Arizona Local Government Safety Project Analysis Model

User's Manual

SPR 504

The contents of the report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Arizona Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation. Trade or manufacturers' names which may appear herein are cited only because they are considered essential to the objectives of the report. The U.S. Government and The State of Arizona do not endorse products or manufacturers.

Technical Report Documentation Page

1. Report No. FHWA-AZ-01-504 (M)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle **Arizona Local Government Safety Project Analysis Model**	5. Report Date June 2001
	6. Performing Organization Code
7. Authors Jason Carey	8. Performing Organization Report No.
9. Performing Organization Name and Address Jason Carey , P.O. Box 786, Flagstaff, AZ 86002	10. Work Unit No.
	11. Contract or Grant No. SPR-PL-1-(57) 504
12. Sponsoring Agency Name and Address **ARIZONA DEPARTMENT OF TRANSPORTATION** **206 S. 17TH AVENUE** **PHOENIX, ARIZONA 85007** Project Manager: John Semmens	13.Type of Report & Period Covered
	14. Sponsoring Agency Code

15. Supplementary Notes
Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration

16. Abstract

     The Arizona Local Government Safety Project Model is a tool that can be used to facilitate the selection of hazardous roadway locations in local jurisdictions, to prioritize those locations by rational means, and to aid in the evaluation of potential spot treatments of safety hazards. However, the model is not intended to automate the entire decision-making process, and can not substitute for the analysis and judgment of a traffic engineer. While Arizona LGSP Model should prove to be a useful tool, particularly for jurisdictions with limited research budgets or capabilities, use of the model is not mandatory, and is subject to the preference of each jurisdiction.

     The Arizona Local Government Safety Project Implementation Model (LGSP model) was created in MS Access 97. The model consists of a self-contained query and reporting database, and a supplemental database of crash records on CDROM. Running the model requires the following hardware and software: Microsoft Office 97 or newer: Access, Word and Excel programs, MS Access must be loaded with the "Linked Table Manager" add-in, CDROM drive or network access, and Approximately 32Mb RAM and 100Mb hard disk space

     The model is computation-intensive, and will require a significant amount of time to run on machines with slower processors. On slower processors, it is particularly important that additional programs be closed while the update is being run. The amount of time required for a complete update of the model will vary with the power of the machine used, the speed of CDROM or network data transfer, and the size of the jurisdiction(s) being analyzed. It is recommended that smaller units of analysis (e.g. a single city rather than an entire county) be examined separately whenever possible.

17. Key Words safety, safety projects, safety modeling	18. Distribution Statement Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161	23. Registrant's Seal
19. Security Classification Unclassified	20. Security Classification Unclassified	21. No. of Pages 39	22. Price	

METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	0.3048	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	6.452	centimeters squared	cm^2
ft^2	square feet	0.0929	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
mi^2	square miles	2.59	kilometers squared	km^2
ac	acres	0.395	hectares	ha
		MASS (weight)		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.0328	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3

Note: Volumes greater than 1000 L shall be shown in m^3.

		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
yd^2	kilometers squared	0.39	square miles	mi^2
ha	hectares (10,000 m^2)	2.53	acres	ac
		MASS (weight)		
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1000 kg)	1.103	short tons	T
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3

		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

°F   -40°F   0   32   98.6   212°F
         -40   0   20   40   60   80   100   120   160   200
°C   -40°C   -20   0   20   37   40   60   80   100°C
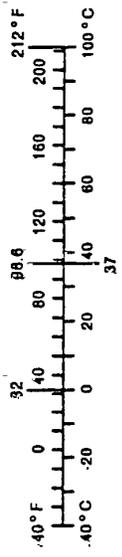
These factors conform to the requirement of FHWA Order 5190.1A

*SI is the symbol for the International System of Measurements

Table of Contents

PREFACE

This document is intended to accompany copies of the Arizona Local Government Safety Project Implementation Model (AzLGSP), distributed by the Arizona Transportation Research Center, Arizona Department of Transportation. The AzLGSP is intended to facilitate hazardous site identification on roads under local government (i.e. cities, towns, counties) jurisdictions. Users are provided with a self-extracting copy of the model (azlgsp-2.exe) and this document on floppy disk, and crash data reference files on CD.

Users are encouraged to report any problems discovered in the program to the ATRC. Any questions, comments or concerns should be directed to:

John Semmens   *jsemmens@dot.state.az.us*   (602) 712-3137

Jason Carey   *jasoncarey@hotmail.com*   (916) 482-1478

Users are encouraged to review this document prior to working with the AzLGSP model.

SOFTWARE INCLUDED

Each recipient has been provided with a floppy disk containing a copy of the Arizona LGSP model as a self-extracting archive "**azlgsp-2.exe**" and a copy of this document.

Each user has also been provided with a "CRASHDATA" CD containing 15 crash data files (one for each county) from 1995 to 2000. The crash data files are Microsoft Access 97 databases (*filename*.mdb) named according to county. For example, Apache County data are located in the file "Apache.mdb"

Note that the CD distibuted in the initial training session held on March 18, 2002 contains a beta version of the AzLGSP model. This version is fully functional, except for the export routines that send crash details to MS Excel. The CD version should be replaced with the version distributed on floppy disk.

After running azlgsp-2.exe, the Arizona LGSP model will be installed on the user's hard drive. The county data files can be left on the CD or copied to a local network, from which they can be accessed via the Linked Table Manager function. The How To Load LGSP model section illustrates the procedure for loading the Arizona LGSP model; and the Getting Started section discusses preparing the model for use.

Users more familiar with the LGSP model may wish to skip to instructions for a particular screen view with which they are working. For ease of reference, thumbnail view of the more common screen views are shown on the following page. Clicking on any of these screen pictures will take the reader to the section of this document discussing that particular screen.

STARTUP

CompSiteTraffic

INPUTS

Safety Project Details

LOC_DTL

PROJ_EVAL

INTRODUCTION

The Arizona Local Government Safety Project Model is a tool that can be used to facilitate the selection of hazardous roadway locations in local jurisdictions, to prioritize those locations by rational means, and to aid in the evaluation of potential spot treatments of safety hazards. However, the model is not intended to automate the entire decision-making process, and can not substitute for the analysis and judgment of a traffic engineer. While Arizona LGSP Model should prove to be a useful tool, particularly for jurisdictions with limited research budgets or capabilities, use of the model is *not mandatory*, and is subject to the preference of each jurisdiction.

The Arizona Local Government Safety Project Implementation Model (LGSP model) was created in MS Access 97. The model consists of a self-contained query and reporting database, and a supplemental database of crash records on CDROM. Running the model requires the following hardware and software:

- Microsoft Office 97 or newer: Access, Word and Excel programs
- MS Access must be loaded with the "Linked Table Manager" add-in
- CDROM drive or network access
- Approximately 32Mb RAM and 100Mb hard disk space

The model is computation-intensive, and will require a significant amount of time to run on machines with slower processors. On slower processors, it is particularly important that additional programs be closed while the update is being run. The amount of time required for a complete update of the model will vary with the power of the machine used, the speed of CDROM or network data transfer, and the size of the jurisdiction(s) being analyzed. It is recommended that smaller units of analysis (e.g. a single city rather than an entire county) be examined separately whenever possible.

MODEL OVERVIEW

The Arizona LGSP Model is basically divided into two processes. The first selects a subset of hazardous locations from one or more jurisdictions based on user-defined parameters. These locations are prioritized according to one of several measures of hazard or severity, and multiple reports are generated to summarize crash incidence, roadway and driver characteristics, and estimated costs associated with each location. The second component of the LGSP model prompts the user for possible safety treatments for one or more locations,

calculates the expected benefits for each project, and returns a benefit-cost analysis that follows HES eligibility guidelines.

The LPSG model stores crash location data until another update is run. Although the data stored takes up a substantial amount of hard disk space, storage facilitates the update process, providing faster access to jurisdiction-specific crash subsets and allowing the user to test alternate safety treatment scenarios without rerunning the model. The two-step procedure takes the following form:
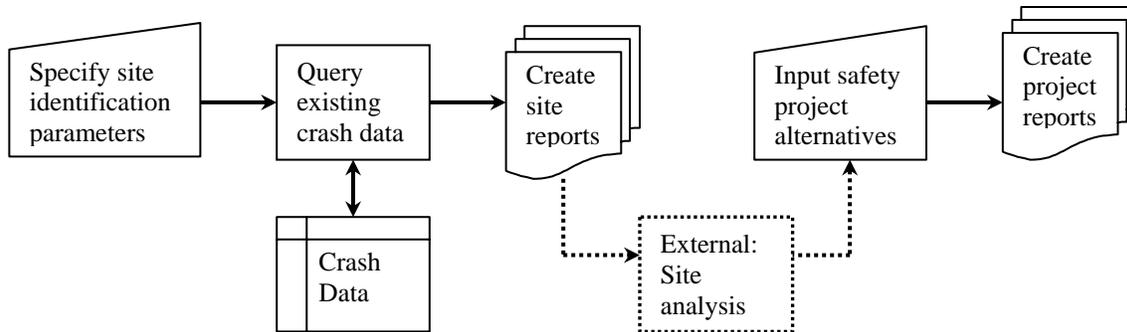
After the user specifies site selection parameters, a series of queries are run on the database to extract, sort and aggregate jurisdictional crash records. From this procedure, a series of reports are generated. These reports identify the highest-priority site locations, summarize such information as the frequency, severity and cost of crashes at each location, provide specific details of roadway type, condition and relationships; vehicle actions, speeds and harmful events; and external factors such as weather. The LGSP model generates a report listing comparable sites for a specific location, allowing the user to perform statistical analyses of relative risk and regression-to-the-mean if needed. These data are also useful for before-and-after comparisons of treated and untreated locations. From various report outputs, it is expected that local traffic engineers will be able to identify target sites for mitigation.

