DEVELOPMENT AND EVALUATION OF AN INCIDENT RESPONSE DATABASE FOR WASHINGTON STATE

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16. ABSTRACT

Incidents (vehicle accidents and disablements) significantly contribute to the growing traffic congestion problem in Washington state. To mitigate the adverse impacts of incidents, WSDOT has established a number of incident management systems that employ a variety of incident management procedures; however, it is difficult to quantify the effectiveness of these incident management procedures because the appropriate data are lacking. This study developed a database program to resolve this data deficiency and provide a single, consistent, statewide incident management database. To develop the database program, extensive interviews with incident management personnel were conducted and a review of the extant literature was undertaken. With this information in hand, the incident management database program was developed and tested extensively in the field. The data entry program was developed using FoxPro, a relational database software for DOS-, Macintosh-, Unix-, or Windows-based computers. The resulting software package is easy to use or modify as needs evolve. Based on field tests of the database program, there is no doubt that its widespread use could eventually have a significant impact on the evaluation and development of incident management systems in Washington state.

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Research Project T9233, Task 24
Incident Response Database

DEVELOPMENT AND EVALUATION OF AN INCIDENT RESPONSE DATABASE FOR WASHINGTON STATE

by

April Cutting
Graduate Research Assistant

Ron Porter
TRAC Support Staff

Fred Mannering
Professor of Civil Engineering

Washington State Transportation Center (TRAC)
University of Washington, JD-10
University District Building
1107 NE 45th Street, Suite 535
Seattle, Washington 98105-4631

Washington State Department of Transportation
Technical Monitor
Bill Legg
Traffic Engineer, Advanced Technology Branch

Prepared for

Washington State Transportation Commission
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and in cooperation with
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DISCLAIMER

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SUMMARY

Traffic congestion has become one of the most prominent issues facing transportation agencies in virtually all major metropolitan areas in the United States. Congestion can be severely aggravated by incidents such as vehicle accidents or disablements. Consequently, transportation agencies have had to recognize the importance of minimizing the time necessary to clear an incident from the roadway. In Washington State, many incident management techniques have resulted. The Washington State Department of Transportation (WSDOT), for example, has developed Incident Response Teams (IRTs) to facilitate efficient clearing of accident sites.

Currently, there is no consistent means of storing the incident data collected by the IRTs. These records are important for a variety of reasons. First, the IRTs could use the data to review and improve their performance based on documented examples of the techniques that have proven to be most time and cost-effective. The records could also be useful for budgeting and planning. Most important, accurate incident records are needed to aid the IRTs in recovering more of the costs of the incident response from the insurance companies of the parties at fault. This project has produced an incident management database to demonstrate how consistent data collection could enhance WSDOT's incident response efforts across the state.

While the information entered into the incident management database is based on information recorded in the Unscheduled Roadway Closure report, the researchers also added other information categories, based on recommendations from IRT personnel across the state. The database contains the IRTs' and Washington State Patrol's (WSP) job or case numbers for easy referencing, and it also contains general information on the location, date, time, and duration of each incident to which the IRT responds. Weather, road, and light conditions at the time of the incident are also recorded; and all participating agencies and their responsibilities are noted, including emergency response

supplies and equipment used by the WSDOT. The database also includes information on the personnel, cleanup, traffic control and required investigations. Finally, the IRT database collects data on the party responsible for the incident, including his or her insurance coverage, for use in recovering the costs of damage to WSDOT property.

The data-entry program acts as an electronic checklist; as such, it uses a series of data-entry screens with pull-down menus to help users record their observations at incident sites. A report writer built into the program allows typical, sample reports to be modified or new reports to be created.

The program was developed using FoxPro, a relational database for IBM-compatible (DOS or Windows operating systems), Unix, or Macintosh computers. The prototype was developed for DOS using a Compaq LTE Lite notebook computer, a 386SL portable computer with a 20-megabyte hard drive and a 25x80 character standard display. FoxPro's cross-platform features enabled final program development (within the time span of the funded project) for use on Macintosh computers.

If demand for the information collected by the IRT increases, then a central database should be considered. A variety of central database systems are available. One of the systems best suited to the needs of the incident response agencies is the geographic information system (GIS). GIS's unique spatial abilities would give IRTs a beneficial tool for analyzing the data they collect. The database could easily include, with slight program modifications, longitude and latitude coordinates using global positioning systems (GPS) that are increasingly easy to use, widely available, and relatively inexpensive (Wald, 1995).

CHAPTER 1

INTRODUCTION

INCIDENT IMPACTS

Traffic congestion is a significant problem in virtually all major metropolitan areas in the United States. In 1984 alone, Seattle area motorists experienced 18.4 million hours of delay [Tanemura and Mannering, 1991]. In general, traffic engineers divide congestion into two categories: recurring and non-recurring.

Recurring congestion can typically be expected every day at the same time. It occurs when traffic demand exceeds the transportation supply. Recurring congestion is usually seen during peak-hour travel, when significant numbers of people commute to or from work at the same time. Traffic demand strategies, such as high occupancy vehicle (HOV) lanes and ride sharing, are intended to combat congestion [Mannering et al., 1990].

When a facility's normal capacity falls below the level of demand, non-recurring congestion occurs. Non-recurring congestion is caused by events such as construction activities or incidents. Incidents usually consist of accidents or vehicle disablements. A typical lane-blocking incident results in 1,350 vehicle hours of delay. Statewide in Washington, 25,000 lane blocking incidents occur each year, which result in 33,750,000 vehicle hours of delay and estimated costs of $337.5 million (WSDOT, 1994: 7-8). National statistics include the following:

- Incidents may account for 60 percent of urban congestion (J. Lindley, "Quantification of Urban Freeway Congestion and Analysis of Remedial Measures," quoted in WSDOT, 1994).
- Incident-induced congestion cost the nation 1.3 billion vehicle-hours of delay at a loss of nearly $10 billion in 1987 (Cambridge Systematics, Inc., 1990, quoted in WSDOT, 1994).

A study in California found that every one minute of blockage during an off-peak period resulted in five minutes of congestion. Obviously, the effects of incidents are even worse when non-recurring congestion occurs during peak periods. The California study found that during peak periods, the delay could become as high as 50 minutes for each minute of blockage [Mannering et al., 1990; Koehne et al., 1991]. These statistics illustrate the importance of minimizing the time required to clear an incident from the roadway.

INCIDENT RESPONSE TEAMS

In general, IRTs are interagency teams trained to respond to large or severe (i.e., nonrecurring) accidents. They can be staffed by volunteers from each of the responding agencies, such as the transportation authority, police department, or fire department (*WSDOT*, *1994*: 12-14). If this is the case, an agent must be available to coordinate duties, so that the response effort proceeds smoothly [Koehne et al., 1991]. The Washington State Department of Transportation's (WSDOT) IRTs in the Northwest Region are not interdisciplinary teams. However, they do coordinate the efforts of other responding agencies. They respond to only those incidents that might close one or more lanes of traffic for one or more hours. Their primary function is to relieve congestion quickly, with the safest methods possible. The IRT is on-call 24 hours a day. WSDOT's Olympic, Southwest, and Eastern regions also have incident response teams. However, they are still in the planning stages or have been in operation for less than a year.

All Northwest Region IRT members receive specialized emergency training. Because traffic control is the major responsibility of the job, IRT members are well schooled in traffic control strategies. They learn how to remove disabled vehicles, and they receive CPR and basic first aid training. IRT members also learn the basics of hazardous materials identification. Additionally, they learn about radio communication, with an emphasis on reporting and public relations. They receive on-the-job training in incident command systems, the departmental procedures and policies of each of the responding agencies, and they learn to use the equipment in the incident response vehicle.

The proper vehicles and equipment are necessary for the IRT to work effectively in the field. Each IRT leader is assigned an incident response vehicle, generally a full-sized four-wheel drive, extended-cab pickup truck with a utility bed box. Each response vehicle is stocked with containment materials, traffic control devices, communication devices, other equipment, and the appropriate documents and references. Additional supplies and large pieces of heavy equipment are available from the area's maintenance office. If necessary, the IRT leader can request rental equipment or equipment from other sources.

The IRT follows a general protocol: after the WSDOT or any other emergency agency dispatch calls the Highway Radio Operator with a request for incident response, the Highway Radio Operator informs the IRT, the Maintenance Area Office, and the Public Affairs officer that an incident has occurred. The Washington State Patrol (WSP) gives the responding WSP trooper's number to the IRT leader so that the IRT can communicate all pertinent information about the incident by radio to the WSP Trooper en route. Members of the IRT and the Maintenance Area Supervisor (or a representative) develop a strategy on the way to the scene so that the Maintenance Area representative can call in additional personnel and equipment if need be.

Once on the scene, WSDOT personnel set up traffic control and clear the roadway as required, while the team leader calls the Highway Radio Operator with traffic control information. The IRT leader gathers information from the WSP on the party responsible for the incident for billing purposes, although the most important identifiers are the accident report number and case number (assigned to cases involving crimes). Once the incident has been cleared, the IRT informs the Highway Radio Operator, who then informs the appropriate personnel. Personnel from all of the agencies represented on the site discuss the incident response effort immediately upon completion to improve future incident responses. The IRT leader is also responsible for filling out two reports, which are the only data collected on-site by the IRT [Mannering et al., 1990].

STUDY OBJECTIVES

Collecting data on incidents is an important step in analyzing the extent of incidents, their impact on traffic, and the relevant agencies' success in dealing with them. Although many methods have been developed to respond to incidents more efficiently, the Seattle area currently has no comprehensive, ongoing collection of data that pertain to incidents and their traffic impacts. Although agencies may coordinate their incident-scene efforts smoothly, each agency keeps separate records of the event. Typically, different agencies are interested in collecting different types of information. The result of this disparity is that many of the vital incident data are spread out among many sources. Consequently, the incident data are difficult to obtain and organized in incompatible formats. Data correlation and analysis become difficult, if not impossible.

This study was originally intended to evaluate the current data collection methods and to develop for testing a database that would centralize incident information in a format that would be accessible and comprehensive. Information for the database was to have been collected from the WSP's Computer Aided Dispatch (CAD) system, WSDOT Northwest Region's Unscheduled Lane Closure reports, and any other responding agencies' reports. The prototype database was to have been used by all participating agencies, WSDOT, and the WSP to understand incident trends and to evaluate incident response efforts. However, at this point, an integrated database is not feasible. The WSP is extremely reluctant to allow non-WSP personnel access to the CAD system, citing two concerns: (1) security, and (2) the possibility that too many users might make the CAD system unavailable at a crucial time. The structure of the CAD data is such that they cannot be read into a database. Also, the CAD system terminals available to non-WSP personnel cannot print to a disk or to a tape. Consequently, there is no way to transfer information digitally from system to system. This means that the only way to transfer information from the CAD system to a prototype database would be to enter the information manually from printed reports.

These institutional barriers led the research team to slightly modify the objectives of this study. The IRTs' needs for incident information were assessed and evaluated with a goal of providing researchers with a more flexible tool for analyzing incidents and incident response. This study's long-term aim was to produce a database that would be used uniformly by all the WSDOT's IRTs throughout the state. The resulting database would also contain information that would facilitate coordination with other databases in the future. The researchers designed and developed a database, which was reviewed by IRT personnel in the Northwest Region. A more extensive review by IRT agencies all over the state will be required before a final incident management database is produced.

RESEARCH APPROACH

The researchers' first task was a literature review (Appendix A), which was conducted to determine the options and technologies available for both incident management and database systems. Researchers spoke with WSDOT incident response teams throughout the state, the WSP, and personnel from the WSDOT's Accident Data Branch. The participating agencies' information needs were assessed through these discussions, and together with the findings of the literature review, the researchers ascertained which information to include in the prototype database. Washington State Transportation Center personnel constructed the prototype database on the basis of this initial assessment. After the first version had been completed, the design was reviewed both by the researchers and by the IRT from Northwest Region IRT. The database was revised on the basis of that review. After the revisions had been made, the program was adapted to the IBM format as described in the project proposal. This report describes the results and findings from the project.

REPORT ORGANIZATION

Chapter 2 describes the prototype database's file structure (the fields that make up each accident record in the file). Chapter 3 discusses the possibility of using a geographic information system used in an incident management database, and Chapter 4 offers conclusions and recommendations based on results of the project. Appendix A contains the literature review. The data-entry screens that enable users to record their observations, along with a dictionary of data items for each screen, are displayed in Appendix B. Appendix C describes how geographic information systems could be employed to collect, store, and analyze incident data. The database files and application can be found in the back pocket of this report on a diskette. Users must install a copy Microsoft FoxPro, which is not included on the distribution diskettes, to use the prototype database.

CHAPTER 2

PROTOTYPE DATABASE

SUMMARY

This chapter introduces the incident response database. It discusses the data entry screens (windows), which will be the most important element of the database for the majority of program users. Therefore, special attention has been paid to the flow and readability of the screens, which are designed to allow field personnel to collect detailed information simply and easily. The screens allow inexperienced computer users to add data, and to search, view, revise, or print reports. Users who are more familiar with database programs, FoxPro in particular, may change reports or create new ones using the built-in report writer. The final version of the prototype database has been written with FoxPro for Macintosh—a relational database system. FoxPro was selected because of its compatibility with other database and spreadsheet programs, and because FoxPro's cross-platform capability allows parallel versions of the database to be used on DOS-, Windows-, or Unix-based computers.

INTRODUCTION

One of the IRTs' duties is to maintain accurate records of all response efforts. These records are important for a variety of reasons. The IRT uses the records to review and improve their performance based on documented indications of the techniques that have proven to be most time- and cost-effective. The records are also useful for budgeting and planning because they provide information on the personnel who responded, the equipment and materials used, and the amount of time necessary to fulfill their duties. Researchers from both inside and outside the WSDOT would be able to analyze the factors correlated with accident frequency and duration if incident response information were available from a single database.

One of the most important reasons to maintain accurate records has to do with the recovery of incident response costs[1] from the insurance companies of the parties at fault. These records encompass the WSDOT personnel, equipment, and materials required to clear the scene, and the maintenance and cleanup activities resulting from the incident. Recovery is currently a problem, and money is being taken mostly from the IRT budget. Complete, accurate records would allow IRTs to recover a higher percentage of their response costs. If the IRTs could document the volume of recovery costs contributed to the state's general fund, the IRTs might be able retain some of those monies.

This chapter describes the fields that make up each accident record in the database files, and the codes used to record the information in each field. The use of the demonstration database will be explained. The information to be recorded was determined on the basis of the Incident Response Guide, MicroCARS, and input from the IRT members. The database management system was programmed solely by Washington State Transportation Center (TRAC) personnel.

DATABASE ACCESS

Appendix B displays all information that may be recorded on the 11 data-entry screens, including all field names and their corresponding screen prompts and descriptions.

[1] WSDOT refers to these as KA, a third-party damages account to which charges are assessed when state property has been damaged by a motorist. Funds are taken out of this account to pay for clean-up, repairs, labor, and materials until the "responsible party" can be charged appropriately [Tanemura and Mannering, 1991, p. 1-17].

Incident Response Team members may use the program to record the following:

Screen	Screen Name	Information Recorded
1	**Incident Response/ Disabled Vehicle Database**	Activity Report date Activity date Time incident occurred Name of person preparing report Tow requested Name of towing company WSDOT job number Classification (incident response/disabled vehicle report) Type of disabled Hazardous material codes Fuel spillage Fire Nonhazardous material Nearest incorporated city County name
2	**Vehicle/Insurance**	Vehicle license number State province issued Vehicle year Vehicle make Vehicle model Vehicle identification number (VIN) Insurance Name of causing party's insurer City where insurer located Policy number Insurer's phone number Number of occupants in causing party's vehicle Number of injured Number of fatally injured

Screen	Screen Name	Information Recorded
3	**Location and Travel Conditions**	State route number Milepost Direction of travel Intersection/nearest landmark Lanes closed Roadway surface Lanes closed Roadway surface Other roadway surface Condition of roadway (dry, wet, etc.) Lighting conditions (night, day, dawn, streets lights on/off, etc.) Weather (rain, snow, cloudy, etc.)
4	**All Vehicles Involved**	Number of vehicles involved by type (bus/motor stage, farm tractor, passenger car, truck combinations, etc.) Vehicle type of causing party
5	**Employee Activity**	Time IRT received call Time first IRT member arrived Time last IRT member depart Date incident ended Categories of employees typically involved in incident response (Maintenance Tech. 1, Incident Response Supv., etc.)
6	**Comments**	

Screen	Screen Name	Information Recorded
7	**Equipment Use**	WSDOT Equipment 1 ton 4 x 2 flatbed, Incident Response Truck, state two trucks, self-propelled sweeper, etc. Emergency Response Vehicle Blower, diesel pump, push bumper, etc. Non-WSDOT Equipment Tow truck, recovery vehicle, crane Description of equipment failure during incident response
8	**Traffic Control**	Occurrence in construction zone Function code Traffic control Detour Cause of incident Time each lane opened WSP case number WSP accident number Trooper number (radio) Duration of incident WSP investigation unit (tape/total station)
9	**Driver Identification**	Driver's last name, first name, middle initial License number Issuing state/province Mailing address Apartment number or other address City, State/Province, ZIP/Postal code Phone number/other phone number

Screen	Screen Name	Information Recorded
10	**Agency Involvement**	Agencies involved (WSDOT, Washington State Patrol, County Emergency Services, etc.) Lead agency (WSDOT, Fire Department, etc.) WSDOT region (Northwest, Olympic, etc.) Maintenance Area Cleanup Delayed to off-peak time Agency responsible for cleanup Name of towing company
11	**Materials and Maintenance**	Materials used (flares, hazmat booms, etc.) Other materials used Maintenance required at scene of incident

DATABASE PROGRAM

The program for the database was first written using FoxBASE+. FoxPro 2.6 was used in later development after Microsoft released the upgrade. The prototype for developed for computers operating under DOS; but the final prototype was developed for use on Macintosh computers.[2] The program was field-tested using Compaq LTE Lite notebook computers and can be used on any portable or office computer equipped with at least a 25x80 character standard display. One of Foxpro's strengths is its compatibility with spreadsheet programs and other relational databases. FoxPro allows users to write data to a comma-delimited ASCII file, as well as to compatible files that may be imported into statistical, spreadsheet, or database files (dBASE, Paradox, Microsoft Excel, Lotus 1-2-3, etc.). Data can also be moved easily between applications, and a report writer tool simplifies using the data to generate reports.

