use to calculate several of the PLANSAFE explanatory variables and run test models in the PLANSAFE software. These data were used in the demonstrations in the August 2010 meeting.

Volusia County TPO submitted input data in January 2011. The research team used these data and the Metroplan Orlando data to create PLANSAFE datasets for all counties in these jurisdictions: Orange, Osceola, Seminole, and Volusia Counties. These datasets included total crash counts and the default PLANSAFE explanatory variables that could be developed using the data provided.

FEEDBACK

In working with the MPOs' data in the software and discussions with other team members, MPO staff and SACOG, the team was able to compile useful feedback. SACOG was especially helpful in providing feedback and notice of software bugs through frequent email communication.

FUNCTIONALITY

- The PLANSAFE safety performance functions require some explanatory variables that are not available or are difficult to forecast.
- There was concern about misuse of the crash reduction factors (CRFs) in the PLANSAFE Main Tool. The August workshop attendees felt many of the mitigation measures available were not appropriate for planning-level analysis and that documentation should be very clear that the CRFs should only be applied based on previous planning analysis
- A chapter could be included in the PLANSAFE documentation that focuses on “special cases” and/or “missing data”.
- It may be useful to show the impact on the cost of crashes to society within the PLANSAFE tool.
- An output dialog box could be embedded in the PLANSAFE software to show how well safety improvements proposed by an MPO match federal requirements for performance measures.
- 3-year crash averages are appropriate if a region has had many new developments; otherwise, a 5-year crash average is sufficient for regular PLANSAFE use.
- The PLANSAFE Census Tool will need to be updated to include the ability to download and process Census 2000 data when they are made available at the block group level.

DEPLOYMENT/MARKETING

- There is potential value added to the project if documentation can be provided to show the user how PLANSAFE relates to a Long Range Transportation Plan. This additional documentation may be prepared by Simon Washington.
- A promotional brochure for PLANSAFE would be helpful to agencies who want to know about required resources, level of effort, and data needs.
- Government agencies are strapped for resources in personnel, time, and money. Agencies are often driven by other mandated activities.
- Pre-processing should be outsourced from an agency.
- The degree of success of a PLANSAFE deployment will likely depend on the size of the MPO. The key question is: How well will this work with MPOs of different sizes?
- The ultimate long-term success of PLANSAFE will depend on how it is funded and how it is managed.
- The deployment and marketing of PLANSAFE could be enhanced if it were tied to a state’s Strategic Highway Safety Plan.

In final feedback, the MPOs expressed desire for more reliable pedestrian and bicycle crash forecasting and countermeasure evaluation.

SOFTWARE IMPROVEMENTS

Installation issues with the PLANSAFE software were identified for certain versions of Windows and ArcGIS. The research team developed interim workarounds for some errors, and corrected all errors in the final installer for the revised software.

Resolved Issues:

1. Non-administrative users were unable to run the PLANSAFE Main Tool properly due to MS Access Database permission issues without several extra modifications required by an administrator during installation. This has been resolved and the extra installation steps will no longer be necessary.
2. The GIS Tools failed to install in some cases on ArcGIS 9.3.1 and at the release of ArcGIS 10 the installation always failed. The installer was fixed and users are now required to use ArcGIS 10.

The research team made additional software refinements based on feedback. Changes in the new PLANSAFE software version include:

1. Made countermeasure portion in the PLANSAFE Main Tool an optional analysis (see Figure 1).
2. Removed intersection and segment-level analysis.
3. Removed all analysis options for roadway segments and intersections.
 - a. Removed option to upload roadway GIS data, except as visual reference in map.
 - b. Removed segment and intersection countermeasures.
4. The Census Tool now functions on Windows 7.
5. Removed suboptimal tool options in the GIS Tool.
6. Fixed error in countermeasure filter.
7. Added additional help documentation and more prominent information where users could otherwise be confused.
8. An updated version of MapWinGIS Active X component has been included to simplify installation process.