Prior to input of safety project alternatives, it is assumed that each potential site will be subjected to greater study, identifying relevant information not provided by the LGSP model. Site engineering studies and surveys of prior treatments are necessary for determining feasibility of improvements at a treatment location. On-site analysis provides the most reliable assessment of influential factors at a project location, and should identify far more site characteristics than an automated review of crash data. Although some degree of inference regarding potential safety improvements can often be made from the LGSP outputs, these reports are not intended to supplant a rigorous on-site evaluation.

Once the target sites have been evaluated, it is expected that one or more improvement projects will be identified as appropriate for the site conditions. At this point, projects can be entered in the LGSP model and evaluated in terms of

a benefit-cost analysis. Each project alternative is assigned expected levels of effectiveness for reducing crashes at the site location. Effectiveness measures (crash reduction factors) can be assigned by the user, or default values generated by the model can be used when available. The effectiveness measures are combined with crash frequency measures to yield an overall reduction in crashes of varying severity at each location. This reduction is then multiplied by the cost associated with a crash of that severity to yield an annual benefit. Annual project benefits are compared with the annualized costs of implementing the safety improvement to yield a benefit-cost ratio.

CAPABILITIES

The Arizona LGSP Model can accomplish the following tasks:

- Analyze multiple jurisdictions
- Limit crash records returned based on user-defined parameters
- Aggregate crash records based on distance from a specific location
- Provide total and annualized crash details, including:
  - Frequency/incidence
  - Units involved
  - Severity (highest observed for each record)
  - Severity (injuries for each person involved)
  - Estimated costs associated with crashes
  - Summary statistics for incidence measures
- Summarize crash details and limit details to a specific subset
- Provide a list of sites comparable to the chosen site of analysis
- Accept and analyze *user input* of traffic volumes at multiple sites
- Analyze multiple safety projects at a location
- Rank order project alternatives by cost effectiveness
- Format project details to supplement HES eligibility applications

LIMITATIONS

The Arizona LGSP Model does not do the following:

- Provide traffic data for a given site, though user inputs for these data can be analyzed
- Know the site history (i.e. which treatment alternatives have been evaluated or implemented in previous years)
- Automatically update crash cost estimates, though these can be modified by the user from the STARTUP page
- Automatically update the crash records file, though instructions for performing this action using an automated format are included in Appendix B

HOW TO LOAD

1. Insert the disk containing the azlgsp-2.exe file in the appropriate drive. This example uses drive letter E:\ For other drive locations, simply substitute the appropriate drive letter.

2. From the Windows desktop, select **START > RUN**

3. The following dialog box will be displayed.
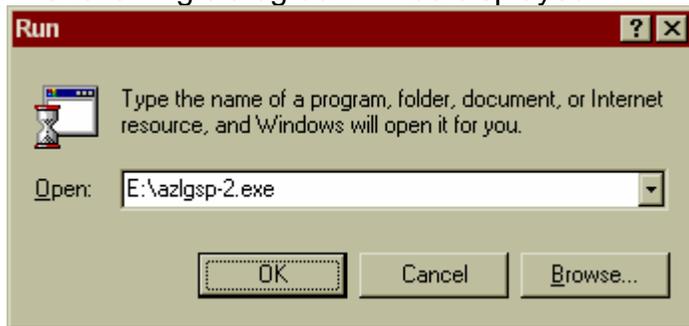
4. Select "Browse" to choose the location of azlgsp-2.exe

5. A new dialog box will be displayed (see below). Select the drive used in Step 1. at the top of the page, choose the "azlgsp-2.exe" file, and press "Open."
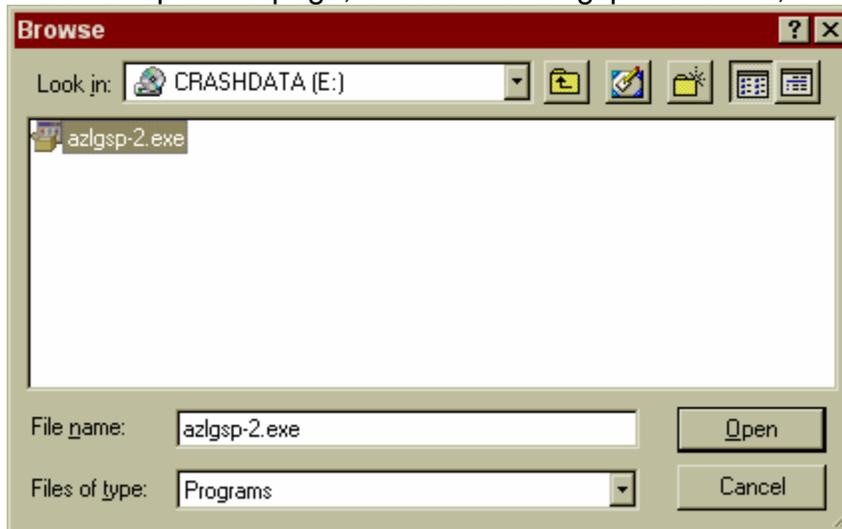
6. The first dialog box should now read "Open: E:\azlgsp-2.exe". Press "OK" to load the model.

FILE LOCATIONS

Three files will be extracted to the user's hard drive, and a new folder will be created for these files at **C:\ADOT\SFTYMDL**.

DO NOT change this directory; the model will not work properly if the file locations are altered. After extracting, verify that all files exist in the new directory:

C:\ADOT\SFTYMDL\AzLGSP2.mde (operating version for Access 97)

C:\ADOT\SFTYMDL\AzLGSP2.mdb (updatable version for conversion)

C:\ADOT\SFTYMDL\SFTYDATA.mdb (storage file for query results)

The only difference between .mde and .mdb versions of the model is that the .mde format does not allow alterations to the macros and forms built into the model. It is recommended that users of MS Access 97 run the AzLGSP2.**mde** file to avoid any unintended changes to the file structure and routines.

Users of newer versions of MS Access may wish to convert the model to the newer version. Files with the .mde extension can not be converted to newer versions. In this case, the AzLGSP2.mdb file should be used. It is recommended that users of newer versions of Access create a new .mde file after converting.

If AzLGSP2.mdb is opened in Access 2000, the user will be asked whether or not to convert the file to Access 2000. Select "yes"/"ok" and Access will perform the conversion. Reopen the new file and select **Tools > Database Utilities > Make MDE** File to create a new .mde version of the model.

Rather than storing internally all jurisdictional data returned from the crash data CD, AzLGSP.mde sends these data to the SFTYDATA.mdb file. The data tables are linked to AzLGSP.mde, but do not increase the size of the file. Running the model again simply replaces the tables in the SFTYDATA.mdb file, without affecting the links in AzLGSP2.mde. If AzLGSP2.mdb is converted to Access 2000 (or later versions), it is recommended that SFTYDATA.mdb be opened and converted as well. Other than for conversion, or to fix occasional replacement errors, there should be no need to modify the SFTYDATA.mdb file.

GETTING STARTED

When opened, the LGSP model first displays two messages for the user. The first message box is a reminder that the CD containing crash records must be loaded for the model to function properly. Previously generated reports may be viewed without the CD, but no new analyses can be completed without the crash data files. Users that have stored crash data on a network drive may ignore this warning.

The next message that appears is a reminder to compact the database periodically. To compact the database, let the STARTUP screen (see below) load, and then

NOTE: The first time the model is opened, the crash data tables will need to be updated before use. To update all linked tables, use the Linked Table Manager located in **Tools > Add-Ins >** Linked Table Manager.

The LGSP model should be accessed using the buttons shown on each screen whenever possible. For example, the "EXIT Program" button will close the database from the STARTUP screen, and other forms contain an "EXIT to Start" button that will return the user to the STARTUP screen. For additional discussion, see the Basic Navigation section.

STARTUP FORM

Once the database has been opened, and compacted or refreshed as necessary, the STARTUP view form will appear (Figure 7). This form provides an outline of the available procedures in the LGSP model, and will reappear at the end of each option procedure chosen.

Prior to selecting options from the STARTUP form, it is recommended that three procedures be followed to so that the model runs properly:

i. Update the Linked Table Manager
ii. Compact the AzLGSP and SFTYDATA databases
iii. Verify that the Crash Costs used are current

From the STARTUP outline, the following choices can be made:

1. Run the entire update and prioritization procedure to select potentially hazardous sites. This option also allows the results of a previous update to be re-sorted by new parameters. Pressing **Button 1** will open the INPUTS form.

2. Buttons 2a and 2b open summary reports for the most recent run of the model. **Button 2a** opens the PRIORITY LIST report, which summarizes the top twenty-five hazard locations, sorted by the parameters selected in the previous update. **Button 2b** opens the RECORD LIST report for the locations summarized in the PRIORITY LIST. The RECORD LIST contains individual summaries for each crash record at a high-priority location.

3. Button 3 is linked to multiple options for viewing and/or exporting crash record details. Pressing **Button 3** opens the Location Details (LOC_DTL) form, in which additional options are presented.

4. **Button 4** opens the Safety Project Details form, used to input safety project ideas once sites and potential treatments have been identified.

5. **Button 5** opens the Project Evaluation Report containing an analysis of effectiveness and benefits versus costs for project entered in option 4.

DATABASE UTILITIES

Because many of the AzLGSP queries rewrite data tables, the file will grow each time it is run. Compacting the database will condense empty spaces (deleted tables), reducing the size of the file and improving performance.