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[2] Conversion of the program for use on computers that operate with Windows could be completed easily if the need arises, but WSDOT now purchases more Macintosh computers than computers with DOS or Windows operating systems.

Two types of portable computers were tested to ascertain which one would best meet the IRTs' needs. In selecting the computers to test, several factors, such as battery life, are important, insofar as the IRT may need to be at the incident response site for extended periods. Initially, it was thought that the database software compatibility would be important, but an informal survey of computer use at WSDOT showed that most maintenance areas prefer to use Macintosh computers because they are relatively easy to use (although though their cost is generally higher than IBM-compatibles). Durability is extremely important, because the incident response environment can be very harsh. Cost is significant, particularly if the units need to be replaced frequently. Connectivity is also important, as the IRTs may be combining information from many different units. Portability is also a concern.

The first computers tested in the field included the Compaq LTE Lite 25 (25 MHz and 386 microprocessor) and the Hewlett-Packard Omnibook 300 (386 microprocessor). Fortunately, WSDOT already owned two Compaq LTE portable computers, which were reassigned from another research project that had recently concluded.

A few of the features of the two computer types and users' reactions follow.[3]

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[3] Macintosh computers were used to test the program in office conditions only; no Macintosh portable computers were used in the field demonstration project.

- **Size**

Hewlett-Packard OmniBook 300

11 inches wide by 6.4 inches deep by 1.4 inches tall; i.e., it occupies an area smaller than an 8-1/2- by 11-inch piece of paper.

> "The size is good; it is easy to store in the cab of a truck."[4]

Compaq LTE 25

11 inches wide by 8.5 inches deep by 1.75 inches tall; i.e., it takes up about the same area as a 8-1/2- by 11-inch piece of paper)

> "The size seems to be adequate for small area storage."

- **Weight**

Hewlett-Packard OmniBook 300

2.9 pounds

Compaq LTE 25

6.0 pounds

- **Operating System**

Hewlett-Packard OmniBook 300

Pre-installed, ROM-based DOS and Windows operating systems.

Compaq LTE 25

DOS; Windows is purchased and installed separately.

- **Software**

Hewlett-Packard OmniBook 300

Built-in, ROM-based software (Microsoft Word and Excel, LapLink Remote Access, HP Phone Book, HP Appointment Book with to-do list, and HP Financial Calculator).

Compaq LTE 25

All applications need to be purchased and installed separately.

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[4] The OmniBook's small size also turned out to be a disadvantage: it was badly damaged during the first few weeks of the test when it was dropped accidentally, and required repair.

- **Display**

Hewlett-Packard OmniBook 300

9-inch reflective Liquid Crystal Display.
VGA (640 x 480 dots). 16 gray levels.

> "The screen is difficult to read (any combination of colors [gray levels])."

Compaq LTE 25

9.5-inch VGA Liquid Crystal Display.

> "Very easy to read from any angle. Colors [gray levels] are clear and definable."

- **Keyboard**

Hewlett-Packard OmniBook 300

The keys [F1] through [F12] perform different functions depending on whether DOS, Windows, or built-in computer utilities are used.

> "Functions are slow to respond. The keyboard is easy to use (not too small)."

Compaq LTE 25

Enhanced PC functionality with compact layout.
Embedded numeric keypad. [Fn] key.

> "Keyboard functions are not standard with other keyboards (double key (i.e., multiple-key combinations) functions are required to move up or down a page, etc.)"

- **Mouse**

  Hewlett-Packard OmniBook 300

  Built-in, storable mouse extends about two inches from the corner of the keyboard.

  > "The mouse (built-in) is difficult to operate consistently."

  Compaq LTE 25

  Serial mouse (or track ball) can be connected.

  > "Access would be easier with a mouse."[5]

- **Data/Disk Storage and Transfer**

  Hewlett-Packard OmniBook 300

  Unable to back up information to transfer to a centrally located office computer,[6] but built-in telecommunications allow data transfer to a central database.

  Compaq LTE 25

  Internal floppy disk facilitates data transfer to a central database.

- **Compatibility**

  Hewlett-Packard OmniBook 300

  "Not compatible with Macintosh PCs.[7] Unable to print information to area printers."[8]

  Compaq LTE 25

  "Not compatible with Macintosh PCs."[7]

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[5] An external track ball is difficult to use in temporary situations, but the database was designed to be operated with keyboard commands; mouse use is optional.

[6] The OmniBook uses a 10-megabyte flash disk that has an effective capacity, through the use of Microsoft's Double Space data compression, of nearly 20 megabytes.

[7] Actually, the data are easily exchanged between computer systems and between programs, but the program did not contain this feature during the first field tests.

[8] Printing features were not enabled during field tests of the demonstration project. The feature was added to the final version of the prototype database for Macintosh computers.

- **Battery life**

Hewlett-Packard OmniBook 300

Memory management feature allows the computer to store information in memory even when the power is turned off.

Recharge time: less than two hours to high level

Operating time from full charge (varies according to usage):

- Flash disk in drive C: nine hours (typical)
- Hard disk in drive C: five hours (typical)

Compaq LTE 25

"Battery output is easier to monitor (than OmniBook)."

- **Memory**

Hewlett-Packard OmniBook 300

Memory management feature allows the computer to store information in memory even when the power is turned off.

Compaq LTE 25

CHAPTER 3

INTEGRATED DATABASE

SUMMARY

Geographic information systems clearly offer many benefits to the incident manager. This chapter shows how they can be used to store all the information included in a traditional database and how they can be used to relate that information to its geographical location. Such a system may be the ultimate goal of an incident response or research agency. However, GIS's benefits cannot overcome the basic institutional obstacles that have prevented creation of an integrated database, which was an original objective of this project.

INTRODUCTION

Collecting data on incidents is an important step in analyzing the extent of incidents, their impact on traffic, and the success of agencies in dealing with them. Currently, many of the vital incident data being recorded are spread out amount the many agencies. This study was originally intended to evaluate current data collection methods and develop for testing database that would centralize information from the WSP's Computer Aided Dispatch (CAD) system, WSDOT Northwest Region's Unscheduled Lane Closure reports, and any other responding agencies' reports in an accessible and comprehensive format. The prototype database was to be used by all participating agencies to better understand incident trends and to evaluate incident response efforts.

However, at this point, an integrated database is not feasible. This is due to the WSP's reluctance to allow non-State Patrol personnel access to the CAD system and to the system's incompatibility of the system with other databases. These problems led the researchers to modify the objectives of this study.

This study produced a relational database that can be used to consolidate and analyze the information collected by the IRT. Given the scale of current IRT operations, individual agencies will keep separate files of accident records. However, demand for the IRT data may eventually justify creation of a central database for storage and analysis of information from all of the IRTs.

Although the relational database created in this project is capable of performing at that level, it lacks one valuable function: the ability to analyze and display information spatially. The linear orientation of transportation systems makes the spatial display of information very useful. Spatial display would require the use of a geographic information system (GIS). A GIS can be defined as a database management system that captures, stores, retrieves, analyzes, and displays locationally defined data [Shine, 1992].

Eventually, WSDOT could easily record GIS information about incident locations in a database, but current equipment prices and the inability to record exact coordinates limit its usefulness:

> ...a [hand-held] device [can read] radio signals from satellites and [triangulate a] position within 100 feet or so. (It would be even more accurate, but the United States Government, for military reasons, requires the signals to be kept slightly fuzzy.)...Any consumer can buy one for about $1,000; in a few years it may cost a few hundred dollars, and a few years after that it may be built invisibly into our pocket telephones." [Glieck, 1993][9]

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[9]Recent developments point to greater use of GPS:

> "The Federal Aviation Administration ... awarded a contract to greatly improve a navigation system that would let civilians, from airline pilots to motorists, use Pentagon satellites to pinpoint their locations anywhere in the United States within 7 meters, or about 21 feet.
>
> The navigation network, called the Global Positioning System, is already accurate in civilian use to within 100 meters, or about 300 feet. The military has equipment that is able to use the system to far greater accuracy, and its precise abilities are classified.
>
> With the improvement announced yesterday, called the Wide Area Augmentation System, the satellites will be far more useful for navigation by commercial and private planes, as well as by ships, trucks, cars,

GEOGRAPHIC INFORMATION SYSTEMS

Like a computer-aided mapping system, a GIS can display and manipulate data graphically. In addition, a GIS can correlate spatial objects with their non-spatial characteristics. For example, a GIS could store the location of an incident and display it on a map. It could also store information particular to each incident such as the date and time, driver information, or road conditions. A GIS works by storing spatial data, which give the location of a feature, and non-spatial or attribute data, which describe that feature. The combination of these two types of data gives the geographic information system the ability to manipulate and analyze data spatially [Shine, 1992].

There are several reasons that spatial analysis and manipulation would be useful in an integrated incident database. The reason most pertinent to this study is that it would allow diverse data sets to be merged strictly on the basis of geographic location. This would be the best possible solution for the discrepancies among the incident databases maintained by the various responding agencies. Even though the CAD system, Accident Data Branch database, and IRT database contain completely different fields, they could all be combined into a single database with a geographic information system. Because all of the agencies' records contain spatial location data, they could be joined in a GIS based on these data. However, this process would not overcome the need to of enter the CAD system data manually.

Another benefit of a geographic information system is that it would allow data to be outputted in the form of a thematic map or chart, as opposed to a text printout [Shine, 1992]. Maps offer system users much easier pattern recognition than do written records. For example, it is much easier to see trouble spots for incidents involving tractor-trailer trucks on a map than on a printout that lists sites by state route and milepost number.

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pleasure boaters and even farmers driving combines, Federal officials said. Receivers to use the system are sold by electronics shops and cost several hundred dollars." (New York Times, August 4, 1995: A7)

Geographic information systems also have the unique ability to perform spatial analysis. Whereas a traditional relational database does not recognize distance or area, a GIS can perform spatial functions, such as determining the number of incidents within a geographic area. For example, a GIS can determine the number of accidents within a mile of a particular feature, such as a weave area or bridge. A GIS can easily accomplish this by using its joined spatial and attribute database [Shine, 1992].

DATA STORAGE AND MANIPULATION

The attribute data constitute the information stored about a spatial object, such as an incident. The incident data are stored separately from the spatial data on the incident, but they are linked by a spatial identifier. The attribute portion of the GIS performs the same functions as a traditional relational database. The data can also be downloaded to other systems for more specialized analysis.

The spatial data in a geographic information system are composed of points, lines, and areas. The basic spatial element is a point, which is typically a feature, such as milepost or incident. Lines are formed by joining points, and areas are formed by joining lines. Spatial data are necessarily stored separately from attribute data so that screen updates, plots, and graphs can be produced quickly [Shine, 1992].

Determining the segmentation of a model is one of the most difficult tasks in producing a transportation network with a GIS. A network model with too few segments will be inaccurate, and a model with too many segments will be unwieldy and redundant. The solution to this dilemma lies in a recent GIS development called dynamic segmentation.

With dynamic segmentation, users select the characteristics by which the segmentation will be performed on the basis of the application. These characteristics may be elements, such as number of lanes, traffic volumes, or shoulder widths. The beginning of the segment is initialized with the characteristics selected by the user. Whenever the value of a selected characteristic changes, a node is introduced. The changing characteristics are updated, and unchanging characteristics are carried forward to the new segment. Dynamic segmentation requires storage of only one network model and only the characteristic data necessary for the application being used. This feature minimizes storage requirements and maximizes GIS performance[Shine, 1992].

While traditional geographic information systems typically work with longitudes and latitudes to locate point or segment features, most incident response agencies work with route names and milepost numbers. This discrepancy can be addressed through milepost geocoding, which works by assigning a milepost to each end of a segment. Insofar as both the length of the segment and the milepost range are known, it is possible to interpolate the location of any milepost within the range to a location on that segment. The system compensates for any discrepancies between the length of the segment and the milepost range by proportioning the error throughout the segment [Shine, 1992].

GIS uses address matching to assign a point object to a location along the segment. The address-matching procedure works by dividing the length of the segment by the difference in the address range. The distance is then proportioned along the address range, with all addresses being equal distances apart. This procedure allows the GIS to accurately locate an event such as an incident on any segment in the network [Shine, 1992].

TIGER SYSTEM

Before the incident management database could be merged with a geographic information system, a geographic base file would be needed. The information necessary to build this file is already contained in the Topological Integrated Geographic Encoding and Referencing (TIGER) System. TIGER was created for the 1990 Census by the Bureau of the Census and the U.S. Geological Survey.

TIGER contains the necessary data for digitally creating every road in the nation. TIGER files also include the information required to create all of the railroads, hydrographic features, and airports in a GIS [Shine, 1992]. The files would have to be edited to delete information unnecessary for the IRT database. The edited files could be linked with the records stored in the incident management database created in this project. However, the TIGER files would require considerable modification to produce files in a format that would be useful to the incident management agencies.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

This project produced a prototype database that was designed primarily for use by WSDOT incident response teams (IRTs) to provide statewide consistency in IRT data collection. WSDOT IRTs can use this database to better understand incident trends and to evaluate incident response efforts. However, the database's primary value may be in keeping accurate records so that the IRTs can recover more of the costs associated with incident response.

Although the database was originally developed using DOS-based software, the system was converted to use on Macintosh computers. The system has been reviewed by Northwest Region IRT personnel, and it has been revised on the basis of their recommendations. The system includes options to create, modify, and review records; and to generate reports. Further revisions will doubtless be necessary after field tests.

The first users of the program report that the program both improves the quantity and quality of data and observations of the events and environment at incident sites. Simultaneously, the time required to complete electronic reports decreases. Typically, paper-based reports require an hour or more to complete, not counting the time required for office personnel to re-enter the information into a database. Anecdotal reports suggest that reports can be completed within "a matter of minutes"[10] using the prototype database. Further improvements to the database could utilize telecommunications link to a central database; and from this central source, descriptions of incidents could be broadcast on the Internet automatically to traffic-advisory radio personnel or Washington

[10] Telephone conversation with Jerry Althauser, Northwest Region (WSDOT), September 28, 1995.

State Patrol, or incorporated into existing WSDOT incident response programs, such as NWFLOW maps, which are generated automatically from loop-sensor data in the Northwest Region, and announcements of incidents, which are currently typed into the WWW home page files.

The main problem encountered by researchers was the lack of cooperation necessary to construct an integrated database using data from the WSP CAD system and WSDOT Northwest Region's Lane Closure reports. As previously discussed, institutional barriers rendered an integrated database infeasible at this time. Once the project objectives had been revised, the only major difficulty was in obtaining input on the information that should be included in the database. Most IRT personnel contacted agreed that the Unscheduled Lane Closure reports needed to be revised and updated into a computer-based format; however, few changes were proposed. Consequently, the first version of the database was designed without sufficient input.

IRT personnel found it easier to make recommendations on the information that should be included after they had been presented with the first working version of the database. The researchers feel the changes made have created a database that accurately reflects the data needs of the WSDOT IRTs. In the future, researchers may want to require more participation from the IRTs during the planning stage of their project to avoid this problem.

RECOMMENDATIONS

Further database development would streamline the interface and reduce the memory requirements. While the graphical interface simplifies the process, the memory required to support the program increase dramatically. The program's report-writing features, while adequate, should be improved, and field testing by incident response personnel should continue. The test database should be distributed for at least six months so that IRTs can get an accurate picture of database use, allowing them to make informed recommendations at the end of the test period. However, the IRTs should be contacted regularly during the test period in order to respond to any problems they may be experiencing. The database test must not be allowed to interfere with the IRTs' other responsibilities.

At this point, each incident response team within WSDOT will need to keep its own records. In the future, a centralized database should be considered, but the need for a centralized database will depend on the demand for the information collected by the IRTs. At this time, outside demand for the IRT data is not expected to be great. Most of the information on incidents is currently distributed by the WSDOT's Accident Data Branch. However, if sufficient demand for a centralized database arose, several options would be available.

A centralized database system would keep all of the IRT records in a single computer, but this would require that the incident response teams forward file updates to a central location, where it could generate the reports required by outside sources, saving the IRTs time and effort.