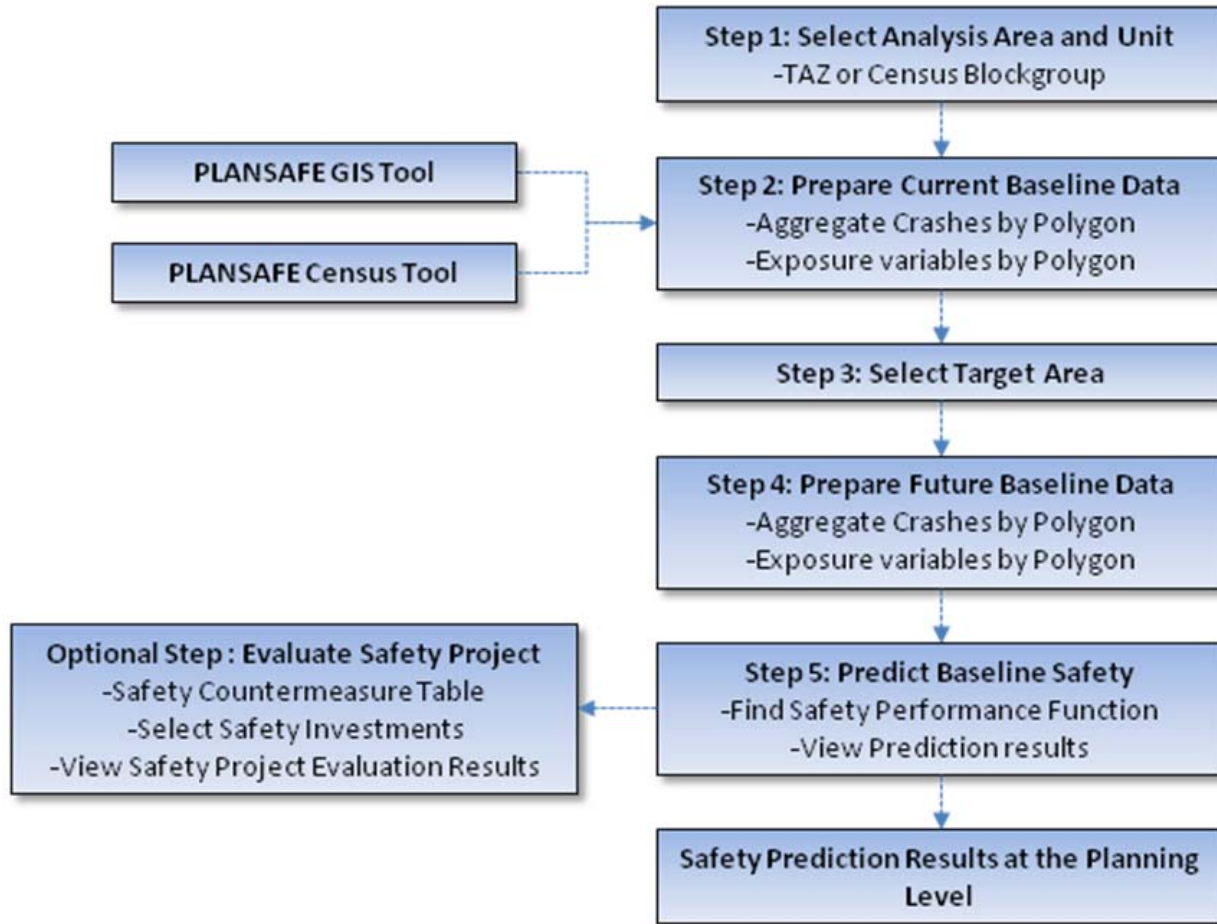


Figure 1: Revised PLANSAFE Analysis Steps

MANUAL IMPROVEMENTS

The research team made extensive revisions to the user manual to improve clarity and reflect changes and improvements to the software. Changes include providing more overview of the PLANSAFE analysis process, explanation of the development of the safety performance functions (SPFs), and restructuring of some portions of the manual.

Changes made are as follows:

1. Research Motivation (Chapter 2) has expanded into a Background chapter and now includes:
 - a. Research Motivation – Same as before
 - b. Analysis Procedures in PLANSAFE – Text pulled from PLANSAFE Main Tool usage chapter to provide better overview in beginning.
 - c. Processes within the PLANSAFE Software – Text extracted from NCHRP Report 546 to explain the modeling process and theory used in PLANSAFE.

2. Software Installation instructions for all PLANSAFE components have been aggregated into a single chapter as opposed to individual locations throughout the manual. Software requirements and installation steps have been modified as necessary.
3. A section was added to the Data Preparation chapter to describe approximation methods for baseline years other than 2000.
4. The PLANSAFE Tools section has been moved ahead of the PLANSAFE Software section since the Census and GIS Tools would be required to be used before the Main Tool and follows a more natural progression for the user.
5. Added a section called “Estimating Variables for Future Baseline Year or Non-Census Years” to Chapter 4, “Data Preparation.”
6. Removed all references to intersection and segment-level analysis.
7. Updated screenshots to reflect the updated PLANSAFE user interface.

CHAPTER 3.

CONCLUSIONS, RECOMMENDATIONS, AND SUGGESTED RESEARCH

The research team has made extensive revisions to the PLANSAFE software tools and the user manual. In working with the MPOs on the pilot implementation, the team discovered several issues and recommendations for future work. It is difficult for MPOs to provide resources for PLANSAFE data preparation, and this work may be best done by consultants. MPOs need help to know how to incorporate PLANSAFE results into their long range transportation plans. Future iterations of the PLANSAFE software could include output that can be pasted directly into planning documents, or the user manual could provide further discussion of how the PLANSAFE output should be used.