To compact the AzLGSP file, select **Tools > Database Utilities > Compact Database** from the menubar, as illustrated in the following figure. After a brief period, the model will automatically re-open, ready for use.

In addition to compacting the AzLGSP file, the SFTYDATA.mdb file will need to be compacted regularly, as this file will grow with each iteration of the model. For compacting the SFTYDATA file, a **button** has been added to the STARTUP window in AzLGSP2, circled in the figure below. Simply press this button to compact the SFTYDATA.mdb file, saving hard disk space.
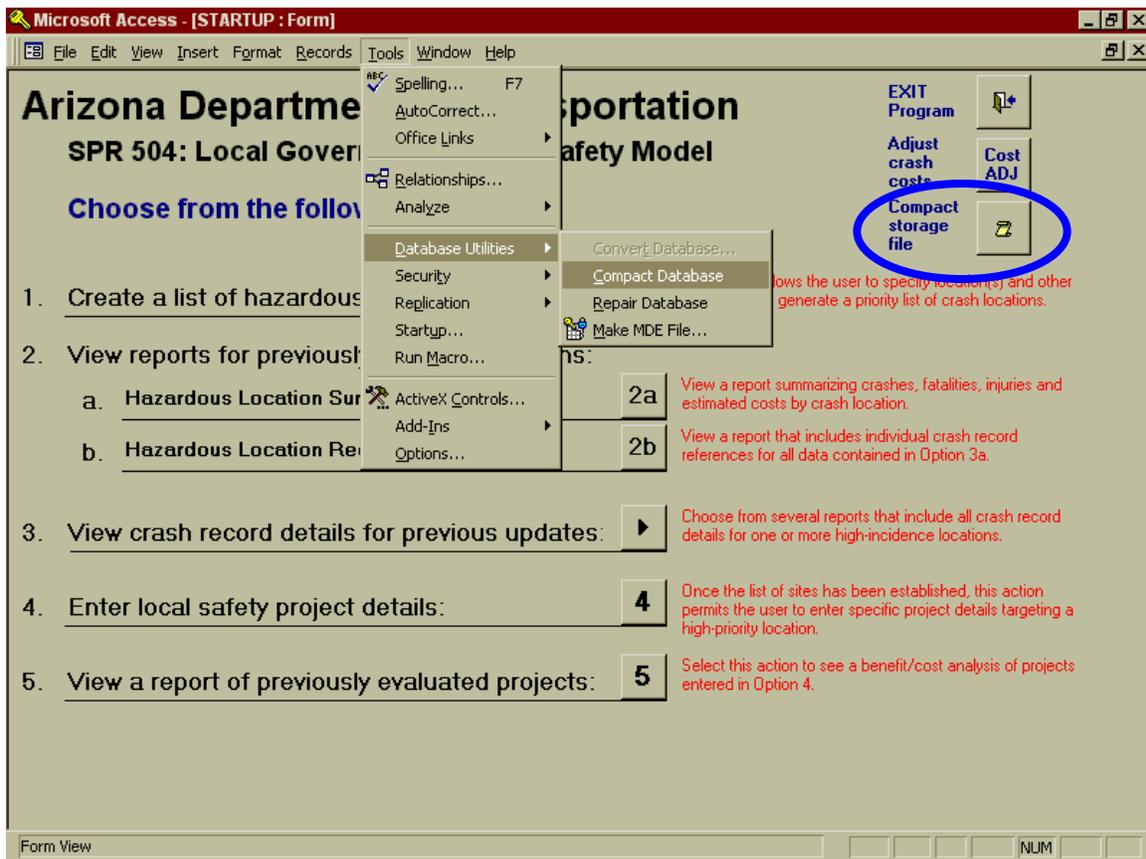
LINKED TABLE MANAGER

The first time the model is opened, the crash data tables will need to be updated before use. To update all linked tables, use the Linked Table Manager located in **Tools > Add-Ins > Linked Table Manager**.
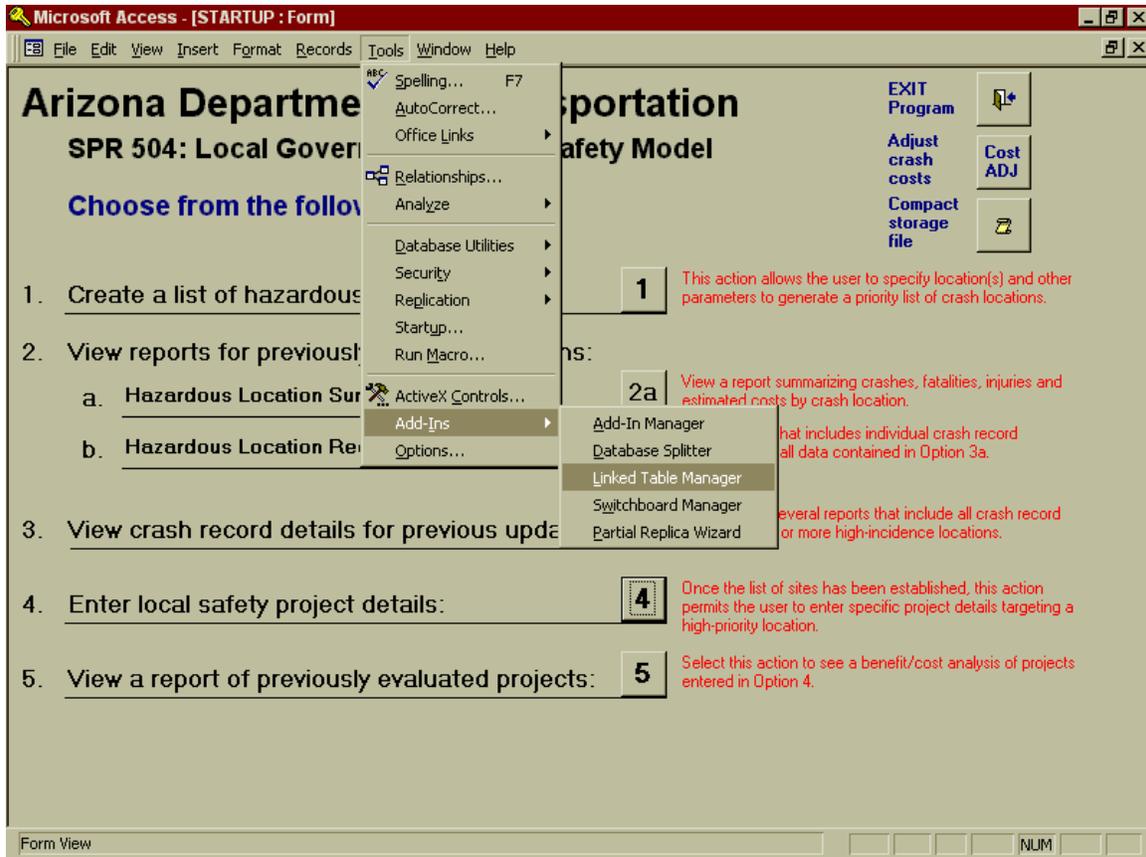

This will open the linked table dialog box shown below. To link crash data from the county to be analyzed, press the "**Select All**" button and the check the box for "**Always prompt for new location**". These are highlighted on the dialog box below.

DO NOT press "OK" yet. First, clear the check marks from the following tables shown in the dialog box:

- LOCATION
- LocationTable
- PRIORITY DETAIL
- PRIORITY LIST

- Table2d
- Table3
- Table4

Note that the tables are grouped alphabetically, with the first four appearing in the middle of the dialog box, and the last three appearing at the end. These seven tables should *always* be linked to **C:\ADOT\SFTYMDL\SFTYDATA.mdb**
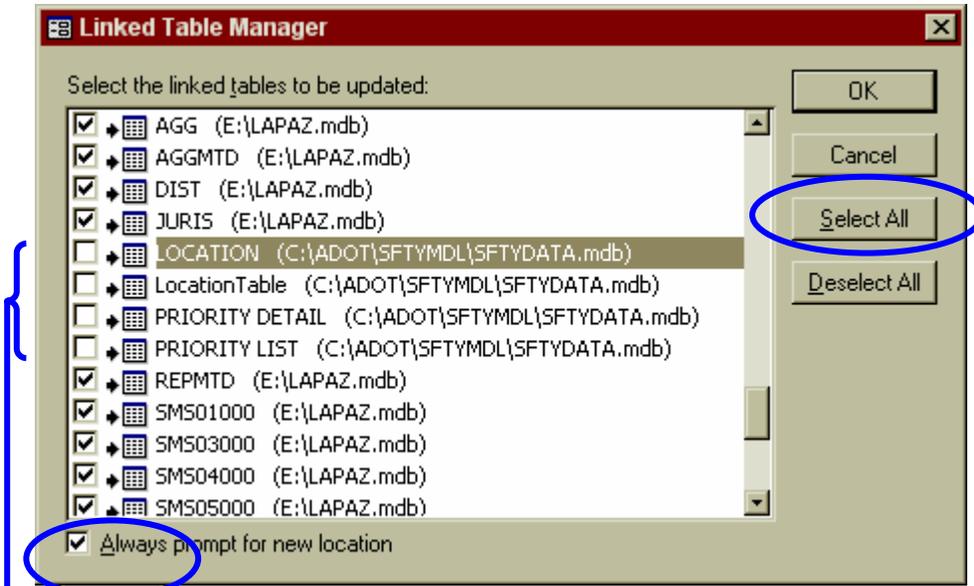
CLEAR CHECK BOXES!