A touch-tone telephone data entry system could also be developed. A system like this would reduce the need to take expensive computer equipment into the field, and all of the information would be collected in one location. However, entering and editing reports by phone might be too complicated, given the amount and type of information recorded. Additionally, the individual IRTs would have to access the central database to get information on its response efforts. Pen-based computer programs could also be developed and were considered as part of the development process. However, much of the discussion and time spent on the project centered on deciding what kind of information should be collected, leaving insufficient time or money to produce a pen-based prototype.

During the project, new developments in hypertext markup language (HTML) applications occurred, along with the explosive use of the Internet, using World Wide Web (WWW, or "Web") browsers such as Netscape and Mosaic. The prototype database could be converted easily to a Web-based application; and this development could simultaneously take advantage of new products, like Apple's Newton Message Pad or Sony's Magic Link.[11] New software and hardware now make it possible to maintain a central database on the Internet, easily accessible to authorized users who could submit reports or view data, and a number of current, routine procedures could be improved: processing insurance claims; estimating maintenance, facilities, and equipment costs related to incidents; determining personnel needs; etc.

If there is a serious need for the information collected by the IRTs, or if the database integrating IRT and WSP data is pursued, a geographic information system (GIS) should be given serious consideration. GIS clearly offers many benefits to the incident manager. GIS could be used to store all the information included in the traditional relational database and could correlate that information with corresponding geographical locations. The ability to produce reports as a thematic map would be particularly useful to the incident manager. A GIS is also the only database system that could merge the incompatible formats of the IRTs and the WSP CAD systems. Although GIS cannot overcome the basic obstacles to creating an integrated database, a GIS may be the ultimate goal of an incident response agency.

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[11] The researchers initially considered using palmtop computers, extremely portable and compact devices slightly larger than standard pocket calculators, but a brief experiment demonstrated that recording extended observations would be difficult because of the characteristics of the limited-size keyboard.

ACKNOWLEDGMENTS

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APPENDIX A

LITERATURE REVIEW

APPENDIX A

LITERATURE REVIEW

SUMMARY

This appendix reviews the origins of Seattle-area incident management techniques and the various studies and references available to the incident manager. The foundations of the current incident management program are revealed in these references. This appendix also discusses types of databases currently used in Washington State and examines their major features and limitations. It includes a basic survey of database elements and database management systems. The origins of the FoxPro for Macintosh system are described in many reference books and periodicals. Particularly helpful, in addition to the documentation that accompanies the application, are "FoxPro Advisor," a programming guide published monthly by Advisor Publications, *Hacking FoxPro* (Slater et al., 1994) and *FoxPro 2.5 for DOS: The Complete Reference* (Jones and Nesbitt, 1993). The procedures examined are important in understanding the database produced by this project.

INTRODUCTION

Both highway incident management and database management are fairly well documented. Many options and technologies are available to the incident manager, just as a multitude of options and technologies are available to the data manager. However, documentation of data management systems as related specifically to incident management is fairly limited. Because of this limitation, the review of incident management databases is divided in three parts: (1) incident management techniques; (2) examples of incident management programs and databases in the Seattle area; and (3) fundamental database strategies.

INCIDENT MANAGEMENT TECHNIQUES

Generation and Assessment of Incident Management Strategies, Vols. 1-4

A thorough review of incident management methods used in the United States, Seattle-area incident characteristics, Seattle-area incident impacts, and an assessment of Seattle's incident management record is presented in four technical volumes produced for the Washington State Department of Transportation (Mannering et al., 1990). The first volume reviews literature on incident management options, surveillance and control, and traffic studies. It offers a discussion of alternative incident mitigation strategies. It also includes incident management and surveillance/control methodologies, and an overview of incident mitigation systems in some major U.S. cities.

The second volume presents an analysis of freeway incidents in the Seattle area. It outlines the research approach used, including a description of the study area, the types of data collected, and the details of data collection. The authors also describe the analytical techniques for incident frequency and duration analysis and interpret the results of that analysis. This volume is of principal interest to the database planner, insofar as it discusses the characteristics with the most influence on incident duration and frequency. This discussion formed the backbone of the incident management database by indicating the most influential data to include.

The third volume examines the effects of incidents on traffic in the Seattle-area network. It discusses the evaluation and application of the traffic simulation model XXEXQ, which was applied to the network of freeways and arterials that make up the major commute routes in the central Puget Sound region. The results of the model simulations are interpreted, and the impact of the incident location on system performance is discussed. A critique of XXEXQ is offered. This particular volume contains several appendices. These appendices offer insights into the selection of a model and the review of existing models and methodologies. The appendices also include the FORTRAN listing of the XXEXQ program and the traffic network used in the simulations.

The fourth and final volume of the technical report presents conclusions and recommendations based on the study findings. This volume offers an assessment of Seattle-area incident management over a two-year period. It covers agency response and accident report times, accident severity and duration, rush-hour responses, special events, and environmental factors. Recent incident management strategies in the Seattle area are evaluated, including incident response storage sites and accident investigation sites. Finally, this volume recommends future incident management strategies.

Framework for Developing Incident Management Systems

Efficient incident management can be achieved through a number of different techniques. However, little guidance in the selection and implementation of an incident management system has been available to agencies initiating the practice in their own jurisdictions. Koehne, Mannering and Hallenbeck (1991) offer a seven-step process for making system decisions. These steps consist of defining the problem, setting goals and objectives, developing alternatives, evaluating and selecting from those alternatives, implementing the system, re-evaluating the system after a specified time, and refining the system. The guide offers important insights into the resources necessary for an efficient response effort. This list of resources allows the database designer to develop a system that will be responsive from the outset that will allow agencies to budget and plan effectively.

Section I of the guide contains a useful orientation to incident response for agencies new to this area of work. It reviews the issues and techniques for creating and implementing a formal incident management system. It describes the five categories of incident response actions that are used throughout the guide. These five categories are incident detection, response, site management, clearance, and motorist information. The relative costs and benefits of the various techniques are examined throughout the guide and are aptly illustrated by "at-a-glance" tables. For each technique included in these incident management categories, specific information is given on technique description, operational procedures, and funding variations.

Section II of the guide deals with the technical details of the majority of incident management actions employed in the United States. A system manager can use this section to pursue the development or enhancement of an incident management system. The system manager can develop a list of alternative techniques to be investigated by comparing the examples presented. Section II also describes the level of involvement of participating agencies, such as the department of transportation, police department or fire department. In summarizing this information, the guide allows system managers to select techniques on the basis of the level of support expected from outside agencies.

The third section summarizes Section I. This summary is meant to lead an agency through the incident management development process, breaking the process into a series of short worksheets, lists, tables, figures, and questionnaires designed to help managers determine whether they have addressed all of the concerns presented in the guide. Section III is designed to help an agency collect and integrate the necessary information, which will allow it to make an informed decision about the actions and responses that would be part of a planned, efficient incident management system appropriate to the resources available and to the cooperating agencies. This section also includes a discussion of methods for quantifying the benefits received from the incident management techniques. In addition, it provides lists of contacts and references to assist agencies in selecting incident response options.

Incident Response Guide

WSDOT instituted its first incident response team in its Northwest Region, which encompasses the central Puget Sound area. The procedures used there formed the basis of the database presented in this document. Tanemura and Mannering (1991) developed the guidelines, resources, and training requirements for WSDOT's Northwest Region.

Although the guide was produced for use in the Puget Sound area, it is easily adaptable to other urban and rural areas as long as the resource information is revised to reflect the new location. The guide describes appropriate response steps and techniques available under certain situations. Procedure lists for requesting additional equipment and staff, as well as general information, contacts, and resources are provided in the guide.

Unplanned Roadway Closure Report

Of particular interest to the IRT database designer was the Unplanned Roadway Closure Report and Explanation Sheet, which is included in the Incident Response Guide. This is the form used by incident response personnel to collect information on accident location, road condition and closure, clean-up and traffic control, incident response activities, and other items. In essence, the form told the database designer which information is important to the IRTs. Because this form was in current use, the researchers were able to collect comments on the information the IRTs wanted to include in the database.

DATABASES IN THE SEATTLE AREA

WSDOT Accident Data Branch

The WSDOT's Accident Data Branch (ADB) maintains and updates a complete list of all accidents that have been reported to the Washington State Patrol (WSP) since January 1, 1980. This database contains more than half a million files, representing approximately 95 percent of the data collected by the WSP. The WSP is the official custodian of all reported accident records for the state. This includes all city, county, and state accident data. The WSP enters the collected data manually into a computer using numeric codes for descriptive labels. Note that 30 to 40 percent of all accidents go unreported.

The data collected by the WSP take up 480 columns, which includes one record for each occupant of each vehicle involved. The ADB requests a more limited version, which has only 170 columns, and includes occupant information on the first three vehicles only. Accidents that occur on state highways are selected from the WSP's main data file and are sent to the ADB on magnetic tape for additional coding and storage. The ADB relays this information to the rest of the WSDOT on its Microcomputer Collision Analysis Report System (MicroCARS).

MicroCARS is a combination of the relational database dBASE 4 and the statistical analysis package SPSSPC+. The ADB uses MicroCARS to analyze accident data statistically. The program can sort and select accidents according to a variety of criteria. For example, it can select records using one or more stretches of a state route as the main criterion. The program can also select accidents according to factors such as collision type or alcohol involvement. This analysis is done for the entire state highway system.

After dBASE 4 selects the records on the basis of the specified selection criteria, SPSSPC+ replaces the numeric codes used to store the data with descriptive labels. It then produces standard reports as requested. A detailed statistical analysis can be run with the selected records. MicroCARS was developed entirely by ADB staff. In 1993, MicroCARS was replaced with an entirely new system called TRIPS. The information contained in this description came from conversations with the ADB staff and from the manual prepared by Jackson, Limotti, Riner and Turner (1990).

Incident Response Team Data

The IRT has many responsibilities during a highway incident. One of the IRT's duties is to collect data on the incidents that they handle. In the Northwest Region this is accomplished by filling out an Unplanned Roadway Closure Report and an Explanation Sheet in the field. Back in the office, IRT staff enter the information by hand into a C program that was developed in-house. Individual records can be selected by the date on which the incident occurred and by the state route number. This program functions somewhat adequately as a data storage device; however, it is unable to print information to an ASCII file, which severely limits its usefulness.

Many of the information fields included in the IRT data are also included in the ADB database. In developing the database for this study, both MicroCARS and the IRT were used to determine which information to include. If the database developed during this project replaces the existing IRT system, a common field, such as the WSP case number, could be used to relate the two data sources. In the past, route and milepost have been used to match records from the two separate sources. This solution has been unsuccessful because milepost signs occur only every mile, with tenth-of-a-mile markers between them on the state routes, and the data have typically been recorded to hundredths of a mile. The human error introduced by this solution has made it difficult to match records on the basis of milepost, even when they are supplemented by accident dates and times.

Washington State Patrol Computer Aided Dispatch

The incidents contained in the IRT data system and MicroCARS are limited to accidents, and thus exclude disablements. The WSP is the only agency in the state that keeps records of disabled vehicle information. This is accomplished through its Computer Aided Dispatch (CAD) System. The CAD records all WSP activities, including accidents and disablements. It also contains valuable information on response times.

In the CAD system, dispatchers input data as it is called in by the WSP troopers. The system is capable of searching for and selecting records from its data storage unit. However, the output format is fairly rigid. The data cannot be read into a database because of the structure of the data. Moreover, the WSP is extremely reluctant to allow non-WSP personnel to access the CAD system. Security breaches are the WSP's main concern, but the WSP also fears that the system may be unavailable in an emergency situation if too many users attempt to simultaneously access the system.

A dumb terminal is available to WSDOT personnel at the Traffic Systems Management Center (TSMC). Access is limited; output cannot be printed to a disk or tape, and paper is the only medium that can be used to display data from the system.

Demonstration Geographic Information System

M. Shine (1992) provided a demonstration database that used a Graphic Information System (GIS) that focused on Interstates 5, 90, and 405, and State Route 520 in Seattle. The demonstration was performed with MicroCARS and IRT data for the months of January and July 1991. The purpose of the study was to show how GIS can be used to collect, store, and analyze incident response data.

DATABASE STRATEGIES

Database and File Management Systems for the Microcomputer

To achieve a basic understanding of how the database in this study should be designed, the researchers had to explore the fundamentals of database management systems. Dinerstein (1985) offers a simple explanation of the basics, with very few programming concepts. This was a particularly useful source, insofar as it was most important to understand how the database would store and retrieve data.

Dinerstein's book discusses the basics of database structure and use. Each database is designed around a central core of facts commonly called a file. Each file is composed of any number of discrete records. Records, in turn, comprise fields, each of which contains a different type of information. For example, a telephone book would be a file, and each person's entry would be a record. Each record would have one field for the person's last name, and one each for the first name, the address, and the telephone number. Fields make a computer-based database searchable. In the case of a telephone book, for example, the database user could request all records in which the last-name field contained the word "Smith." Computer-based databases can also be sorted according to the order of fields.

In the case of incident response information, the database would contain one or more files. Each record in these files would be associated with a particular incident. Each record, in turn, would contain fields with specific bits of information collected at the incident site.

The book also discusses the main methods of storing and accessing files and records. The most common types of database management systems, relational, hierarchical, network, and indexed, are reviewed. Relational databases, which are similar to paper charts or tables, are commonly referred to as flat-file databases. For example, the user may want to create a database for roads and their characteristics. This type of database would have one column of road names running down the left margin of the paper, and a row of road characteristics, such as number of lanes, average volumes, length, or physical condition, running across the top of the page. In the table of this analogy, there is only one slot for each combination of road and characteristic. Each slot in the table relates or associates an element from one list with an element from the other. Many simple personal computer databases fit this format.

In hierarchical databases, every set of facts belongs to a larger category. One analogy is the organizational chart of a large corporation. An individual employee belongs to a department, which in turn belongs to a branch, which in turn belongs to a division. The drawback of this database format is that it can be very time-consuming. To find any individual record, the program must tediously work down the chain of categories.

Network databases, which are also known as multi-file relational databases, are used when the information the user wants to store is too complex to fit into a traditional flat-file or relational database. Essentially, network databases link several tables together. Network databases' speed, versatility, and degree of control have earned them prominence in business. However, considerable programming skills may be required for their operation.

With indexed databases, like relational databases, all of the data files are flat files, and the records have exactly the same structure. Linkages in an indexed file system are performed through the use of index files. An index file is a file with two fields or columns. The first field is a column of values, usually an identifier, taken from the associated data file. The second field consists of a column of pointers. The pointers are basically the addresses of the associated records. The book does a very thorough job of explaining the basics of the structure and the use of all of these types of databases. Common data problems and some simple solutions are presented, as are case studies for each type of database management system.

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APPENDIX B

DATA ENTRY SCREENS AND DATABASE STRUCTURE

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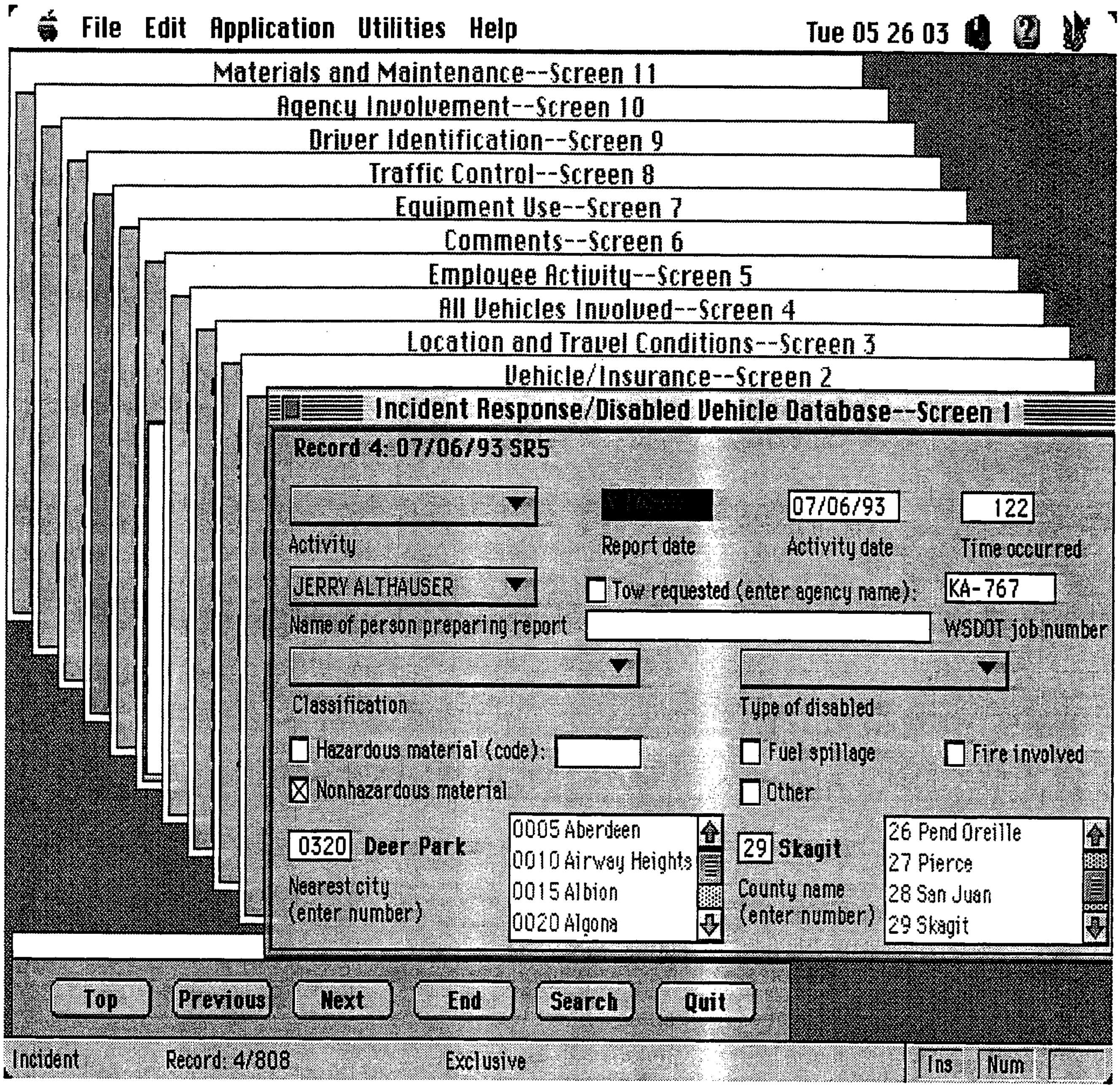
DATA ENTRY SCREENS AND DATABASE STRUCTURE



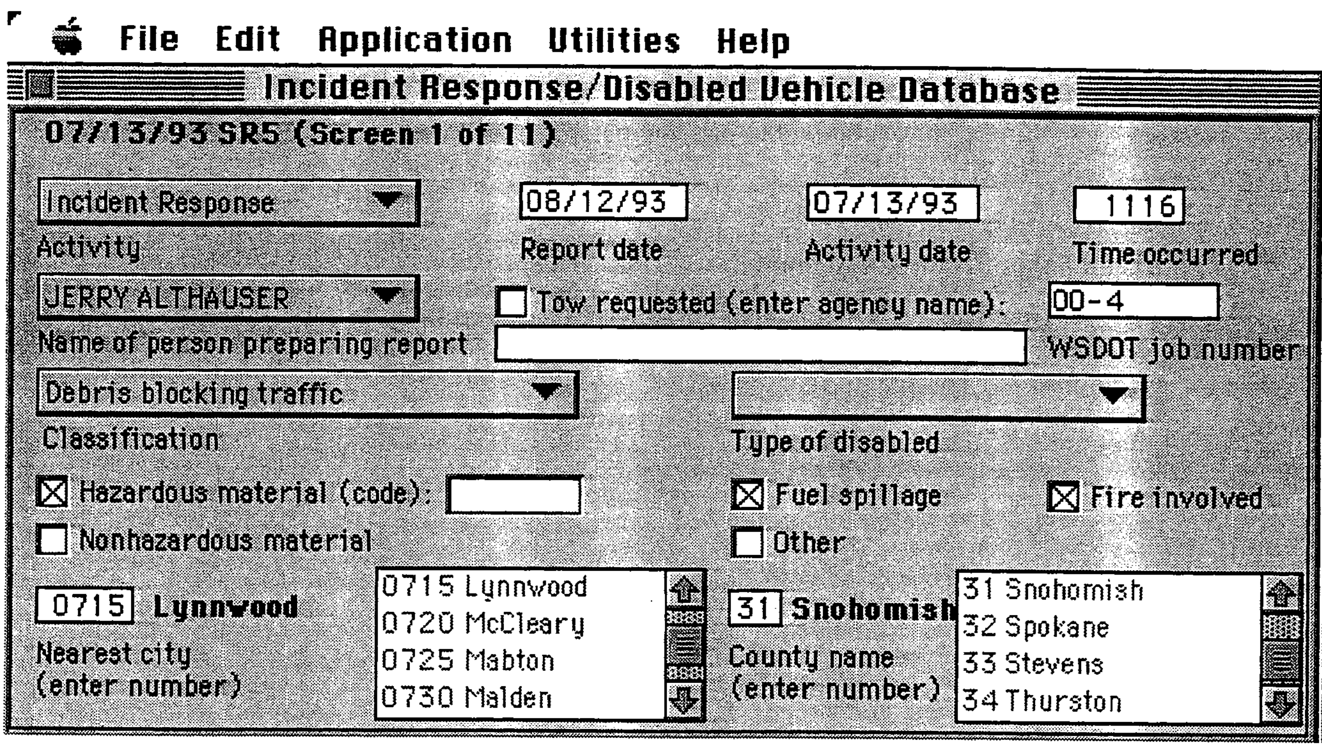
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items[a]
C	activity	Activity	Incident Response Disabled Vehicle Other
D	date_prep	Report date	
D	date_incid	Activity date	
N	time_incid	Time occurred	
C	name_prep	Name of person preparing report	Jerry Althauser Dan Berry Lester Eastlick Bob George Greg Hansen Bob Kofstad Tim McBride Ron Morton Don O'Brien Lori Parise John Parkinson Larry Roberts Steve Russell Other
L	tow_request	Tow requested (enter agency name):	
L	tow_name	(Enter agency name)	
C	job_no	WSDOT job number	
C	class	Classification	Fatality Personal injury Property damage Hazardous material Disabled vehicle Debris blocking traffic Other
C	type_dis	Type of disabled	Flat tire Out of gas Mechanical breakdown UTL Overheated Abandoned vehicle Accident Other
L	hazard	Hazardous material (code):	
N	haz_code		
L	spill	Fuel spillage	
L	fire	Fire involved	
L	nonhazard	Nonhazardous material	
L	other	Other	
N	citynumber	Nearest city (enter number)	
N	*citynumber	Scrollable list: all incorporated cities in Washington and their corresponding codes	
N	county_no	County name (enter number)	
N	**county_no	Scrollable list: Washington counties/codes	

Key to field types: C—Character N—numeric M—memo (text-edit region) L—logical (yes/no; true/false)

[a] All selections display as a single column in the Incident Response Database program, but this report occasionally uses two columns to accommodate space limitations.

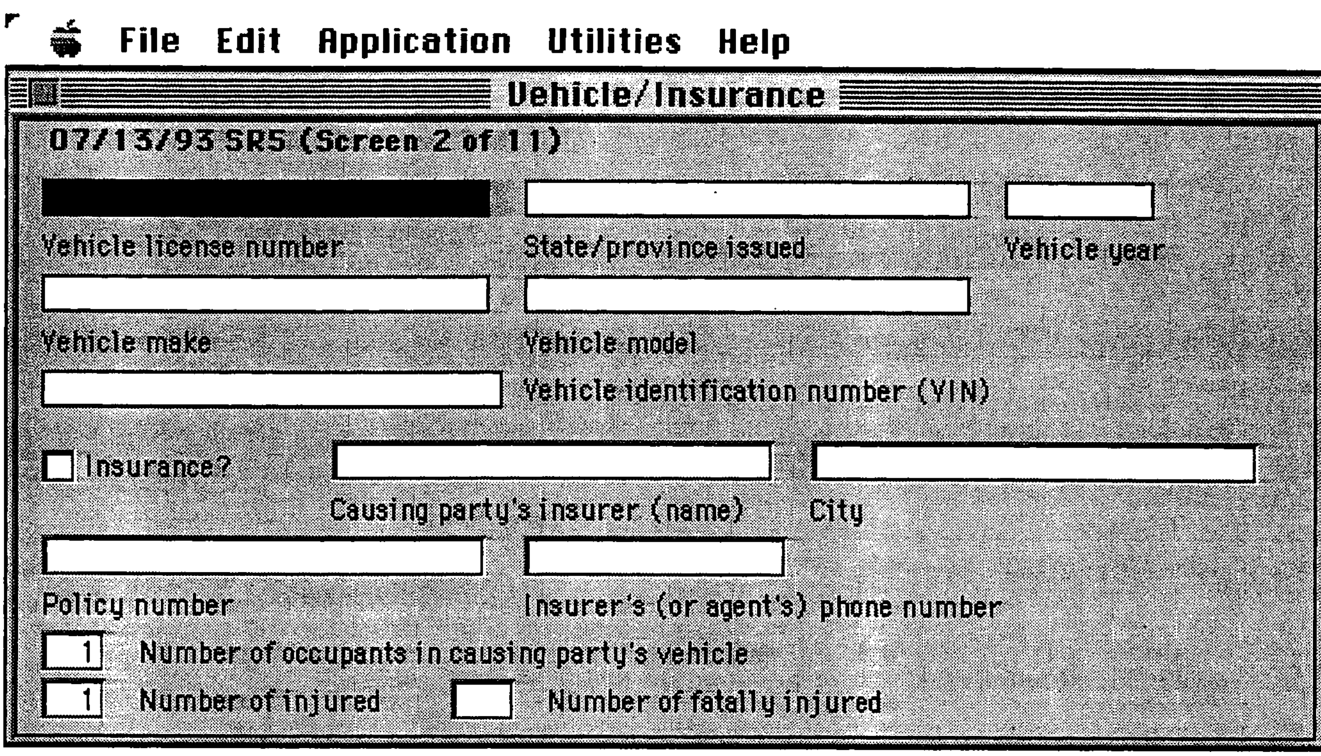
* The information displayed on the screen originates from a related field in a related database (CITY.DBF).

** The information displayed on the screen originates from a related field in a related database (COUNTY.DBF).


File Edit Application Utilities Help
Incident Response/Disabled Vehicle Database
07/13/93 SR5 (Screen 1 of 11)
Incident Response
Activity
08/12/93
Report date
07/13/93
Activity date
1116
Time occurred
JERRY ALTHAUSER
Name of person preparing report
Tow requested (enter agency name):
00-4
WSDOT job number
Debris blocking traffic
Classification
Type of disabled
Hazardous material (code):
Nonhazardous material
Fuel spillage
Other
Fire involved
0715 Lynnwood
Nearest city (enter number)
0715 Lynnwood
0720 McCleary
0725 Mabton
0730 Malden
31 Snohomish
County name (enter number)
31 Snohomish
32 Spokane
33 Stevens
34 Thurston

Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
C	vehlicens	Vehicle license number	
C	vehstate	State/province issued	
N	vehyear	Vehicle year	
C	vehmake	Vehicle make	
C	vehmodel	Vehicle model	
C	vehvin	Vehicle identification number (VIN)	
L	insurance	Insurance?	
C	insurer	Causing party's insurer (name)	
C	ins_city	City	
C	ins_no	Policy number	
C	ins_phone	Insurer's (or agent's) phone number	
N	vehoccup	Number of occupants in causing party's vehicle	
N	vehinjure	Number of injured	
N	vehfatal	Number of fatally injured	

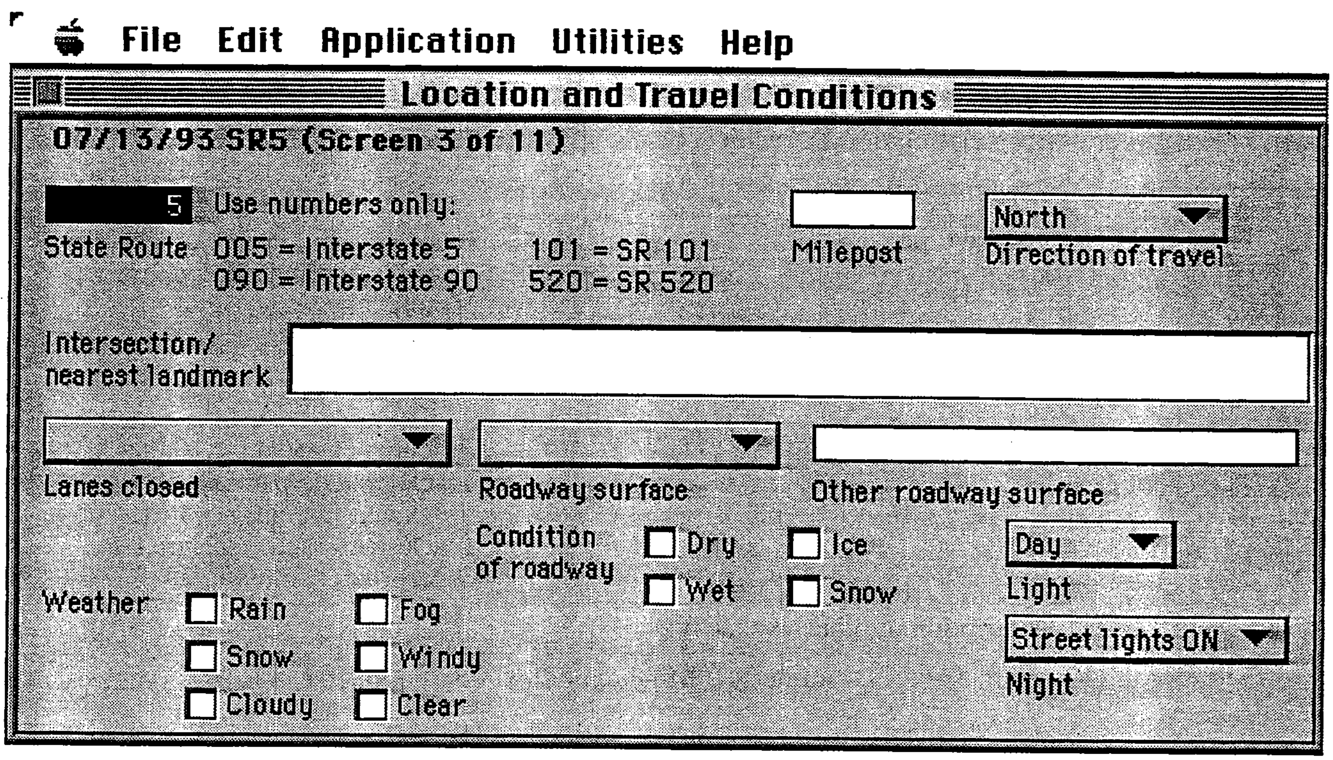
Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Vehicle/Insurance
07/13/93 SR5 (Screen 2 of 11)
Vehicle license number
State/province issued
Vehicle year
Vehicle make
Vehicle model
Vehicle identification number (VIN)
Insurance?
Causing party's insurer (name)
City
Policy number
Insurer's (or agent's) phone number
1
Number of occupants in causing party's vehicle
1
Number of injured
Number of fatally injured

Field type	Field name	Information to record as it appears on the data-entry screen	List popup items[a]
N	state_rout	State Route—Use numbers only: e.g., 005 = Interstate 5, 101 = SR 101, 090 = Interstate 90, 520 = SR 520	
N	milepost	Milepost	
C	travel	Direction of travel	East West North South Both ways: East-West Both ways: North-South
M	intersect	Intersection/nearest landmark	
C	lane_close	Lanes closed	Single lane Multiple lanes All lanes—both directions All lanes—one direction Ramp Intersection
C	surface	Roadway surface	Concrete Asphalt Other
M	surface_a	Other roadway surface	
		Condition of roadway	
L	road_1	Dry	
L	road_2	Wet	
L	road_3	Ice	
L	road_4	Snow	
C	light	Light	Day Dawn Night Dusk
C	night	Night	Street lights ON Street lights OFF NO street lights
L	weather_1	Rain	
L	weather_2	Snow	
L	weather_3	Cloudy	
L	weather_4	Fog	
L	weather_5	Windy	
L	weather_6	Clear	

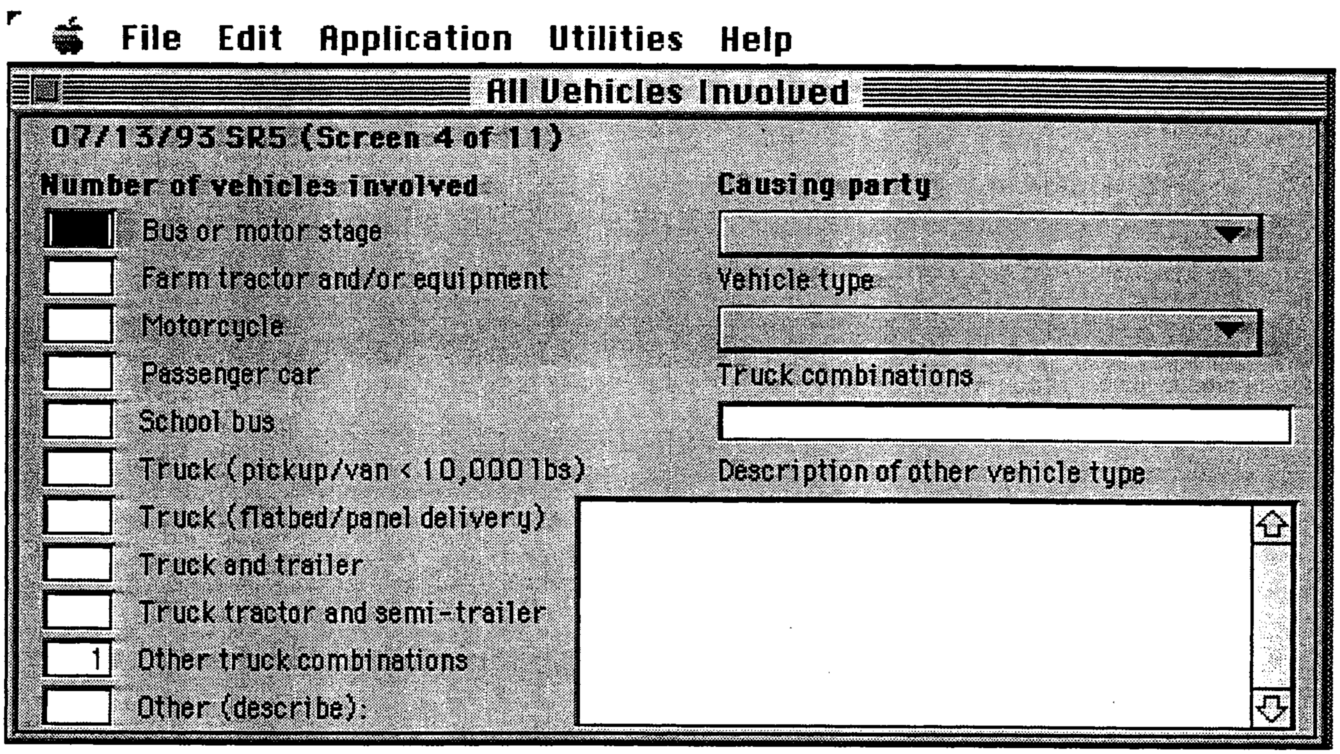
Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

[a] All selections display as a single column in the Incident Response Database program, but this report occasionally uses two columns to accommodate space limitations.