After clearing the checkboxes for the seven reference tables located in C:\ADOT\SFTYMDL\SFTYDATA.mdb, press the "OK" button. A new location dialog box will appear.
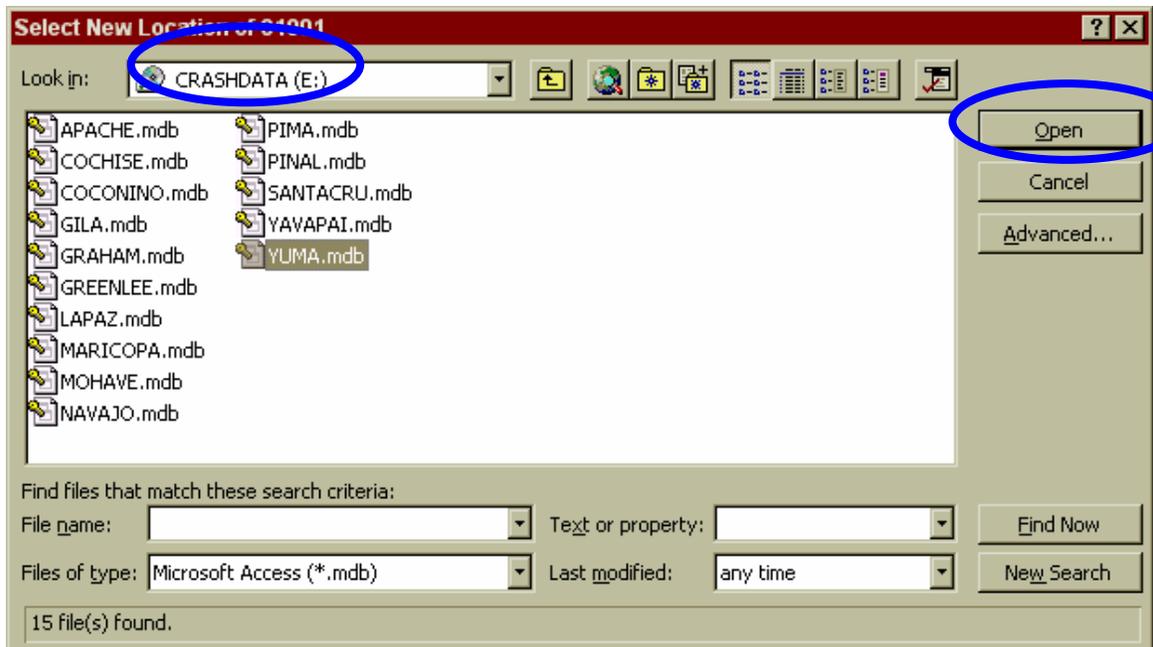
Because all linked files are located in the CRASHDATA file, the remaining tables will automatically be refreshed.

If any of the seven tables from C:\ADOT\SFTYMDL\SFTYDATA.mdb are included in the update (i.e. if the check boxes are not cleared from these tables), an update error will occur. The error will force the tables to be updated individually, rather than as a group. The "Select New Location" dialog box shown above will appear for each table in the update procedure. Pressing "Open" will only link one table at a time.

Because this process is very time-consuming, the best response is not to continue the update. Press "Cancel" to close the new location dialog box. Restart the Linked Table Manager, ensure that the tables from SFTYDATA.mdb are not selected (i.e. check boxes are cleared), and try the update again.

This process must also be completed each time a new crash data file is to be analyzed. For example, if the user wishes to replace "APACHE.mdb" (i.e. the Apache County data file) with a new file "YUMA.mdb," the tables must be refreshed with the new file name.

The crash data files have been subgrouped according to county level jurisdiction in order to improve the processing time of the LGSP model. Interested users may also obtain complete data for 5-year periods contained in a single file from the ATRC. However, use of the county-level databases is strongly encouraged, particularly for smaller counties, as these files reduce run time by 90 percent or more.

Once the reference files for the jurisdiction of interest have been updated in Linked Table Manager, the AzLGSP model will be ready to generate site reports. Closing the Linked Table Manager will return the user to the STARTUP page.

COST DATA

In addition to the five STARTUP options in the numerical outline, the user can also adjust the cost estimates for crashes of varying severity used in the benefit-cost analyses. This procedure should be done prior to running a new update. To access the crash costs page, press the "Cost ADJ" button circled on the STARTUP form shown above.

The COMPCOST form, shown below, will be opened. This form allows the user to adjust the average estimated *total* cost of a crash depending on the maximum severity observed. The format follows the HES eligibility guidelines used by the Arizona Department of Transportation. These figures are posted on the Internet, and are also available from ADOT Traffic and Engineering.

After adjusting crash costs as necessary, the "Exit" button (circled above) will return the user to the STARTUP page.

USING THE ARIZONA LGSP MODEL

This section will follow the procedures for a complete update from start to finish. Sections can be accessed from the Quicklinks list or the Screen ID links at the top of this document.

Pressing Button 1 on the STARTUP page opens the INPUTS form, which allows the user to specify criteria for selection of hazardous roadway sites. Each option is linked to a reference table, and the option selected is copied to the INPUTS table.

INPUTS: CREATING A SITE LIST

To create a list of high-priority (i.e. hazardous) sites, the user must specify a jurisdiction of analysis. This can be a county, a city or town, or reservation. In checkbox below the **Jurisdiction** menu, the user can specify whether to include cities and towns in the county-level analysis. For example, to include all jurisdictions in Gila County, the **Include sublevels** option would be set to "Yes."

Start and end dates must be entered in numerical format. In most cases, no more than five complete years of data will fit on a crash data CDROM. However, if the program is run over a network, there is no limitation on the number of years of data that could be included on a server-based crash data file.

To exclude **alcohol-related** crashes, type "No" in the appropriate box. To include all crashes, type "Yes." The default value for this option is "No."

The **Location Method** menu provides four options for identifying a crash site, all of which rely on cross streets to identify the reference point.

- **Route** method limits a site to crashes occurring on one route at a junction

- **Junction** method aggregates all crashes at a junction regardless of route

- **Junction-related** refines "Junction" method to include only junction crashes classified as related to the junction and/or intersection

- **Intersection-related** refines "Junction" method to include only junction crashes specifically related to the intersection

After specifying the site identification method, the **aggregation distance** must be selected. Aggregation distance refers to the radius from the cross street reference within which crashes will be included at that site. For example, selecting "500 feet" will include all crashes referencing a particular junction that occurred *no more than* 500 feet from that junction.

Finally, the user must specify the **reporting method** criterion used to prioritize hazardous locations. Again, four options are provided:

- **Total Incidence** prioritizes sites by the number of crashes (of any severity) observed in the period of analysis

- **Total Fatalities** prioritizes sites by the number of fatalities observed at each site; crash counts are used to weight sites with no fatalities

- **Total Fatalities + Injuries** option filters injurious locations by ordinal measures of severity; crash counts are used to weight sites with no injuries

- **Weighted by Severity** option is similar to the "Total Fatalities + Injuries" option, except that the relative magnitude of severity in terms of crash costs is considered in place of ordinal mneasures

Once the user inputs have been specified, the **GET RESULTS** button will run the prioritization procedure (the TRAFSAF macro). This process can take anywhere

from 2 minutes to several hours, depending on the jurisdiction(s) selected an the speed of the computer used. When the TRAFSAF macro begins, the following message will be displayed:
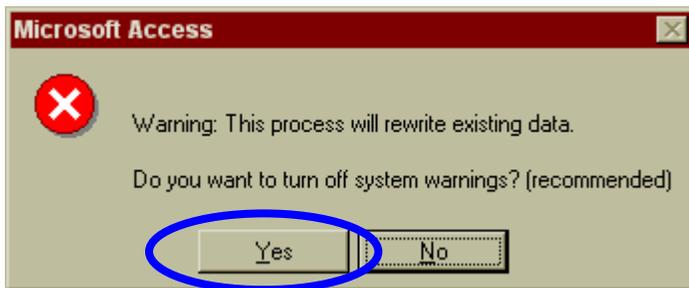
Because the macro rewrites existing tables, the program will ordinarily verify that the previous information should be deleted. These verification messages will appear every few minutes while the model is running, and will stop the update until the user responds. By selecting the "YES" button, the delete warnings will be temporarily disabled while the TRAFSAF macro runs. This option speeds up the site identification procedure and allows the user to avoid constant monitoring of the update process. A notification message will still appear approximately halfway through the update to document progress thus far.

If the "YES" button is selected, the database windows will minimize and the LGSP model will appear inactive for some length of time. Again, it is **recommended that no other programs be run until the** PRIORITY LIST **report appears at the end of the update**.

<u>MODIFYING RESULTS</u>

After the initial run of the TRAFSAF macro, jurisdiction locations can be re-queried for new aggregation distances or reporting methods without running the entire procedure again. The macro action buttons next to the Aggregation Distance and Reporting Method menus can be used to re-sort *existing* locations. The time savings from using this method is greater than 50 percent. For example, if "intersection-related" crashes for Quartzite were initially queried using a 500-foot aggregation distance and prioritized according to total fatalities, these data could be requeried using a 100-foot distance to determine which crashes occurred within the smaller radius from the intersection. Similarly, crashes at these sites could be re-prioritized according to different severity measures (e.g. total incidents, total number of persons harmed, etc.).

To re-query existing data, simply change one of the Distance or Reporting parameters in the menus on the STARTUP page. Then press the "Re-sort existing records" button for the category changed. A new PRIORITY LIST will be generated using the new parameters.

No other changes should be made prior to running these procedures. For example, changing the Location Method will cause the program to return invalid and/or incomplete data. These options are intended to facilitate the examination

of existing data for a variety of scenarios, and should only be used after a full update procedure has been completed.