File Edit Application Utilities Help
Location and Travel Conditions
07/13/93 SR5 (Screen 3 of 11)
5
Use numbers only:
State Route
005 = Interstate 5
090 = Interstate 90
101 = SR 101
520 = SR 520
Milepost
North
Direction of travel
Intersection/
nearest landmark
Lanes closed
Roadway surface
Other roadway surface
Condition
of roadway
Dry
Wet
Ice
Snow
Day
Light
Weather
Rain
Snow
Cloudy
Fog
Windy
Clear
Street lights ON
Night

Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
N	veh_type10	Bus or motor stage	
N	veh_type8	Farm tractor and/or equipment	
N	veh_type12	Motorcycle	
N	veh_type1	Passenger car	
N	veh_type11	School bus	
N	veh_type2	Truck (pickup/van <10,000 lbs)	
N	veh_type3	Truck (flatbed/panel delivery)	
N	veh_type4	Truck and trailer	
N	veh_type5	Truck tractor and semi-trailer	
N	veh_type6	Other truck combinations	
N	veh_type7	Other (describe):	
M	veh_typem	(Description of other vehicle type)	
		Causing party	
C	veh_typea	Vehicle type	Bus or motor stage Farm tractor and/or equipment Motorcycle Passenger car School bus Other
C	veh_typeb	Truck combinations	Truck (pickup/van < 10,000 lbs) Truck (flatbed/panel delivery) Truck and trailer Truck tractor and semi-trailer Other truck combinations
C	cpveh_desc	Description of other vehicle type	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help

All Vehicles Involved

07/13/93 SR5 (Screen 4 of 11)

Number of vehicles involved

	Bus or motor stage
	Farm tractor and/or equipment
	Motorcycle
	Passenger car
	School bus
	Truck (pickup/van < 10,000 lbs)
	Truck (flatbed/panel delivery)
	Truck and trailer
	Truck tractor and semi-trailer
1	Other truck combinations
	Other (describe):

Causing party

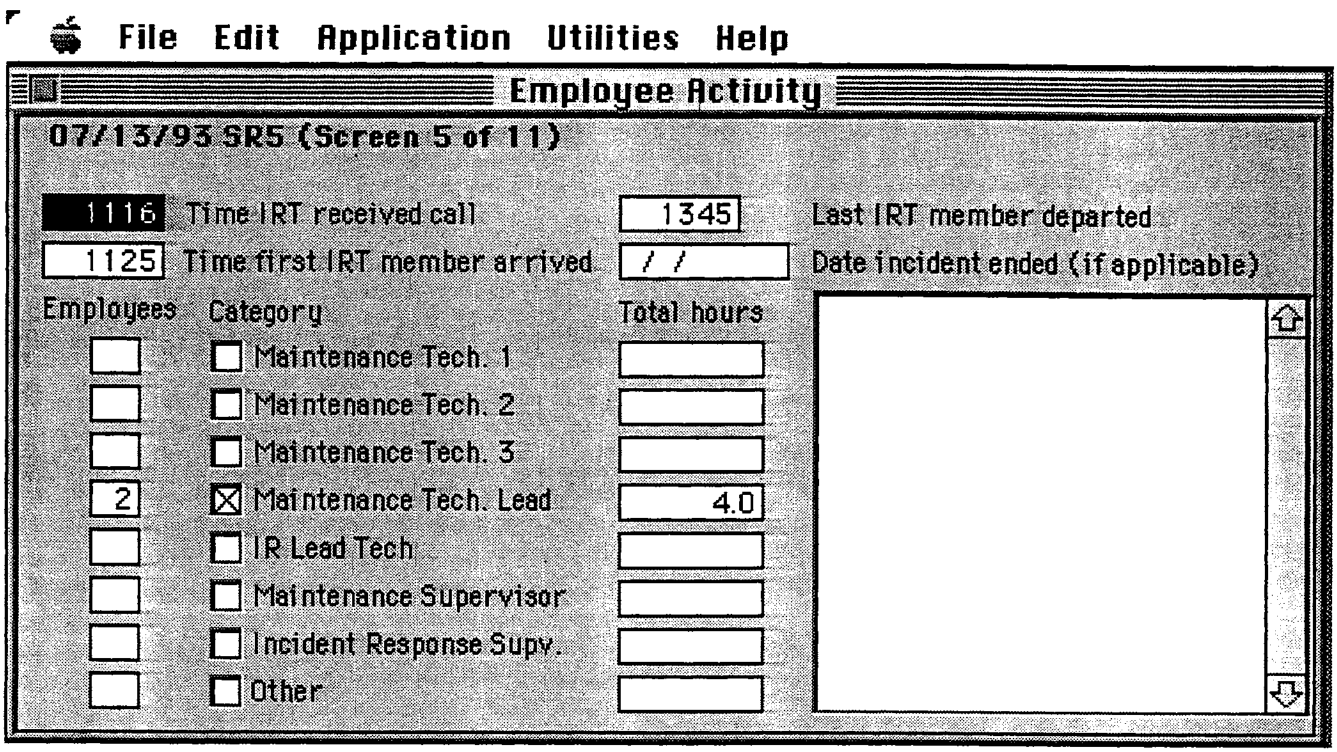
Vehicle type

Truck combinations

Description of other vehicle type

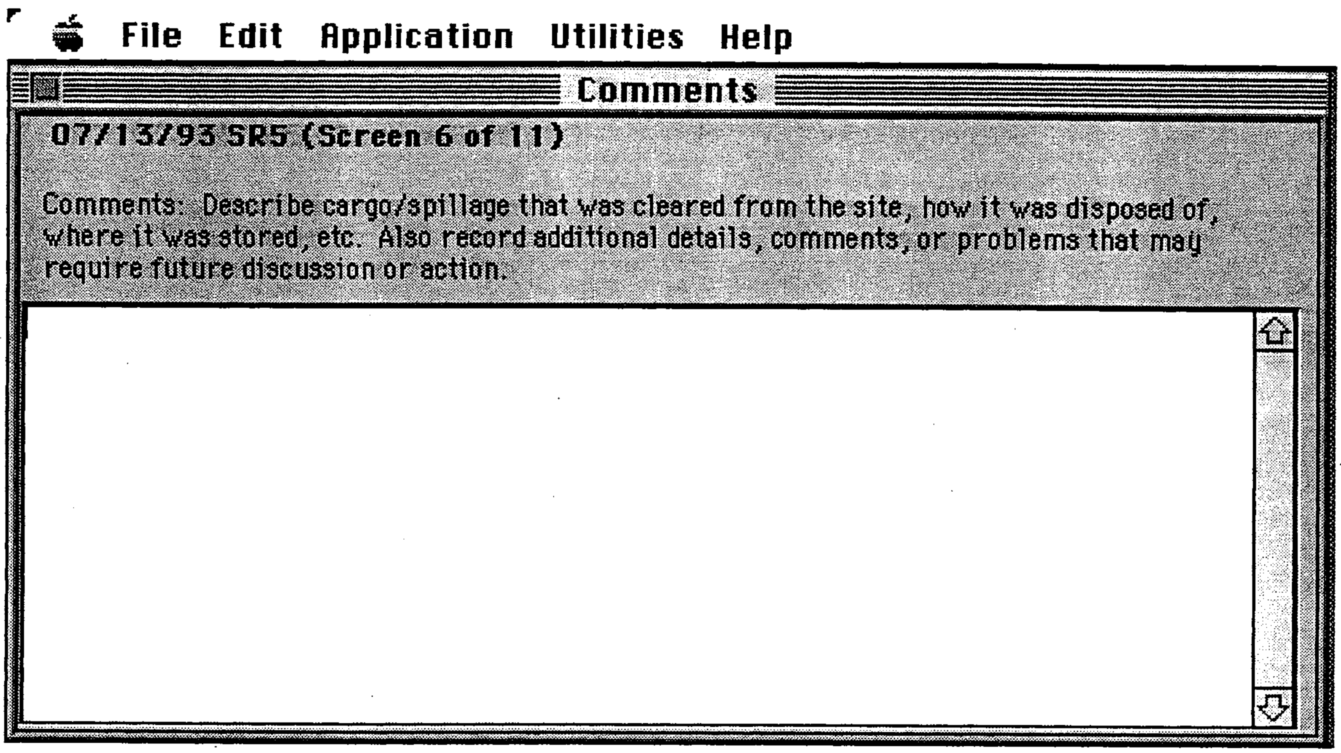
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
N	time_call	Time IRT received call	
N	time_arriv	Time first IRT member arrived	
N	time_depar	Last IRT member departed	
D	date_end	Date incident ended (if applicable)	
N L N	wsdot1 wsdot1_emp wsdot1hrs	Maintenance Tech 1	
N L N	wsdot2 wsdot2_emp wsdot2hrs	Maintenance Tech 2	
N L N	wsdot3 wsdot3_emp wsdot3hrs	Maintenance Tech 3	
N L N	wsdot4 wsdot4_emp wsdot4hrs	Maintenance Tech Lead	
N L N	wsdot9 wsdot9_emp wsdot9hrs	IR Lead Tech	
N L N	wsdot5 wsdot5_emp wsdot5hrs	Maintenance Supervisor	
N L N	wsdot6 wsdot6_emp wsdot6hrs	Incident Response Supv.	
N L N	wsdot8 wsdot8_emp wsdot8hrs	Other	
M	employees	(Text-edit region to record additional information)	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Employee Activity
07/13/93 SR5 (Screen 5 of 11)
1116 Time IRT received call
1125 Time first IRT member arrived
1345 Last IRT member departed
/ / Date incident ended (if applicable)
Employees
Category
Total hours
Maintenance Tech. 1
Maintenance Tech. 2
Maintenance Tech. 3
2 Maintenance Tech. Lead 4.0
IR Lead Tech
Maintenance Supervisor
Incident Response Supv.
Other

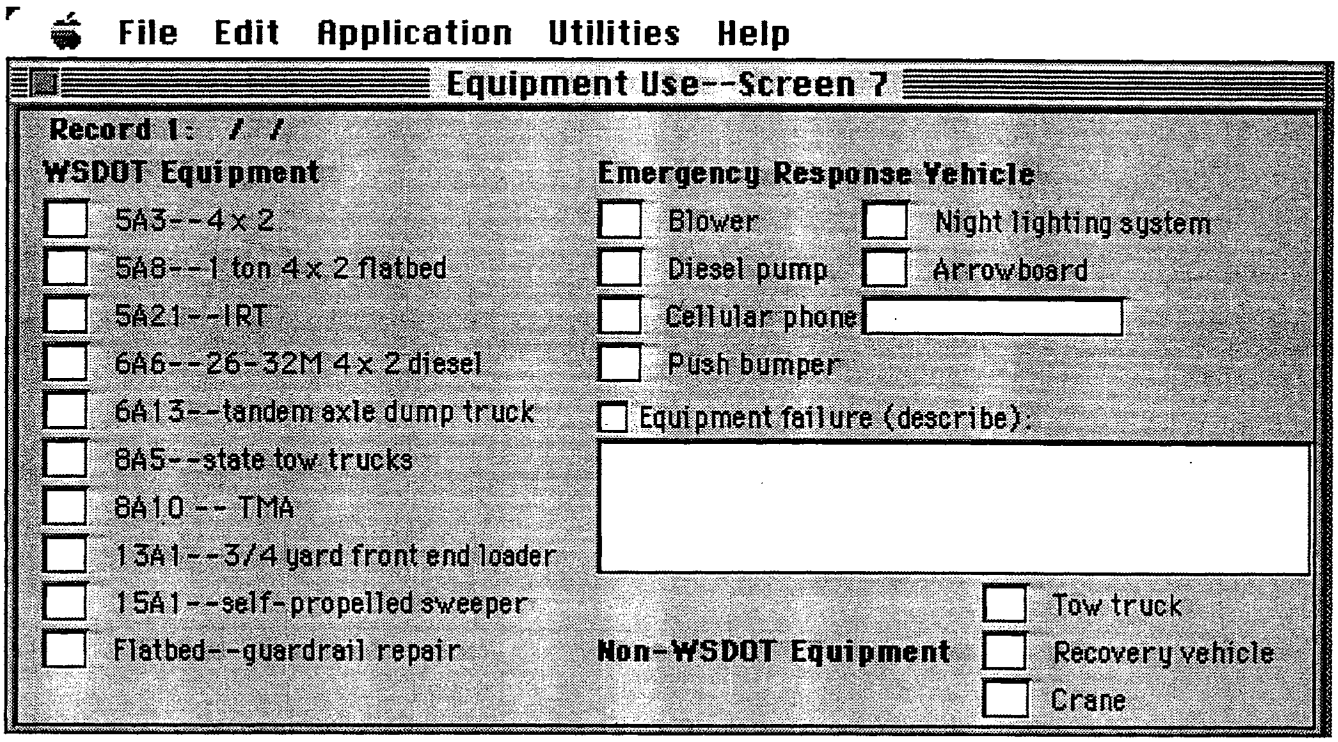
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
M	comments	Comments: Describe cargo/spillage that was cleared from the site, how it was disposed of, where it was stored, etc. Also record additional details, comments, or problems that may require future discussion or action.	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Comments
07/13/93 SR5 (Screen 6 of 11)
Comments: Describe cargo/spillage that was cleared from the site, how it was disposed of, where it was stored, etc. Also record additional details, comments, or problems that may require future discussion or action.

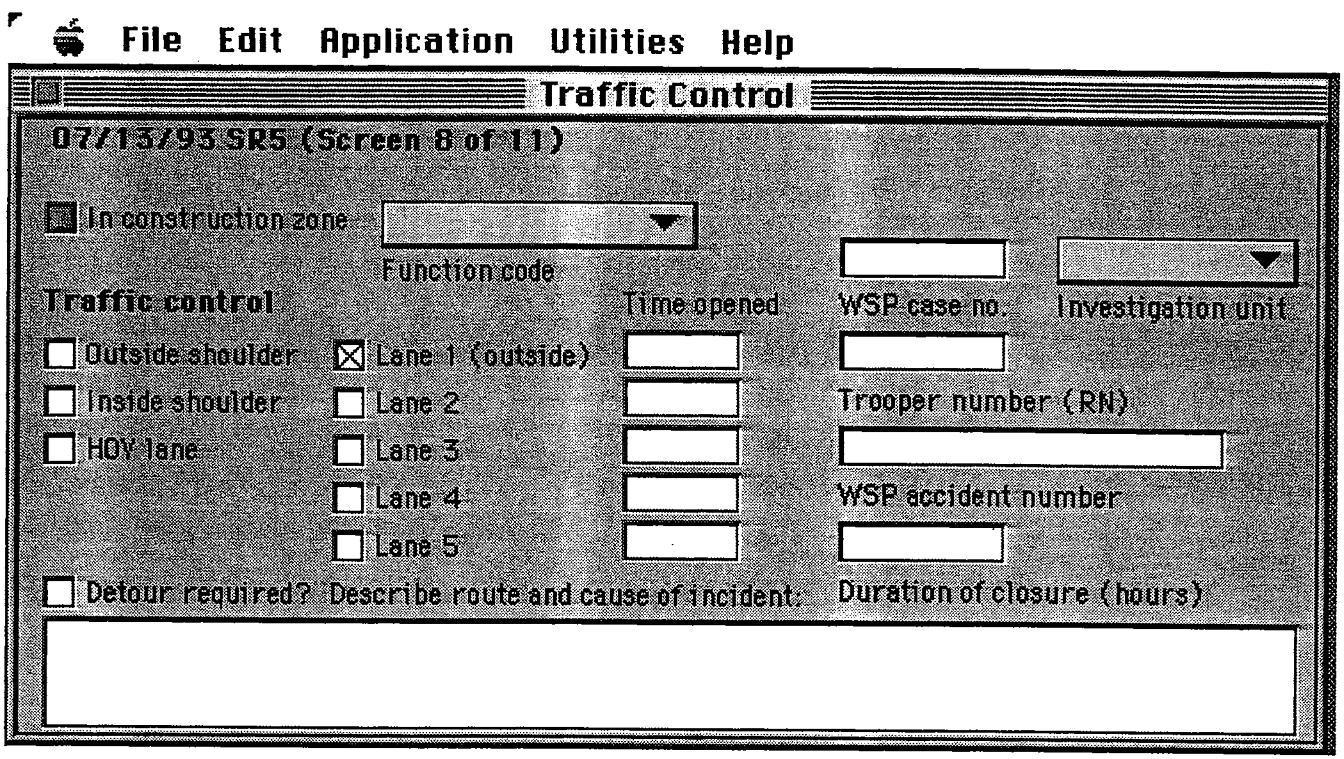
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
		WSDOT Equipment	
N	dot_a	5A3--4 x 2	
N	dot_c	5A8--1 ton 4 x 2 flatbed	
N	dot_d	5A21--IRT	
N	dot_e	6A6--26-32M 4 x 2 diesel	
N	dot_o	6A13--tandem axle dump truck	
N	dot_p	8A5--state two trucks	
N	dot_b	8A10--TM	
N	dot_g	13A1--3/4 yard front end loader	
N	dot_h	15A1--self-propelled sweeper	
N	dot_f	Flatbed--guardrail repair	
		Emergency Response Vehicle	
N	dot_i	Blower	
N	dot_k	Night lighting system	
N	dot_j	Diesel pump	
N	dot_n	Arrowboard	
N	dot_m	Cellular phone	
N	dot_cell	(Cellular phone number)	
N	dot_l	Push bumper	
L	malfunc	Equipment failure (describe):	
M	malfunc_m	(Text edit area to describe equipment malfunctions)	
		Non-WSDOT Equipment	
N	non_a	Tow truck	
N	non_b	Recovery vehicle	
N	non_c	Crane	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Equipment Use--Screen 7
Record 1: / /
WSDOT Equipment
5A3--4 x 2
5A8--1 ton 4 x 2 flatbed
5A21--IRT
6A6--26-32M 4 x 2 diesel
6A13--tandem axle dump truck
8A5--state tow trucks
8A10 -- TMA
13A1--3/4 yard front end loader
15A1--self-propelled sweeper
Flatbed--guardrail repair
Emergency Response Vehicle
Blower
Night lighting system
Diesel pump
Arrowboard
Cellular phone
Push bumper
Equipment failure (describe):
Non-WSDOT Equipment
Tow truck
Recovery vehicle
Crane