VIEWING RESULTS

When the TRAFSAF macro has finished running, the **PRIORITY LIST** report will be displayed. If an update has already been completed, the PRIORITY LIST report can also be accessed by pressing **Button 2a** on the STARTUP menu. As shown in the following figure, the PRIORITY LIST summarizes the results of the local site prioritization procedure, returning the twenty-five most hazardous locations as defined in the user inputs section. Locations are ranked by jurisdiction in descending order of importance as specified in the "Reporting Method" option. Crash incidence and severity measures are included for each location.

The PRIORITY LIST report can be printed or closed from the preview screen, but can not be modified. Closing the report returns the user to the STARTUP menu. If greater detail is required for the location summary, **Option 2b** can be run to open the **Priority Location Record List**. This report contains the same site location references as the Priority List, but each individual crash record is represented along with costs for each crash sorted by year of analysis.

The Priority Location Record List is also useful for gathering any additional data that may be required. Because crashes are indexed according to record number, a list of records provides a simple means of identifying items of interest. However, the record list report does not provide substantially different information than the Priority List report, and is intended only as a supplemental reference to be used as needed. Because the record list report can be quite long (e.g. records for Gila County locations shown in Figure 11 take up 19 pages), it is recommended that printing be done from the file menu (File > Print) and then specific page numbers selected for printing.

As in the case of the Priority List report, closing the Priority Location Record List will return the user to the STARTUP menu. In the case of a complete update, the next step would be the examination of individual crash details for one or more locations.

BASIC NAVIGATION

It is strongly recommended that buttons included on forms (e.g. STARTUP, INPUTS, SITE DETAILS, PROJECT DETAILS and PROJECT EVALUATION) be used to move between screens. These forms all contain buttons to move between records, perform update functions, and return to the previous or STARTUP form.

All forms can also be closed using the lower "X" (close form) box in the top right hand corner of the form. Closing a form in this manner will return the user to the STARTUP screen. This procedure can be used to close a blank form in the event that the user has omitted data prior to running a query. For further discussion, refer to the ERROR: NO DATA discussion for incomplete safety project entries.

To navigate reports (e.g. Priority List, Priority Records, Crash Details), use options on the lower menu bar to manipulate the report. The report can be resized, printed, closed or exported to other MS Office programs from this menu bar. These options are highlighted in blue on the figure below.

In most cases, if a form or report does not display, open or close properly, simply compacting or closing the database will solve the problem.

CRASH SITE DETAILS

Pressing **Button 3** (marked with an arrow) on the STARTUP menu takes the model user to the **Record Details** form shown in below. Several viewing options are available for individual crash records.

The most complete data are available by selecting the "Details for each crash" option for all Priority List locations (a.i.), all locations where fatal crashes occurred (a.ii.), or a specific location chosen from the Priority List (a.iii.). These options will create one-page reports for each crash record, listing recorded details on roadway, driver, incident and vehicle characteristics. A sample report is shown below.

Additional procedures that can be run from this page include creating a one-page summary of all crashes at a particular location, exporting crash details to an Excel spreadsheet (useful for Pivot Table reports and other custom summaries), and generating a list of other sites in the jurisdiction with similar characteristics. The latter procedure can be used to include traffic counts in the comparitive analysis.

Priority Locations: Fatal Crash Details

JURIS	Globe	YEAR	1995	
RTE_A	MESQUITE	ST	RECORD	03551001
RTE_B	BROAD	ST		

ON_NAME	BROAD	DISTANCE	0
COLL_MANN	Angle	DAYLIGHT	Darkness
INTSEC_REL	Intersection Related	JUNC	Intersection
FHE	Collision with other Motor Vehicle	TRAF_WAY	Roadway/Alley
SCENE	Investigated	WEATHER	Cloudy
NONVEH_DES	Same as First Harmful Event	OWNER	Unknown
ALIGN	Straight Roa	GRADE	Downgrade
LOCALE	Urban / LANE / Lane 1	R_CONTROL	Non-Controlled Access
R_CHAR	Two-Way Striped Center Line	R_COND	Not Reported, No Unusual Conditions
R_SURF	Asphalt	R_SPECLOC	Not Reported, None
R_SURFCOND	Not Reported, No Unusual Conditions	R_TERRAIN	Hilly
Control 1 Type	Stop Sign	Control 1 Oper	Functional
Control 2 Type	Striping	Control 2 Oper	Functional

UNIT_NUM	1	Unit Speed	25	Posted Speed	25 / Safe Speed	0
PHE	Other			SUB_HE	Collision with Other Fixed Object	
UNIT_ACT	Going Straight Ahead			Travel Direction	W	
PHYS_1	No Apparent Defects			PHYS_2	Not Reported	
VIOL_1	Failed to Yield Right-Of-Way			VIOL_2	Not Reported	
VISION	Not Obscured			VEH_DMG	Disabling	
VEH_SKID	Skidding			VEH_STOP	Vehicle in Motion	
DEFECT_1	Defective Brakes			DEFECT_2	no defn for now	
UNIT_NUM	2	Unit Speed	25	Posted Speed	25 / Safe Speed	25

EXPORTING DATA

Due to the number of crashes at many sites, the detail reports can be tedious to examine, particularly in the case of option a.i. "All Priority List locations." Items b.i. and b.ii. are intended to facilitate the use of the information contained in the detail reports. Selecting either of these buttons will automatically export crash details to an Excel spreadsheet. The export options have been pre-formatted to simplify analysis (e.g. record subtotaling by route, harmful event(s), etc.), and will automatically write to the following location:

C:\ADOT\SFTYMDL\SFTYPROJ.XLS

Note that the data transfer takes less than two minutes, but the spreadsheet will not automatically open. The following dialog box will appear as a reminder of the export file location when one of the b. options is chosen.

Export Data

This action will export crash details to a new spreadsheet at c:\ADOT\SFTYMDL

[OK]

In addition to the crash details export capability, the LGSP model can also produce a summary of many crash details for a single location. This option can be accessed by pressing the "Summary of Location Details" button after choosing a location in option iii. The summary report form will be generated after a run-time of approximately two minutes.

SUMMARY RESULTS

The Location Detail Summary Report subtotals a number of crash details for the chosen location, and return such information as crash counts per route, average distances from the reference junction, average vehicle speeds and posted speed limits.

Microsoft Access - [LOCATION DETAIL SUMMARY]

File Edit View Insert Format Records Tools Window Help

Location Detail Summary Report

Print this report   Exit to Start page

| Jurisdiction | Globe | | Number of Crashes | 8 | |
| Route A | MESQUITE | ST | Route B | BROAD | ST |

Crashes On Route	BROAD	8	Location Averages	Distance	PostedSpd	UnitSpd	SafeSpd
				21.83	20.83	13.33	6.25

Subtotals for Observed Crash Characteristics:

Intersection Relation	No Relationship	3	Traffic Way	Roadway/Alley	7
	Intersection Related	3		Roadside	1
	Alley Intersection	2			

| Alignment | Not Reported | 7 | Roadway Character | Two-Way Striped Center Line | 7 |
| | Straight Roa | 1 | | Not Reported | 1 |

Grade	Downgrade	5	Collision Manner	Single Vehicle	4
	Level	3		Rear-End	2
				Angle	2

First Harmful Event	Collision with other Motor Vehicle	4	Prior Harmful Event	Other	7
	Collision with Motor Vehicle Parked	3		No Improper Driving	4
	Collision with Other Fixed Object	1		Unknown	1

Unit Action	Going Straight Ahead	6	Violation	No Improper Driving	4
	Making Left Turn	2		Followed Too Closely	2
	Backing	2		Failed to Yield Right-Of-Way	2
	Unknown	1		Unknown	1

Special Location	Not Reported, None	6	Vehicle Motion	Vehicle in Motion	12
	Pedestrian Crosswalk/Striped	1			
	Pedestrian Crosswalk/Not Striped	1			

Form View   NUM

This form can be printed in a one-page layout by selecting the print option at the top of the screen. It should be noted that counts for different variables will not always match the number of crashes. This occurs because some variables are

recorded for each vehicle (e.g. unit action and violation), while others pertain to the site (e.g. traffic way and grade).

COMPARISON SITE LIST

The final option available for crash location detail reporting is the **Comparison Site List**, also located in section a.iii. The Comparison Site List report returns a summary of additional sites in a jurisdiction that have similar characteristics to the site location being analyzed. This report is intended to facilitate before-and-after comparisons between treated and untreated locations, and to provide basic statistics for estimating regression-to-the-mean potential at a given site.

Selection Criteria

The Comparative Site List identifies other locations in the jurisdiction that match the following criteria from the reference location:

- junction and intersection relationships

- traffic way and roadway characterisitics

- special locations (e.g. pedestrian crosswalks)

- traffic control devices

- maximum posted speed

Depending on the characteristics of the reference location, the number of sites returned can range from none to several hundred. The Comparative Site List generates summary statistics (average annual crash incidence and standard deviation) for *all* sites in the report. Analysis of any location subsets is left to the user of the model.

Two different Comparison Site List reports can be generated. The only difference between them is that one report contains crash rate data using average daily traffic (ADT) counts entered by the user. When the Comparison Site List button is selected in details section iii., a message box will appear, asking whether the user would like to include traffic count data. If the "No" button is pressed, no further action is required. A summary list of related crash locations is generated (see Comparative Sites Report A – No Traffic Data).
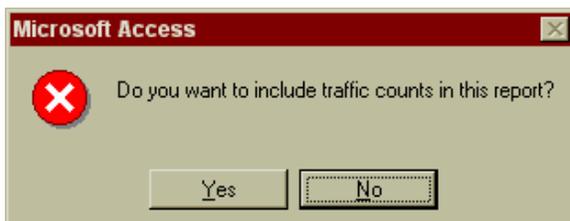
If the "Yes" button is pressed, another message box will appear, this time asking whether traffic counts need to be added or modified. If traffic counts have already been entered, pressing "No" will open the Comparison Site List containing ADT counts, crash rates for each location and summary statistics for the crash rates measurements (see Comparative Sites Report B – Traffic Data).

Note that crash rates are expressed in terms of annual crashes per 10,000 passing vehicles.
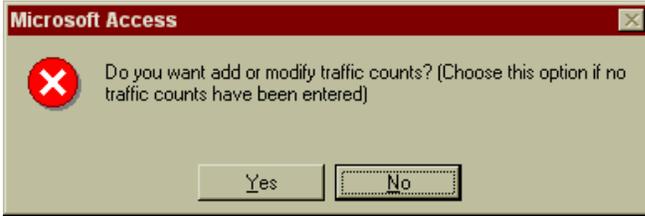
TRAFFIC COUNTS

Pressing "Yes" on the second dialog box will open the Comparative Sites Traffic form shown below. This form allows the model user to enter average daily traffic counts for any or all locations in the comparison site report. Average daily traffic counts can be based on any period, but must reflect *daily* figures. The LGSP calculates annual crash rates per 10,000 passing/entering vehicles using the following formula:

$$AnnualCrashRate = AnnualCrashes * ADT * 365 / 10,000$$

Note that it is not necessary to enter traffic counts for all sites. The LGSP model calculates crash rate statistics based only on the sites for which traffic counts have been entered. Leaving some sites blank will not affect the calculation of

statistical outputs (comparison sites average and standard deviation). However, the more sites for which traffic counts are included, the more reliable the forecast.

WARNING Crash data will only be stored for the location most recently selected in the Record Details Form. Changing the location and then choosing to enter traffic data will *delete* traffic data for the previous location. ***Printing or copying traffic data is strongly recommended prior to analyzing a new site***.

Once traffic counts have been entered, pressing the "Get Report" button in the Comparative Sites Traffic form will open the Comparison Site List that includes traffic-adjusted crash rates. Refer to the following page for illustrations of the two Comparison Site reports. Closing either Comparative Site List will return the user to the STARTUP menu.

To recount the traffic-related and non-traffic-related comparison options, select Option 3 from the STARTUP menu, then press the Comparison Site List button in Record Details Form section iii. At the first message box, press "No" to view the report that does not contain traffic data. Press "Yes" to continue to the second message box. At the second message box, press "No" to view the report containing previously entered traffic data. Press "Yes" to modify traffic data in the Traffic Data Input form.

Comp Site Report: No Traffic

Microsoft Access - [COMP_REPORT]

File Edit View Tools Window Help

`75%` ▾ Close

Comparative Site Report

Selection Criteria: Jurisdiction, Junction, Intsec Relation, Traffic Way, Rdwy Characteristics, Special Location(s), Traffic Control(s), Speed

Jurisdiction: **Globe**

Sorted by: Total Crashes

Primary Route	Sffx	Secondary Route	Sffx	Crashes	Annual Crashes	Total Units	Units / Crash	Total Fatal	Total Injured
WILLOW	ST	BROAD	ST	40	8.0	77	1.9	0	29
ASH	ST	3RD	ST	26	5.2	51	2.0	0	18
HILL	ST	ASH	ST	22	4.4	43	2.0	0	17
HIGH	ST	ASH	ST	14	2.8	25	1.8	0	9
WILLOW	ST	HACKNEY	AV	13	2.6	27	2.1	0	7
BROAD	ST	BLAKE	ST	12	2.4	29	2.4	0	19
MURPHY	ST	BROAD	ST	10	2.0	18	1.8	0	6
SANTEE	ST	BROAD	ST	8	1.6	14	1.8	0	1
WILLOW	ST	OAK	ST	8	1.6	11	1.4	0	6
LANE	ST	BROAD	ST	7	1.4	14	2.0	0	5
WILLOW	ST	CEDAR	ST	5	1.0	9	1.8	0	3
WILLOW	ST	MESQUITE	ST	4	0.8	9	2.3	0	3
BROAD	ST	BERAUTTI	ST	4	0.8	9	2.3	0	5
WILLOW	ST	EUCLID	ST	3	0.6	4	1.3	0	0
WILLOW	ST	PINAL	ST	2	0.4	4	2.0	0	0
BROAD	ST	0060		2	0.4	3	1.5	0	1

Wednesday, April 04, 2001   Page 1 of 2

Page: 1

Ready   NUM

Comp Site Report: Traffic

Microsoft Access - [COMP_REPORT]

File Edit View Tools Window Help

`75%` ▾ Close

Comparative Site Report

Selection Criteria: Jurisdiction, Junction, Intsec Relation, Traffic Way, Rdwy Characteristics, Special Location(s), Traffic Control(s), Speed

Jurisdiction: **Globe**

Sorted by: Total Crashes

Primary Route	Sffx	Secondary Route	Sffx	Crashes	Annual Crashes	Total Units	Units / Crash	Total Fatal	Total Injured	Loc ADT	Ann Crsh Rate
WILLOW	ST	BROAD	ST	40	8.0	77	1.9	0	29	85	2.5786
ASH	ST	3RD	ST	26	5.2	51	2.0	0	18	96	1.4840
HILL	ST	ASH	ST	22	4.4	43	2.0	0	17	73	1.6513
HIGH	ST	ASH	ST	14	2.8	25	1.8	0	9	66	1.1623
WILLOW	ST	HACKNEY	AV	13	2.6	27	2.1	0	7	22	3.2379
BROAD	ST	BLAKE	ST	12	2.4	29	2.4	0	19		0
MURPHY	ST	BROAD	ST	10	2.0	18	1.8	0	6		0
SANTEE	ST	BROAD	ST	8	1.6	14	1.8	0	1		0
WILLOW	ST	OAK	ST	8	1.6	11	1.4	0	6		0
LANE	ST	BROAD	ST	7	1.4	14	2.0	0	5		0
WILLOW	ST	CEDAR	ST	5	1.0	9	1.8	0	3		0
WILLOW	ST	MESQUITE	ST	4	0.8	9	2.3	0	3		0
BROAD	ST	BERAUTTI	ST	4	0.8	9	2.3	0	5		0
WILLOW	ST	EUCLID	ST	3	0.6	4	1.3	0	0		0
WILLOW	ST	PINAL	ST	2	0.4	4	2.0	0	0		0
BROAD	ST	0060		2	0.4	3	1.5	0	1		0

Wednesday, April 04, 2001   Page 1 of 2

Page: 1

Ready   NUM

SAFETY PROJECT SELECTION

In most cases, additional studies and site analyses will be required before proceeding to Option 4: Input of Potential Projects. The Priority List and various detail reports provide a means of identifying hazardous sites and enough additional information to form hypotheses about the appropriate site treatments. However, these details do not supplant the need for on-site evaluation(s) by local traffic engineers. Once a field evaluation has been performed for one or more hazardous sites identified in Options 1 – 3, it is assumed that several potential safety treatments will have been identified for these locations. Option 4 provides an input form for potential safety projects, which can then be evaluated in terms of expected effectiveness and associated benefits versus project costs.

PROJECT DETAILS FORM

Pressing **Button 4** on the STARTUP menu opens the **Safety Project Details** form. Any number of safety projects can be evaluated from this page. However, each project must be assigned a unique "Project Number" identifier prior to analysis. It is recommended that the "Alternatives" fields also be used to distinguish between multiple possibilities at the same location. A site location must be selected from the "Project Location" menu – omitting this step will cause the project data to be ignored, and a blank error form to appear when the sites are evaluated (see NO DATA ERROR below).

The remaining inputs for a preliminary project assessment are listed below. Note that some fields are required inputs, while others may be left blank.

On Route: specify which route at the project location will receive the safety treatment

Project Type: select from the menu of 76 different project types organized by seven broad project classes; an "other safety improvements" category is also provided in the event that none of the available types are suitable; this field is used to assign default values for project life cycle and estimated effectiveness (*required*)

Project Description: enter a brief but specific description of the safety treatment; this field will help discern multiple treatments at the same site and is included in the Project Evaluation report

Total Construction Cost: enter the total estimated implementation cost of the project; do *not* annualize this figure – the model will perform this calculation (required)

Annual Maintenance Cost: enter the annual cost (if any) of operating or maintaining the treatment; only include costs that are not reflected in the "Total Construction Cost;" for example, include the annual cost of periodic repairs to crash cushions after construction

Project Life: enter the expected life span of the safety improvement in whole years; the model will assign default values based on the Project Type; this field is only required if defaults are not available for the Project Type selected

Interest Rate: enter the interest rate used to annualize costs by calculating capital recovery factors; as in all term-based financing, the higher the interest rate, the more expensive the project; the model currently uses a range from 8 percent to 16 percent per HES guidelines

Project Effectiveness: enter expected crash/accident reduction factors for crashes of each severity class; this field is not required for the preliminary analysis – when available, the LGSP model will assign default values if these fields are left as "0"; note that the final estimate of effectiveness is the responsibility of the model user, but these figures can be adjusted in the next step

When entering multiple projects, use the "Next Record" and "Previous Record" arrow buttons to move from screen to screen. For example, after entering Project #1, press the "Next Record" button to view a blank screen in which Project #2 can then be entered. To edit Project #1, simply press the "Previous Record" button to back up one input screen. Once all projects have been entered, press the "Evaluate" button in the bottom right corner of the screen. This will activate a Project Evaluation macro, and after several minutes (generally less than three) the Project Evaluation **Form** will be displayed.