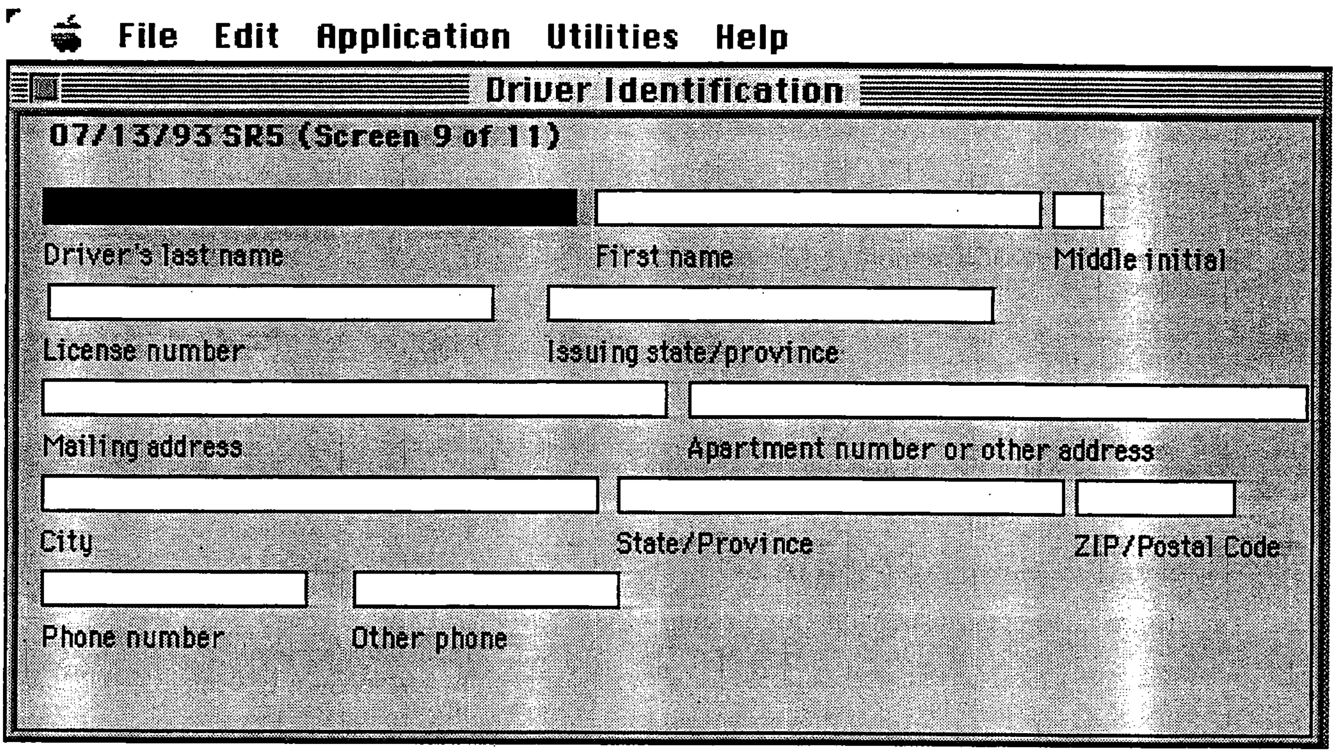
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
L	construct	In construction zone	
C	func_code	Function code	Guardrail (54) Flagging (55)
		Traffic control	
L	lane_out	Outside shoulder	
L	lane_in	Inside shoulder	
L	lane_hov	HOV lane	
L N	lane_no1 lane1_open	Lane 1 (outside) Time opened	
L N	lane_no2 lane2_open	Lane 2 Time opened	
L N	lane_no3 lane3_open	Lane3 Time opened	
L N	lane_no4 lane4_open	Lane 4 Time opened	
L N	lane_no5 lane5_open	Lane 5 Time opened	
L	detour	Detour required?	
M	route	(Text-edit region): Describe route and cause of incident:	
C	wsp_case	WSP case no.	
C	trooper_no	Trooper number (RN)	
N	wsp_acc	WSP accident number	
N	duration	Duration	
C	wsp_unit	Investigation unit	None Tape Total station

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Traffic Control
07/13/93 SR5 (Screen 8 of 11)
In construction zone
Function code
Traffic control
Time opened
WSP case no.
Investigation unit
Outside shoulder
Inside shoulder
HOV lane
Lane 1 (outside)
Lane 2
Lane 3
Lane 4
Lane 5
Trooper number (RN)
WSP accident number
Detour required? Describe route and cause of incident:
Duration of closure (hours)

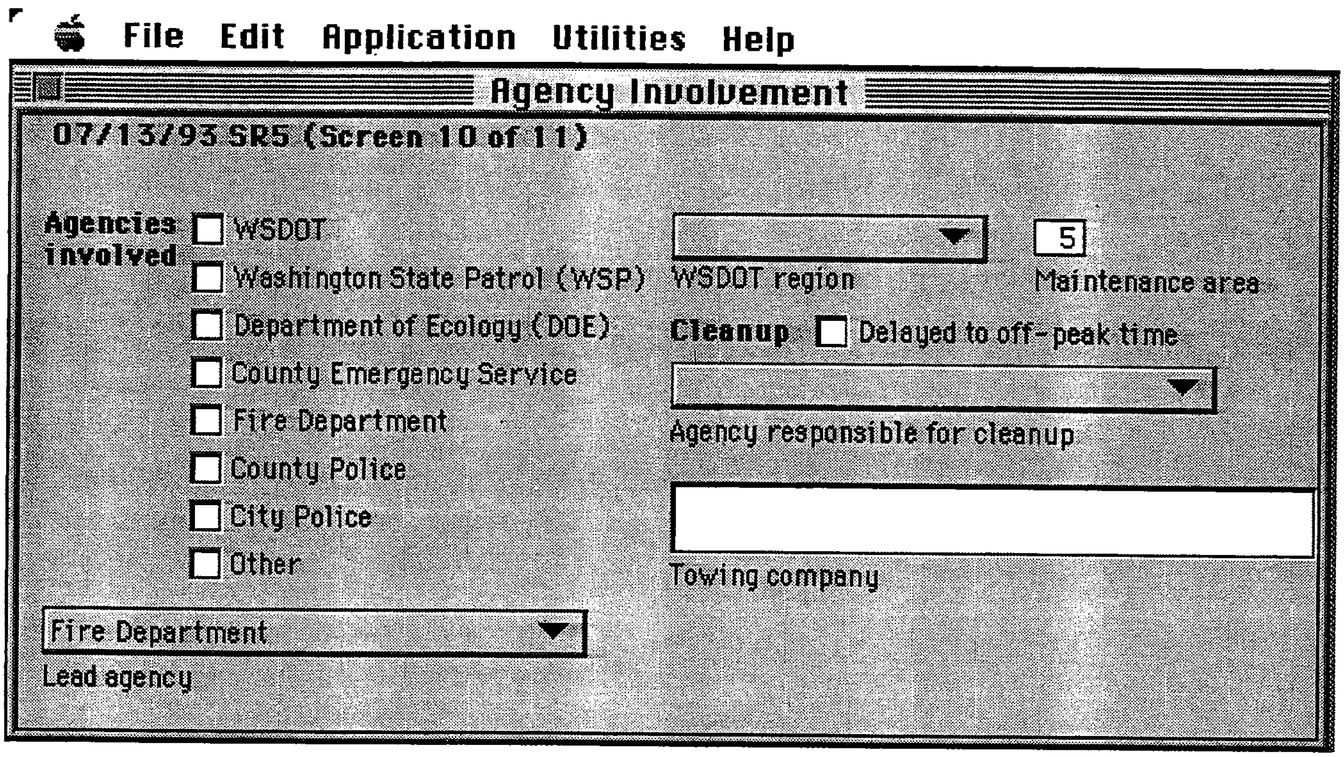
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
C	drvlname	Driver's last name	
C	drvfname	First name	
C	drivinit	Middle initial	
C	licsno	License number	
C	licstate	Issuing state/province	
C	drvaddr1	Mailing address	
C	drvaddr2	Apartment number or other address	
C	drvcity	City	
C	drvstate	State/province	
C	drvzip	ZIP/Postal code	
C	drvphone1	Phone number	
C	drvphone2	Other phone	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Driver Identification
07/13/93 SR5 (Screen 9 of 11)
Driver's last name
First name
Middle initial
License number
Issuing state/province
Mailing address
Apartment number or other address
City
State/Province
ZIP/Postal Code
Phone number
Other phone

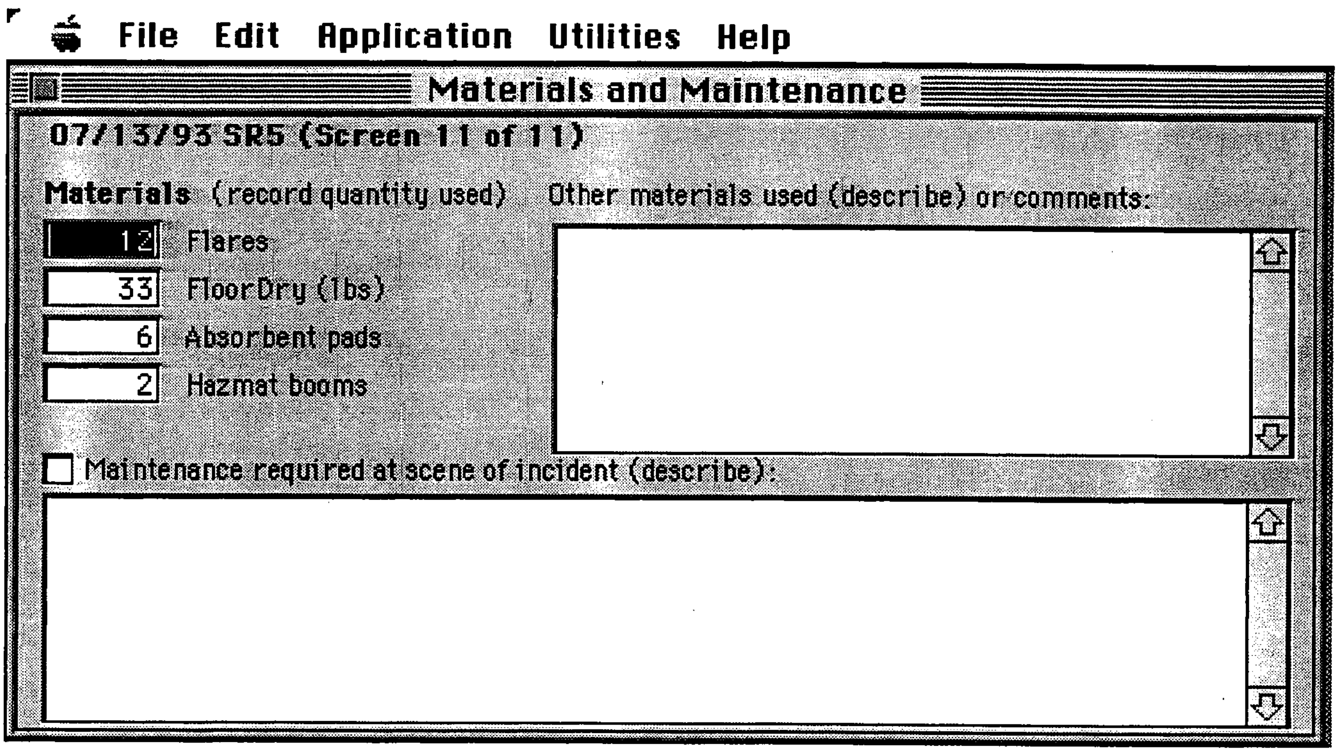
Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
L	ag_wsdot	WSDOT	
L	ag_wsp	Washington State Patrol (WSP)	
L	ag_doe	Department of Ecology (DOE)	
L	ag_ces	County Emergency Service	
L	ag_fd	Fire Department	
L	ag_cop	County Police	
L	ag_cip	City Police	
L	ag_other	Other	
C	ag_lead	Lead agency	WSDOT Washington State Patrol Department of Ecology (DOE) County Emergency Service Fire Department County Police City Police Other
C	region	WSDOT region	Eastern North Central Northwest Olympic South Central Southwest
N	maintarea	Maintenance area	
		Cleanup	
L	equipdela	Delayed to off-peak time	
C	ag_cleanup	Agency responsible for cleanup	WSDOT Department of Ecology (DOE) Owner/operator of vehicle Other agency Towing company
C	tow_name	Towing company	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Agency Involvement
07/13/93 SR5 (Screen 10 of 11)
Agencies involved
WSDOT
Washington State Patrol (WSP)
Department of Ecology (DOE)
County Emergency Service
Fire Department
County Police
City Police
Other
Fire Department
Lead agency
WSDOT region
5
Maintenance area
Cleanup
Delayed to off-peak time
Agency responsible for cleanup
Towing company

Field type	Field name	Information to record as it appears on the data-entry screen	List popup items
N	material_a	Flares	
N	material_b	FloorDry (lbs)	
N	material_c	Absorbent pads	
N	material_d	Hazmat booms	
L	maintain_r	Maintenance required at scene of incident (describe):	
M	maintain	(Text-edit region to describe maintenance that should be reported or performed)	
M	material	Other materials used (describe) or comments:	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)


File Edit Application Utilities Help
Materials and Maintenance
07/13/93 SR5 (Screen 11 of 11)
Materials (record quantity used)
12 Flares
33 FloorDry (lbs)
6 Absorbent pads
2 Hazmat booms
Other materials used (describe) or comments:
Maintenance required at scene of incident (describe):

Alphabetical List of Field Names and Field Characteristics

activity	C
ag_ces	L
ag_cip	L
ag_cleanup	C
ag_cop	L
ag_doe	L
ag_fd	L
ag_lead	C
ag_other	L
ag_wsdot	L
ag_wsp	L
citynumber	N
citynumber	N
class	C
comments	M
construct	L
county_no	N
county_no	N
cpveh_desc	C
date_end	D
date_incid	D
date_prep	D
detour	L
dot_a	N
dot_b	N
dot_c	N
dot_cell	N
dot_d	N
dot_e	N
dot_f	N
dot_g	N

dot_h	N
dot_i	N
dot_j	N
dot_k	N
dot_l	N
dot_m	N
dot_n	N
dot_o	N
dot_p	N
drivinit	C
drvaddr1	C
drvaddr2	C
drvcity	C
drvfname	C
drvlname	C
drvphone1	C
drvphone2	C
drvstate	C
drvzip	C
duration	N
employees	M
equipdela	L
fire	L
func_code	C
hazard	L
haz_code	N
insurance	L
insurer	C
ins_city	C
ins_no	C
ins_phone	C

intersect	M
job_no	C
lane_close	C
lane_hov	L
lane_in	L
lane_no1 lane1_open	L N
lane_no2 lane2_open	L N
lane_no3 lane3_open	L N
lane_no4 lane4_open	L N
lane_no5 lane5_open	L N
lane_out	L
licsno	C
licstate	C
light	C
maintain	M
maintain_r	L
maintarea	N
malfunc	L
malfunc_m	M
material	M
material_a	N
material_b	N
material_c	N
material_d	N
milepost	N
name_prep	C
night	C
nonhazard	L