SAFETY PROJECT ANALYSIS

Project benefits are annualized using historical crash rates, crash cost figures and effectiveness parameters. It should be noted that, regardless of estimated effectiveness, the benefits associated with a safety improvement will be constrained by average incidence rates for each type of crash. Annual benefits are calculated by multiplying the annual crash rate by the reduction factor to yield a "Total Annual Reduction," which is then multiplied by the estimated cost of each type (i.e. severity) of crash to yield the "Annual Benefit" estimate. Safety project costs are annualized in a similar manner.

Depending on the interest rate and life cycle of the safety improvement, an appropriate capital recovery factor is assigned. The capital recovery factor is multiplied by the total construction cost to yield an annual construction and/or implementation cost. Annual maintenance costs are then added to the annualized construction costs to calculate the "Total Annual Project Cost."

The "Total Annual Benefit" and "Total Annual Cost" figures are compared in the "Project Summary" section on the right side of the form. Dividing total annual benefits by total annual costs returns a project benefit-cost ratio. If this figure is greater than 1.0, the project is within the range required for HES funding eligibility. However, this does not imply that projects are automatically eligible for

HES funds. A completed application must be submitted and approved prior to funding.

PROJECT EVALUATION FORM

The Project Evaluation Form contains a preliminary benefit-cost analysis and associated estimates of effectiveness for each project entered in the Project Details form. Projects are displayed individually, and may be viewed by using the "Next Record" and "Previous Record" buttons. As shown in the figure below, each project view contains a summary of project number, type, class, location and description.

Once the evaluation procedure has been run, the user has the option of editing existing projects and/or adding new projects or creating a final Project Evaluation Report. These options can be chosen via the buttons located in the bottom right corner of the Project Evaluation Form. If the "Edit/Add" button is selected, the user will be returned to the Safety Project Details form. If the "Report" button is chosen, the model creates the report shown in the following section (STARTUP Option 5).

ERROR WARNING: NO DATA

If the Project Evaluation form is a blank screen (see figure below), the user has not specified a site location in the Project Details form. Close the Evaluation form by clicking lower "X" (close window) button, shown in the figure below. This will close the current form and return to the STARTUP form. Select Option 4 to return to the PROJEC
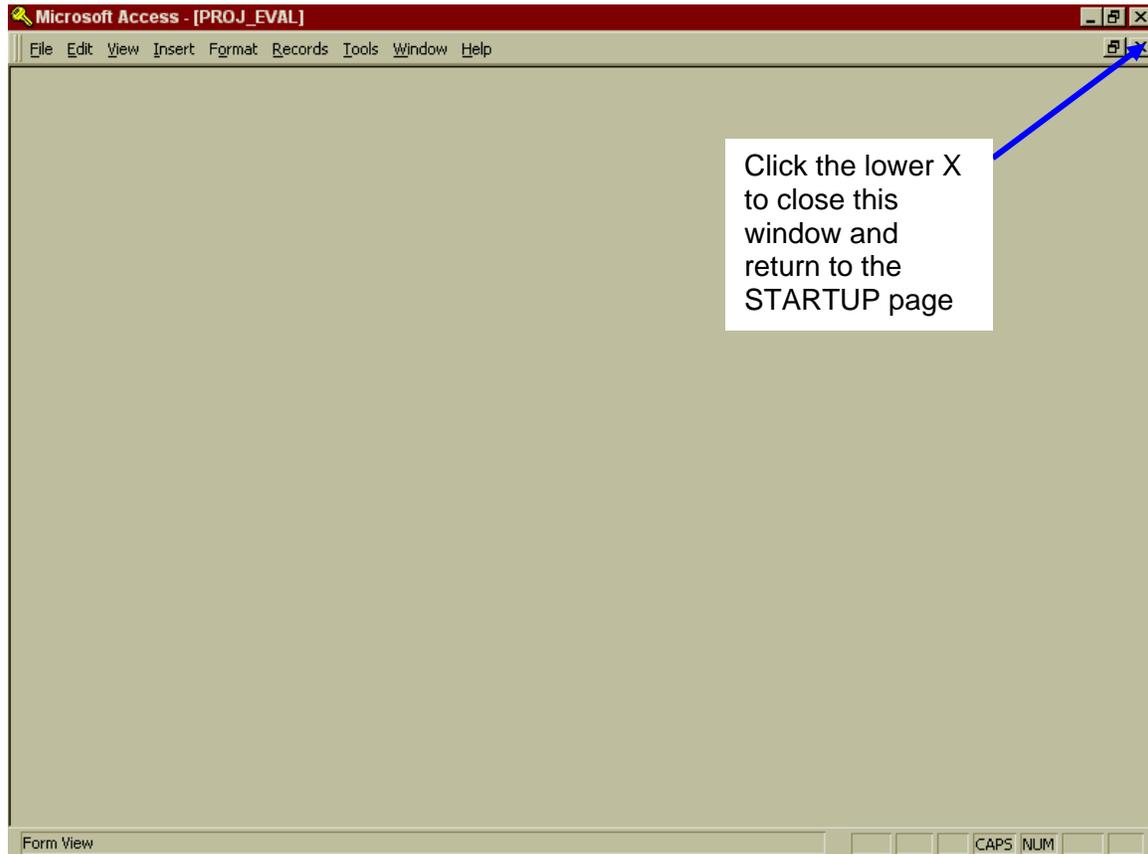
PROJECT EVALUATION REPORT

The Safety Project Evaluation report can be accessed through the previous step, or by selecting Option 5 from the STARTUP menu. This report contains the same data as the Project Evaluation form, formatted for printing. A Project Evaluation report should be accompanied by the Priority List, Location Details and/or the Detail Summary, as well as the Comparative Sites report.

Additional data are required for HES applications. The LGSP model outputs can be used to support an application, but traffic, engineering and historical treatment analyses are also required for an HES program application.

Safety Project Evaluation Report

| PROJECT NUMBER | test 1 | Date | 4/2/01 | Alternative | 1 |

| Primary Route | FLORENCE | | BLVD |
| Secondary Route | COLORADO | | ST |

| Project On Route | Florence | From MP | 0 | To MP | 0 |

Safety Project Details

Project Class	ROADSIDE IMPROVEMENTS
Project Category	Vegetation/obstacle removal
Project Description	Relocate utility pole

| Benefit/Cost Ratio | 18.9936 | Annual Benefit: | $113,202 |
| BCR In Range? | YES | Annual Cost: | $5,960 |

Safety Project Benefits

Crash Type	Annual Incidence	Reduction Factor	Annual Reduction	Severity Cost	Annual Benefit
Fatal	0.0000	30.0%	0.0000	$2,600,000	$0
Incap. Injury	0.4000	29.5%	0.1180	$180,000	$21,240
Non-incap. Injury	6.0000	29.5%	1.7700	$36,000	$63,720
Possible Injury	3.6000	29.5%	1.0620	$19,000	$20,178
Property Dmg. Only	12.6000	32.0%	4.0320	$2,000	$8,064
				Total Annual Benefit	$113,202

Safety Project Costs

Assumptions:		Total Construction Cost	$40,000
Capital Recovery Factor	0.149	Annual Construction Co	$5,960
Interest Rate	8.0%	Annual Maint. Cost	$0
Project Life (Years)	10	Annual Project Cost	$5,960

Use of the LGSP model need not be confined to spot treatment analyses. However, the availability of funding for spot improvements makes it likely that these projects will be the primary focus for most LGSP users. In cases where treatments are limited in scope or area of influence, it is recommended that multiple iterations of the model be run using different aggregation distances. For example, while a guardrail installation may conceivably affect a large stretch of highway, the relocation of a utility pole has a much more concentrated impact area. Whereas an aggregation of crash data within a 500-foot radius may be appropriate for the guardrail evaluation, a radius of 100 feet or less may be more appropriate for the utility pole. These analyses can be reassessed from the inputs form (select Option 1) to save update time.

TRAFSAF MACRO: SITE IDENTIFICATION PROCEDURE

The LGSP model returns prioritized local crash sites and relevant details based on a number of user inputs. Data are grouped and manipulated according to a series of Access queries that run upon activation of the TRAFSAF macro. A flowchart delineating the order of macro procedures is provided on the following pages.

Activation of the TRAFSAF macro from the INPUTS form will follow the steps shown in the table below. For each step, the purpose of the procedure and the data elements involved are identified. Tables are indicated with a "T:" prefix, queries by the "Q:" prefix.

The following tables shown in the "Type" column of the TRAFSAF query table are outputs that AzLGSP writes to the SFTYDATA.mdb file:

> LOCATION
>
> LOCATION TABLE
>
> PRIORITY LIST
>
> PRIORITY DETAIL
>
> TABLE 2D
>
> TABLE 3
>
> TABLE 4

ERRORS

In rare cases, certain combinations of input parameters will generate a run time error. An example that occurred during an update for Parker (LaPaz County) using the 500-foot aggregation distance is shown below.
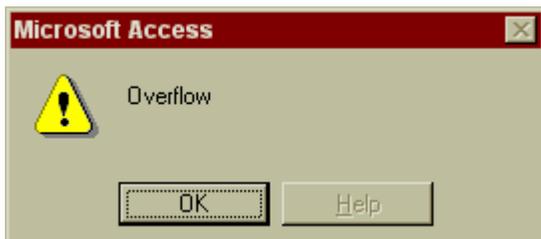
The overflow error stops the transfer of data to SFTYDATA.mdb and required that the TRAFSAF macro be halted before completion. The following dialog box will appear to prompt that the TRAFSAF macro be halted.

Halting the macro is not a problem in itself. After pressing the "Halt" button in the previous dialog box, the program will display the following screen:
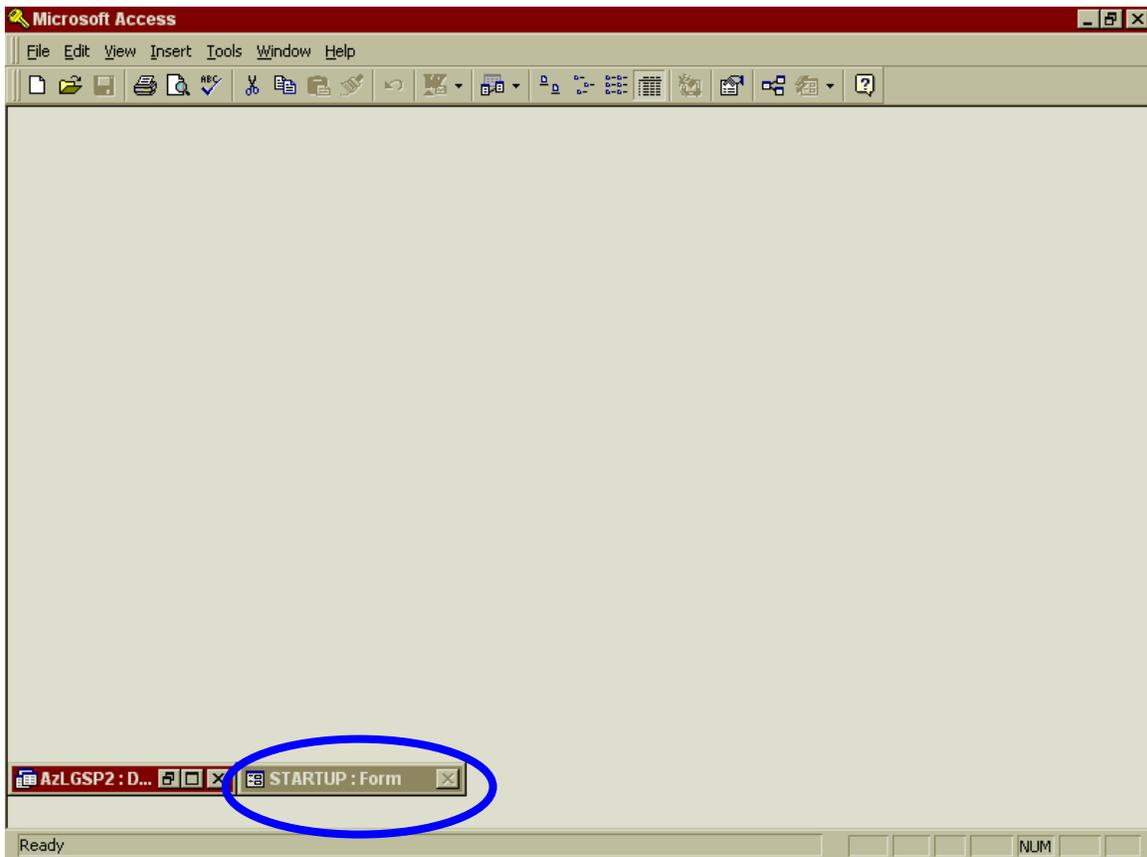

Click on the STARTUP:Form bar circled in the figure above. This will reopen the STARTUP page. From the STARTUP page, proceed to INPUTS (Option #1) and change the aggregation distance and/or reporting method for the jurisdiction. Re-run the model using the new site selection parameters and the problem should be resolved.

ARIZONA LGSP MODEL TRAFSAF CLASSIFICATION QUERY

Query	Purpose	Elements	Type
Step1	Translate inputs to proper jurisdiction(s)	T: INPUTS; T:JURIS	Select
Step1b	Return all crashes identified in Step1 jurisdiction	Q: Step1; T:SMS06000	**T: LOCATION**
Step1c1	Assign unique identifier (On_Road)	T:LOCATION; T:SMS13000	Select
Step1c2	Assign unique identifier (At_Road)	T:LOCATION; T:SMS13000	Select
Step2	Return incident-level details for all crashes in T: LOCATION	T:LOCATION; T:SMS01000; T:SMS05000; Q:Step1c1; Q:Step1c2	**T: LocationTable**
Step2a	Filter locations by Reference Method and Aggregation Distance	T:LocationTable; T:INPUTS	Select
Step2b	Restrict Step2a results by Alcohol delimiter; summarize records	Q:Step2a; T:SMS08000	**T: Table2d**
Step3	Return incident-level results for filtered records for T:LocationTable, limited by month and year filter	T:LocationTable; T:Table2d; T:INPUTS	**T: Table3**
Step4	Return unit and person details for Table3 records, add crash cost estimates by maximum injury	T:Table3; T:SMS08000; T:SMS10000; T:SMS12000; T:COMPCOST	**T: Table4**
Step4a	Aggregate and annualize Table4	T:Table4; T:INPUTS	Select
Step4a2	Return Step4a maximum values	Q:Step4a	Select
Step5	Create a priority list of locations, sorted by user preference	T:Table3; T:Table4; T:INPUTS; T:JURIS; Q:Step4a; Q:Step4a2	**T: PRIORITY LIST**
Step6	Join and summarize all details for each incident in T:PRIORITYLIST	T:PRIORITYLIST; T:Table3; T:Table4; T:SMS04000	**T:PRIORITY DETAIL**
DETAIL RPT	Add descriptor fields to T: PRIORITY DETAIL	T:Priority Detail; T:LocationTable; Q:01000; Q:05000; Q:07000-1; Q:07000-2;Q:08000; Q:12000; Q:08000-1; Q:08000-2; Q:12000-1	T: P_DETAILRPT

Arizona LGSP "TRAFSAF" Macro Flowchart
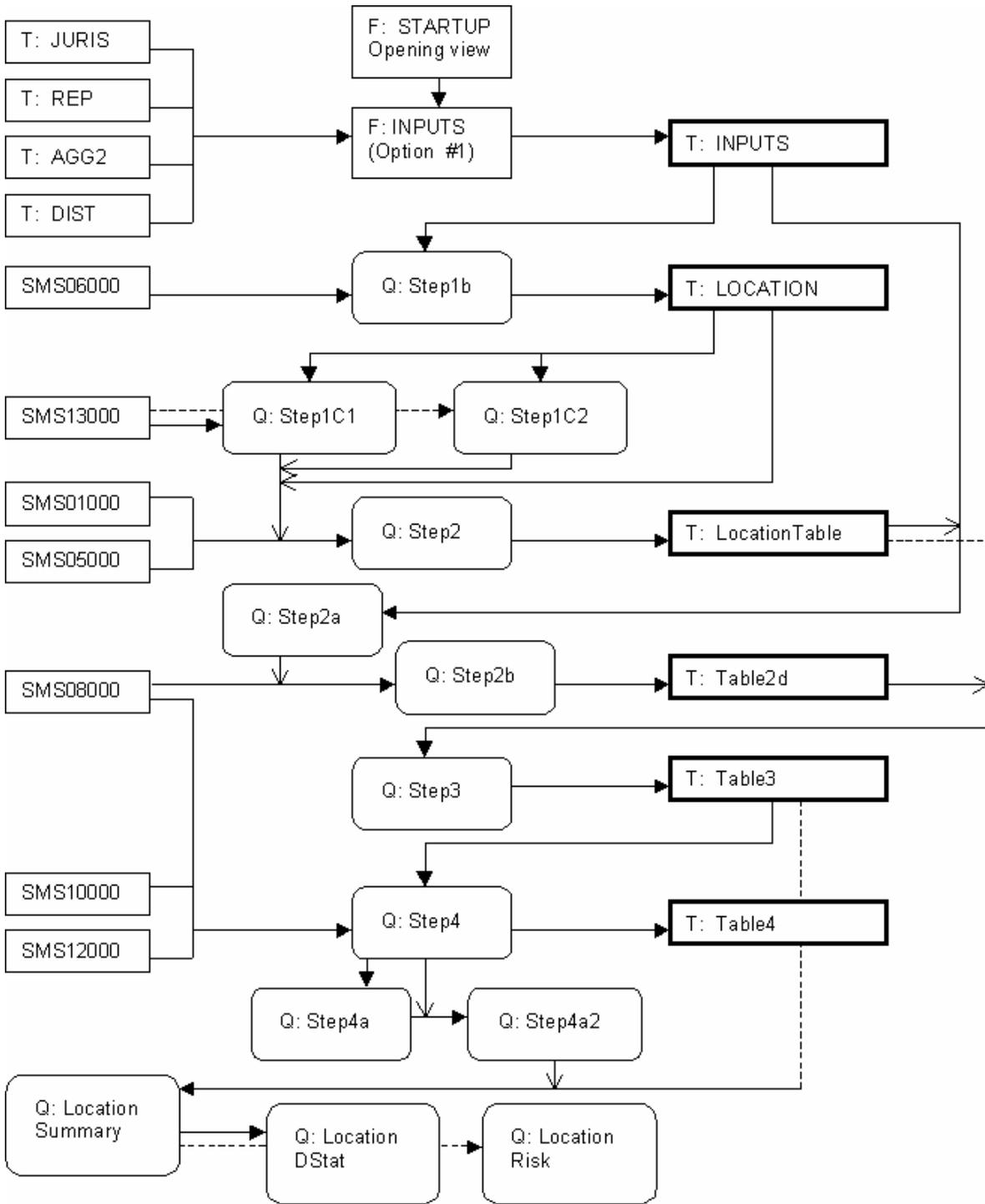
TRAFSAF Macro Flowchart (Continued)