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Alphabetical List of Field Names and Field Characteristics

non_a	N
non_b	N
non_c	N
other	L
region	C
road_1	L
road_2	L
road_3	L
road_4	L
route	M
spill	L
state_rout	N
surface	C
surface_a	M
time_arriv	N
time_call	N
time_depar	N
time_incid	N
tow_name	C
tow_request	L
travel	C
trooper_no	C
type_dis	C
vehfatal	N
vehinjure	N
vehlicens	C
vehmake	C
vehmodel	C
vehoccup	N
vehstate	C
vehvin	C

vehyear	N
veh_type1	N
veh_type10	N
veh_type11	N
veh_type12	N
veh_type2	N
veh_type3	N
veh_type4	N
veh_type5	N
veh_type6	N
veh_type7	N
veh_type8	N
veh_typea	C
veh_typeb	C
veh_typem	M
weather_1	L
weather_2	L
weather_3	L
weather_4	L
weather_5	L
weather_6	L
wsdot1 wsdot1_emp wsdot1hrs	N L N
wsdot2 wsdot2_emp wsdot2hrs	N L N
wsdot3 wsdot3_emp wsdot3hrs	N L N
wsdot4 wsdot4_emp wsdot4hrs	N L N

wsdot5 wsdot5_emp wsdot5hrs	N L N
wsdot6 wsdot6_emp wsdot6hrs	N L N
wsdot8 wsdot8_emp wsdot8hrs	N L N
wsdot9 wsdot9_emp wsdot9hrs	N L N
wsp_acc	N
wsp_case	C
wsp_unit	C

Key to field types: C—Character N—numeric M—memo (text-edit region) L—logical (yes/no; true/false)

Alphabetical Listing of Field Names and Corresponding Data-Entry Screen Prompts

Field name	Information to record as it appears on the data-entry screen	List popup items[a]
activity	Activity	Incident Response; Disabled Vehicle; Other
ag_ces	County Emergency Service	
ag_cip	City Police	
ag_cleanup	Agency responsible for cleanup	WSDOT Department of Ecology (DOE) Owner/operator of vehicle Other agency Towing company
ag_cop	County Police	
ag_doe	Department of Ecology (DOE)	
ag_fd	Fire Department	
ag_lead	Lead agency	WSDOT Washington State Patrol Department of Ecology (DOE) County Emergency Service Fire Department County Police City Police Other
ag_other	Other	
ag_wsdot	WSDOT	
ag_wsp	Washington State Patrol (WSP)	
citynumber	Scrollable list: all incorporated cities in Washington and their corresponding codes	
citynumber	Nearest city (enter number)	
class	Classification	Fatality Personal injury Property damage Hazardous material Disabled vehicle Debris blocking traffic Other
comments	Comments: Describe cargo/spillage that was cleared from the site, how it was disposed of, where it was stored, etc. Also record additional details, comments, or problems that may require future discussion or action.	
construct	In construction zone	

Key to field types: C—Character N—numeric M—memo (text-edit region) L—logical (yes/no; true/false)

Field name	Information to record as it appears on the data-entry screen	List popup items[a]
county_no	Scrollable list: Washington counties/codes	
county_no	County name (enter number)	
cpveh_desc	Description of other vehicle type	
date_end	Date incident ended (if applicable)	
date_incid	Activity date	
date_prep	Report date	
detour	Detour required?	
dot_a	5A3--4 x 2	
dot_b	8A10--TM	
dot_c	5A8--1 ton 4 x 2 flatbed	
dot_cell	(Cellular phone number)	
dot_d	5A21--IRT	
dot_e	6A6--26-32M 4 x 2 diesel	
dot_f	Flatbed--guardrail repair	
dot_g	13A1--3/4 yard front end loader	
dot_h	15A1--self-propelled sweeper	
dot_i	Blower	
dot_j	Diesel pump	
dot_k	Night lighting system	
dot_l	Push bumper	
dot_m	Cellular phone	
dot_n	Arrowboard	
dot_o	6A13--tandem axle dump truck	
dot_p	8A5--state two trucks	
drivinit	Middle initial	
drvaddr1	Mailing address	
drvaddr2	Apartment number or other address	
drvcity	City	
drvfname	First name	
drvlname	Driver's last name	
drvphone1	Phone number	
drvphone2	Other phone	
drvstate	State/province	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Field name	Information to record as it appears on the data-entry screen	List popup items[a]
drvzip	ZIP/Postal code	
duration	Duration	
employees	(Text-edit region to record additional information)	
equipdela	Delayed to off-peak time	
fire	Fire involved	
func_code	Function code	Guardrail (54) Flagging (55)
hazard	Hazardous material (code):	
haz_code		
insurance	Insurance?	
insurer	Causing party's insurer (name)	
ins_city	City	
ins_no	Policy number	
ins_phone	Insurer's (or agent's) phone number	
intersect	Intersection/nearest landmark	
job_no	WSDOT job number	
lane_close	Lanes closed	Single lane Multiple lanes All lanes—both directions All lanes—one direction Ramp Intersection
lane_hov	HOV lane	
lane_in	Inside shoulder	
lane_no1 lane1_open	Lane 1 (outside) Time opened	
lane_no2 lane2_open	Lane 2 Time opened	
lane_no3 lane3_open	Lane3 Time opened	
lane_no4 lane4_open	Lane 4 Time opened	
lane_no5 lane5_open	Lane 5 Time opened	
lane_out	Outside shoulder	
licsno	License number	
licstate	Issuing state/province	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Field name	Information to record as it appears on the data-entry screen	List popup items[a]	
light	Light	Day Dawn	Night Dusk
maintain	(Text-edit region to describe maintenance that should be reported or performed)		
maintain_r	Maintenance required at scene of incident (describe):		
maintarea	Maintenance area		
malfunc	Equipment failure (describe):		
malfunc_m	(Text edit area to describe equipment malfunctions)		
material	Other materials used (describe) or comments:		
material_a	Flares		
material_b	FloorDry (lbs)		
material_c	Absorbent pads		
material_d	Hazmat booms		
milepost	Milepost		
name_prep	Name of person preparing report	Jerry Althauser Dan Berry Lester Eastlick Bob George Greg Hansen Bob Kofstad Tim McBride	Ron Morton Don O'Brien Lori Parise John Parkinson Larry Roberts Steve Russell Other
night	Night	Street lights ON Street lights OFF	NO street lights
nonhazard	Nonhazardous material		
non_a	Tow truck		
non_b	Recovery vehicle		
non_c	Crane		
other	Other		
region	WSDOT region	Eastern North Central Northwest Olympic South Central Southwest	
road_1	Dry		
road_2	Wet		

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Field name	Information to record as it appears on the data-entry screen	List popup items[a]
road_3	Ice	
road_4	Snow	
route	(Text-edit region): Describe route and cause of incident:	
spill	Fuel spillage	
state_rout	State Route—Use numbers only: e.g., 005 = Interstate 5, 101 = SR 101, 090 = Interstate 90, 520 = SR 520	
surface	Roadway surface	Concrete; Asphalt; Other
surface_a	Other roadway surface	
time_arriv	Time first IRT member arrived	
time_call	Time IRT received call	
time_depar	Last IRT member departed	
time_incid	Time occurred	
tow_name	Towing company	
tow_request	Tow requested (enter agency name):	
travel	Direction of travel	East; West; North; South; Both ways: East-West; Both ways: North-South
trooper_no	Trooper number (RN)	
type_dis	Type of disabled	Flat tire; Out of gas; Mechanical breakdown; UTL; Overheated; Abandoned vehicle; Accident; Other
vehfatal	Number of fatally injured	
vehinjure	Number of injured	
vehlicens	Vehicle license number	
vehmake	Vehicle make	
vehmodel	Vehicle model	
vehoccup	Number of occupants in causing party's vehicle	
vehstate	State/province issued	
vehvin	Vehicle identification number (VIN)	
vehyear	Vehicle year	
veh_type1	Passenger car	
veh_type10	Bus or motor stage	
veh_type11	School bus	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Field name	Information to record as it appears on the data-entry screen	List popup items[a]
veh_type12	Motorcycle	
veh_type2	Truck (pickup/van <10,000 lbs)	
veh_type3	Truck (flatbed/panel delivery)	
veh_type4	Truck and trailer	
veh_type5	Truck tractor and semi-trailer	
veh_type6	Other truck combinations	
veh_type7	Other (describe):	
veh_type8	Farm tractor and/or equipment	
veh_typea	Vehicle type	Bus or motor stage Farm tractor and/or equipment Motorcycle Passenger car School bus Other
veh_typeb	Truck combinations	Truck (pickup/van < 10,000 lbs) Truck (flatbed/panel delivery) Truck and trailer Truck tractor and semi-trailer Other truck combinations
veh_typem	(Description of other vehicle type)	
weather_1	Rain	
weather_2	Snow	
weather_3	Cloudy	
weather_4	Fog	
weather_5	Windy	
weather_6	Clear	
wsdot1 wsdot1_emp wsdot1hrs	Maintenance Tech 1	
wsdot2 wsdot2_emp wsdot2hrs	Maintenance Tech 2	
wsdot3 wsdot3_emp wsdot3hrs	Maintenance Tech 3	
wsdot4 wsdot4_emp wsdot4hrs	Maintenance Tech Lead	
wsdot5 wsdot5_emp wsdot5hrs	Maintenance Supervisor	

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Field name	Information to record as it appears on the data-entry screen	List popup items[a]
wsdot6 wsdot6_emp wsdot6hrs	Incident Response Supv.	
wsdot8 wsdot8_emp wsdot8hrs	Other	
wsdot9 wsdot9_emp wsdot9hrs	IR Lead Tech	
wsp_acc	WSP accident number	
wsp_case	WSP case no.	
wsp_unit	Investigation unit	None Tape Total station

Key to field types: **C**—Character **N**—numeric **M**—memo (text-edit region) **L**—logical (yes/no; true/false)

Database File Structure

Structure for table: INCIDENT.DBF
Number of data records:
Date of last update: 09/25/95
Memo file block size: 64
Code Page: 0

Field	Field Name	Type	Width	Dec	Index	Collate
1	CITYNUMBER	Numeric	4		Asc	Machine
2	COUNTY_NO	Numeric	2		Asc	Machine
3	CITYNAME	Character	30			
4	COUNTYNAME	Character	15			
5	ACTIVITY	Character	25			
6	DATE_PREP	Date	8			
7	DATE_INCID	Date	8			
8	TIME_INCID	Numeric	4			
9	NAME_PREP	Character	25			
10	TOW_REQUES	Logical	1			
11	TOW_NAME	Character	55			
12	JOB_NO	Character	7			
13	CLASS	Character	30			
14	TYPE_DIS	Character	20			
15	HAZARD	Logical	1			
16	HAZ_CODE	Numeric	4			
17	SPILL	Logical	1			
18	FIRE	Logical	1			
19	NONHAZARD	Logical	1			
20	OTHER	Logical	1			
21	VEHLICENS	Character	20			
22	VEHSTATE	Character	20			
23	VEHYEAR	Numeric	4			
24	VEHMAKE	Character	20			
25	VEHMODEL	Character	20			
26	VEHVIN	Character	17			
27	INSURANCE	Logical	1			
28	INSURER	Character	20			
29	INS_CITY	Character	20			
30	INS_NO	Character	20			
31	INS_PHONE	Character	14			
32	VEHOCCUP	Numeric	3			
33	VEHINJURE	Numeric	3			
34	VEHFATAL	Numeric	3			
35	STATE_ROUT	Numeric	3			
36	MILE_POST	Numeric	5	1		
37	TRAVEL	Character	25			
38	INTERSECT	Memo	10			
39	LANE_CLOSE	Character	25			
40	SURFACE	Character	20			
41	SURFACE_A	Memo	10			
42	ROAD_1	Logical	1			
43	ROAD_2	Logical	1			
44	ROAD_3	Logical	1			
45	ROAD_4	Logical	1			
46	NIGHT	Character	17			
47	LIGHT	Character	5			
48	WEATHER_1	Logical	1			
49	WEATHER_2	Logical	1			
50	WEATHER_3	Logical	1			
51	WEATHER_4	Logical	1			
52	WEATHER_5	Logical	1			
53	WEATHER_6	Logical	1			
54	VEH_TYPE10	Numeric	2			
55	VEH_TYPE8	Numeric	2			
56	VEH_TYPE12	Numeric	2			

57	VEH_TYPE1	Numeric	2	
58	VEH_TYPE11	Numeric	2	
59	VEH_TYPE2	Numeric	2	
60	VEH_TYPE3	Numeric	2	
61	VEH_TYPE4	Numeric	2	
62	VEH_TYPE5	Numeric	2	
63	VEH_TYPE6	Numeric	2	
64	VEH_TYPE7	Numeric	2	
65	VEH_TYPEM	Memo	10	
66	VEH_TYPEA	Character	30	
67	VEH_TYPEB	Character	30	
68	CPVEH_DESC	Character	35	
69	TIME_CALL	Numeric	4	
70	TIME_ARRIV	Numeric	4	
71	TIME_DEPAR	Numeric	4	
72	DATE_END	Date	8	
73	WSDOT1	Numeric	1	
74	WSDOT1_EMP	Logical	1	
75	WSDOT1HRS	Numeric	5	1
76	WSDOT2	Numeric	1	
77	WSDOT2_EMP	Logical	1	
78	WSDOT2HRS	Numeric	5	1
79	WSDOT3	Numeric	1	
80	WSDOT3_EMP	Logical	1	
81	WSDOT3HRS	Numeric	5	1
82	WSDOT4	Numeric	1	
83	WSDOT4_EMP	Logical	1	
84	WSDOT4HRS	Numeric	5	1
85	WSDOT9	Numeric	1	
86	WSDOT9_EMP	Logical	1	
87	WSDOT9HRS	Numeric	5	1
88	WSDOT5	Numeric	1	
89	WSDOT5_EMP	Logical	1	
90	WSDOT5HRS	Numeric	5	1
91	WSDOT6	Numeric	1	
92	WSDOT6_EMP	Logical	1	
93	WSDOT6HRS	Numeric	5	1
94	WSDOT8	Numeric	1	
95	WSDOT8_EMP	Logical	1	
96	WSDOT8HRS	Numeric	5	1
97	EMPLOYEES	Memo	10	
98	COMMENTS	Memo	10	
99	DOT_A	Numeric	1	
100	DOT_C	Numeric	1	
101	DOT_D	Numeric	1	
102	DOT_E	Numeric	1	
103	DOT_O	Numeric	1	
104	DOT_P	Numeric	1	
105	DOT_B	Numeric	1	
106	DOT_G	Numeric	1	
107	DOT_H	Numeric	1	
108	DOT_F	Numeric	1	
109	DOT_I	Numeric	1	
110	DOT_K	Numeric	1	
111	DOT_J	Numeric	1	
112	DOT_N	Numeric	1	
113	DOT_M	Numeric	1	
114	DOT_CELL	Numeric	10	
115	DOT_L	Numeric	1	
116	MALFUNC	Logical	1	
117	MALFUNC_M	Memo	10	
118	NON_A	Numeric	1	
119	NON_B	Numeric	1	
120	NON_C	Numeric	1	
121	CONSTRUCT	Logical	1	

122	FUNC_CODE	Character	15	
123	LANE_OUT	Logical	1	
124	LANE_IN	Logical	1	
125	LANE_HOV	Logical	1	
126	LANE_NO1	Logical	1	
127	LANE1_OPEN	Numeric	4	
128	LANE_NO2	Logical	1	
129	LANE2_OPEN	Numeric	4	
130	LANE_NO3	Logical	1	
131	LANE3_OPEN	Numeric	4	
132	LANE_NO4	Logical	1	
133	LANE4_OPEN	Numeric	4	
134	LANE_NO5	Logical	1	
135	LANE5_OPEN	Numeric	4	
136	DETOUR	Logical	1	
137	ROUTE	Memo	10	
138	WSP_CASE	Character	8	
139	TROOPER_NO	Character	4	
140	WSP_ACC	Numeric	15	
141	DURATION	Numeric	6	1
142	WSP_UNIT	Character	15	
143	DRVLNAME	Character	20	
144	DRVFNAME	Character	20	
145	DRVINIT	Character	1	
146	LICSNO	Character	20	
147	LICSTATE	Character	20	
148	DRVADDR1	Character	30	
149	DRVADDR2	Character	30	
150	DRVCITY	Character	25	
151	DRVSTATE	Character	20	
152	DRVZIP	Character	10	
153	DRVPHONE1	Character	14	
154	DRVPHONE2	Character	14	
155	AG_WSDOT	Logical	1	
156	AG_WSP	Logical	1	
157	AG_DOE	Logical	1	
158	AG_CES	Logical	1	
159	AG_FD	Logical	1	
160	AG_COP	Logical	1	
161	AG_CIP	Logical	1	
162	AG_OTHER	Logical	1	
163	AG_LEAD	Character	30	
164	REGION	Character	15	
165	MAINTAREA	Numeric	1	
166	EQUIPDELA	Logical	1	
167	AG_CLEANUP	Character	30	
168	MATERIAL_A	Numeric	3	
169	MATERIAL_B	Numeric	3	
170	MATERIAL_C	Numeric	3	
171	MATERIAL_D	Numeric	3	
172	MAINTAIN_R	Logical	1	
173	MAINTAIN	Memo	10	
174	MATERIAL	Memo	10	
** Total **			1267	

Structure for table: CITY.DBF
Number of data records: 271
Date of last update: 09/06/95
Code Page: 0

Field	Field Name	Type	Width	Dec	Index	Collate
1	CITYNUMBER	Numeric	4		Asc	Machine
2	CITYNAME	Character	30		Asc	Machine
3	CITY	Character	30		Asc	Machine
** Total **			65			

Structure for table: COUNTY.DBF
Number of data records: 39
Date of last update: 07/09/95
Code Page: 0

Field	Field Name	Type	Width	Dec	Index	Collate
1	COUNTY_NO	Numeric	2		Asc	Machine
2	COUNTYNAME	Character	15		Asc	Machine
3	COUNTY	Character	18		Asc	Machine
** Total **			36			

APPENDIX C

A DEMONSTRATION OF THE USE OF GEOGRAPHIC INFORMATION SYSTEMS FOR INCIDENT MANAGEMENT

A DEMONSTRATION OF THE USE OF GEOGRAPHIC INFORMATION SYSTEMS FOR INCIDENT MANAGEMENT

by

Michael Edward Shine

A thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Science in Civil Engineering

University of Washington

1992

Approved by ______________________________
(Chairperson of Supervisory Committee)

Program Authorized
to Offer Degree ______________________________

Date ______________________________

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CHAPTER 1. INTRODUCTION

The purpose of this report is to demonstrate how a Geographic Information System (GIS) can be used to collect, store, and analyze incident data. The demonstration will focus on SR 5, SR 90, SR 405, and SR 520 in Seattle, since they are the primary routes used by travelers to commute to the central business district. The report will also show how additional data that is related to incidents, but associated with highway segments can be incorporated into a GIS using the process of dynamic segmentation.

In recent years, incident management has received increasing attention as a low cost way to improve the level of service on highways in urban areas. The premise is that by reducing delays caused by incidents, the existing transportation network is able to function more efficiently, and thereby help reduce the demand for expensive, new facilities.

In Seattle, the Washington State Department of Transportation (WSDOT) has implemented an incident management plan that includes the Incident Response Team (IRT). The IRT responds to severe incidents and works with other agencies to clear the incident and restore full capacity to the roadway as soon as possible.

In order to study incidents, evaluate their impact on traffic, and to monitor the effectiveness of incident management strategies such as the IRT, it is necessary to collect and consolidate incident data. Of particular interest is information relating to accidents and disabled vehicles, since these are the most common forms of incidents occurring on Washington's highways. [1]

Currently there are three sources of data for this information; WSDOT's Accident Data Branch, the Incident Response Team, and the Washington State Patrol (WSP) Computer Aided Dispatch (CAD) System.

Each agency has unique and valuable information for studying incidents. The Accident Data Branch has a complete listing of all accidents occurring on state highways. The Incident Response Team maintains an internal database on all the events it responds to. It contains such information as the number of lanes blocked and the duration of the event. The WSP Computer Aided Dispatch System contains the only known source of disabled vehicle information.

A relational database might be used to consolidate and analyze this information. However, a relational database lacks an important capability. That is the ability to analyze and display information spatially. To do this requires a geographic information system (GIS). A GIS is defined as a computerized database management system for the capture, storage, retrieval, analysis, and display of spatial (locationally defined) data. [2]

When studying incidents, or most other transportation related events, it is beneficial to be able to show where it is located. This allows for patterns to be disseminated, such as where do alcohol related accidents occur, or where is the highest concentration of disabled vehicles during the afternoon peak period? Also, there are other factors to consider that relate to incidents, but are not included in the three data sources. These include such things as pavement condition, roadway geometrics, traffic volumes, shoulder width, signage, and signalization. [3] A GIS using a common geographic referencing system can associate all of these factors with a particular incident to allow for a more detailed examination as to the incidents cause, and what effect it will have on the traffic flow.

CHAPTER 2 BACKGROUND

INTRODUCTION

The purpose of this chapter is to provide the reader with general information on incident management programs in the Seattle area, the databases being used in this study, and geographic information systems.

INCIDENT MANAGEMENT

An incident can be defined as any random event which reduces the capacity of the roadway. It includes traffic accidents, disabled vehicles, spilled loads, adverse weather conditions, and congestion caused by special events. [4] The impact of these incidents can be severe, particularly when they occur during peak travel periods. An accident that blocks one lane of a two lane freeway reduces the capacity of that segment by more than 50%. When an incident occurs that results in the reduced capacity of the road being less than the upstream volume, congestion results.

To reduce the effects of incidents on the transportation network, many agencies have developed incident management plans. These plans can be defined as a coordinated and preplanned approach used to restore freeway traffic to normal operations as quickly as possible after an incident has occurred by using human and mechanical means. [4]

In the Seattle area, the Washington State Department of Transportation (WSDOT) has developed the Incident Response Team (IRT). The IRT responds to incidents which result in the blockage of one or more lanes for more than one hour. The team typically takes care of traffic control at the site along with ensuring that the physical condition of the road is acceptable for normal traffic.

DATABASES

WSDOT Accident Data Branch

The Washington State Department of Transportation, through its Accident Data Branch (ADB), maintains a complete list of all the accidents occurring on state highways. The data is originally collected by the Washington State Patrol (WSP) from accidents reports, and manually entered into a computer using numeric codes for descriptive labels. WSP is the official custodian of all accident records for the state, and therefore stores all city, county, and state accident data.

After the data has been entered into the WSP computer, accidents occurring on state highways are selected from the main data file and sent to the ADB on magnetic tape for additional coding and storage. ADB then disseminates this information throughout WSDOT using its Micro Computer Collision Analysis Report System (MicroCARS).

MicroCARS is a combination relational database (dBASE 4) and statistical analysis package (SPSSPC+) used by WSDOT to statistically analyze accidents. It is capable of selecting accidents from one or more stretches of a state route, or it can select records meeting certain criteria such as collision type or alcohol involvement from the entire state highway system.

After selecting the records from the database, SPSSPC+ replaces the numeric codes with descriptive labels and produces standard reports if they are requested. It is also capable of performing detailed statistical analysis of the selected records.[5]

The variables included in MicroCARS along with their definitions are given in Table 1. Descriptions of the coded variables are given in Appendix A.

Incident Response Team Data

One of the functions of the IRT is to collect data on the incidents it responds to. At present it does this using a C program which was developed in-house. After being compiled, the source code for this program was lost due to a hardware failure. Although the program functions adequately for storing the data, it is unable to print out the information to an ASCII file which makes it of limited use.

To prepare the data for this project, the 1991 IRT data was manually keyed into a spreadsheet program and then saved as a comma delimited ASCII file. This file is given in Appendix B.

Much of the data recorded by the Incident Response Team is the same as that stored in MicroCARS. This duplication of data is wasteful and can be eliminated if a common field is used to relate the two data sources. Typically, records have been attempted to be matched using the route and milepost. This has caused difficulties because milepost signs only occur every mile on the state routes and the data has been coded to the hundredth of a mile. The error introduced when the approximation to hundredths of miles occurs makes it difficult to match records based on milepost alone.

The type of data collected by the IRT and included in this project are given in Table 2.

Washington State Patrol Computer Aided Dispatch

The Washington State Patrol (WSP) is the only agency in the state that maintains disabled vehicle information. It does this through its Computer Aided Dispatch (CAD) System. The CAD keeps a record of all activities WSP respond to including accidents and disabled vehicles.

The system works by having dispatchers input data to the system when it is called in from troopers. The CAD system is capable of searching and selecting records from its data storage unit, but the output format is fairly inflexible. Also, the structure of the data is such that it is not capable of being read into a database.

Gaining access to this system proved difficult for several reasons. One being the WSP reluctance to allow outsiders access. They cite security reasons as a primary concern, and possible system degradation if to many people are using the system.

There is one terminal that WSDOT personnel have access to at the Traffic Systems Management Center (TSMC). Even there access is limited and the only way to get output is on paper. The terminal does not have a way to write information to disk or tape.

TIGER System

For the 1990 census, the Bureau of the Census in cooperation with the US. Geological Survey developed the Topological Integrated Geographic Encoding and Referencing (TIGER) System. The TIGER System is a database which contains information for creating a geographic base file (GBF).

TIGER contains information for digitally creating every road in the nation, and also includes the address ranges for every street segment in the 345 largest cities in the US. TIGER Files also hold the data necessary to create all of the railroads, hydrographic features, and airports in a GIS. Additionally, all the boundaries, names, and numeric codes used by the Census Bureau in the 1990 Census are included. This means that data collected by the Census Bureau can be georeferenced to its corresponding area in a Geographic Information System. [6] Data from the 1980 Urban Transportation Planning Package (UTPP), which contains journey-to-work information is also capable of being assigned to the census geography. [3]

TIGER Files were made by combining GBF/DIME (Dual Independent Map Encoding) Files, US Geological Service 1:100,000 maps, and geographic area relationships files used for tabulating the 1980 census data.

GBF/DIME files were created for the 1970 Census of Housing and Population so that census data could be collected by mail in large urban areas. It not only contains street segment information for the largest urban areas in the nation, but also any additional data needed to form the boundaries of geographic areas not bounded by streets. This segment data includes railroads, shorelines, and political jurisdictions.

Since GBF/DIME Files only cover about two percent of the nation's land surface, the US. Geological Survey National Map Series were scanned to provide the base map of the remaining area. To this data was added the geographic areas used by the Census Bureau for collecting and maintaining population and housing data. [7]

GEOGRAPHIC INFORMATION SYSTEMS

Introduction

A GIS is a computerized database management system for the capture, storage, retrieval, analysis, and display of spatial (locationally defined) data. [2] Since incident data, like all other transportation data, is locationally defined, it is only natural to store and analyze this data with a geographic information system.

Like a computer aided mapping system (CAM), a GIS can display and manipulate data graphically. However, unlike a CAM, a GIS can relate spatial objects to its non-spatial attributes. For example, an incident occurs at a certain location on a road. A CAM can show on a drawing where it occurred, but it can not store information about the incident such as the age of the driver, and the weather conditions at the time of the accident. To do this requires a GIS.

A Geographic Information System works by storing two types of data;

spatial data which shows where a feature is located, and non-spatial (or attribute) data that describe the feature. By combining the two together, the ability to perform spatial analysis and manipulation is gained.

Spatial analysis and manipulation is important for several reasons. One being that it allows diverse data sets to be merged based on their geographic locations. The effect an accident has on traffic flow is in some degree related to the amount of shoulder space available at the accident site. A large shoulder allows travelers to maneuver around the accident, while the absence of a shoulder forces commuters to merge into other lanes to bypass the impact site. Merging the two in a traditional database might be difficult because of varying file and data structure. However, since both have a spatial location, the two can be joined in a GIS based on their location.

Another benefit is that is allows data to be outputted as a thematic map or chart rather than a printout. This allows for easy pattern recognition. A map showing the location of all alcohol related accidents is much more informative than a printout describing the route and mileposts of the events.

Finally, the ability to perform spatial analysis is unique to a GIS. A traditional database has no concept of distance or area. As such, it would be difficult to determine which accidents occur within a one mile radius of an intersection. A GIS can easily accomplish this because its spatial database and attribute database are joined.

Attribute Data

Attributes are information stored about a spatial object. In the case of an incident it may include the time, number of vehicles involved, and the weather conditions. This data is stored separately from its spatial counterpart, but linked to it by its spatial identifier.

An attribute database performs the same functions as a traditional database. It stores and analyzes non-spatial data. It is capable of executing Structured Query Language (SQL) commands, cross tabulations, and simple statistical analysis. The data can also be down loaded to other software applications for more detailed analysis.

Spatial Data

In a Geographic Information System, spatial data is composed of points, lines, and areas. This information is stored separately from attribute data because of the need to quickly produce plots and perform screen updates.

The basic spatial element is the point. Lines are made by joining points together, and areas are made by joining lines. A typical use of a point feature is a traffic sign or an incident. A line feature is normally used for road segments and culverts. Area features may include traffic analysis zones or census tracts.

Dynamic Segmentation

Geographic Information Systems were originally developed for use with environmental and natural resource applications. These applications deal primarily with areas, so GIS capabilities center mainly around polygon manipulations. [3] In the field of transportation, the major spatial element used is the line segment. Although point and area features are important, their importance is determined by how they affect the transportation network. For this reason, GIS use by transportation agencies has been limited. However, new developments in GIS technology show promise for dealing with linear elements. The most promising of these developments is called dynamic segmentation.

One of the major difficulties in modeling a transportation network is determining how it should be segmented. This is important because a model with to few segments will not be accurate, while a model with to many segments will be to large and have redundant information.

There have been several ways used to model transportation networks in the past. One is to use a separate network for each attribute of interest. Using the road depicted in figure 1 as an example, there will be three separate networks. One for the number of lanes, one for the shoulder width, and one for the volume. Spatial queries can then be answered by using line overlay techniques. Such a query might be, where is a four lane road with no shoulder and has a volume of less than 5000?

The problem with this method is that as the number of attributes of interest increase, so does the number of networks that must be stored. This results in large storage requirements and degradation in system performance.

Another method is to segment the roadway based on a specific attribute and then apply other attributes to the existing segmentation. Again using figure 1, if the road is originally segmented based on the number of lanes, the first segment will have 3, 6, and 4000 stored in its attribute table for the number of lanes, shoulder width, and volume respectively. However, storing a value for the shoulder width and volume for the second segment is more difficult. Since only a single attribute value can be stored for a segment, obviously whatever value is used will only be accurate for a portion of the segment. This method succeeds in reducing the number of networks needed to be stored, but does so at the cost of accuracy in the model.

Another alternative in segmenting the roadway is to divide the roadway into extremely small sections. Dividing the 10 mile roadway shown in figure 1 at every tenth or hundredth of a mile retains accuracy and keeps the number of network models to be stored down. However, redundancy again occurs as information is repeatedly stored for each segment. The result is the size of the attribute database increases and system performance slows.

The solution to the above problem is called dynamic segmentation. It works by storing the transportation network segmented solely on topology, although other a priori segmentation can be introduced. The attributes are stored separately and the user decides which attributes are to be used for segmentation based on the application. Using the selected attributes, the beginning of the segment is initialized. Thereafter, whenever the value of a selected attribute changes, a node is introduced, changing attributes are updated and unchanging attributes are carried forward to the new segment. [8,9]

Referring to figure 1, if the attributes of interest are the number of lanes and volume, the values of 3 and 4000 would be stored at mile post 0. At mile post 2.1, the road would be segmented and values of 4 and 4000 are stored in the attribute table. At milepost 4.8, another segmentation occurs with values of 4 and 6000. Finally, at mile post 9.1, the road is segmented again with values of 4 for the number of lanes, and 3000 for volume stored in the attribute table.

Dynamic segmentation results in only one network model needing to be stored and only the attribute data necessary for the application being used. Clearly this minimizes storage requirements for the GIS and maximizes system performance. Also, since a priori segmentation is not used, it is easy to add or delete attributes in the geographic information system.

Milepost Geocoding

Another problem with using geographic information systems with transportation applications is the way in which locations are typically stored. GIS normally works with either longitude and latitude, or state plane coordinate systems. Transportation agencies, however, typically use route name and mile posts for locating either point or segment features. [10]

To deal with this problem, GIS developers are using milepost geocoding. This process works by assigning a mile post to each end of a segment. Since the length of the segment is known along with the milepost range, it is possible to interpolate any milepost within the range to a location on the segment. This allows both x and y coordinates to be determined. Typically, the length and milepost range for a given segment are not equal. This occurs because of digitizing errors, measurement errors, or roadway realignment. Milepost geocoding compensates for this by proportioning the error throughout the segment.

Address Matching

One of primary reasons the Census Bureau developed the GBF/DIME, and later the TIGER, System was to assign addresses to census areas for tabulation. Because of the availability of address ranges in the large urban areas, many GIS vendors have developed address matching procedures. These procedures look at the route name and address to assign a point object to a location along the segment. The procedures work by dividing the length of the segment by the difference in the address range. The distance is then proportioned along the address range with each address being an equal distance from each other.

In most cases, streets are addressed by having odd numbers on one side and even numbers on the other. Address matching procedures allow for this by reading from the address ranges which side of the street is odd and even, and assigning the points accordingly.

One of the problems with address matching is that in urban areas, dwellings are frequently not linearly apportioned along the street. In fact, in many areas there are large gaps in the addresses of adjacent units. Sometimes even different floors of the same building are given different addresses. This reduces the accuracy of the address matching geocoding process when nonlinear forms of addresses are used. However, when a linear address system is used, as in mileposts, the procedure is capable of locating the events quite accurately on the segments.

SUMMARY

This chapter explains the impact of incidents on the transportation network and the need for incident management. It then goes on to explain why it is necessary to collect and analyze incident data. Also included is a detailed examination of the databases available to create an incident management geographic information system in the Seattle area.

The last section of this chapter give a brief description of how information is stored and manipulated in a GIS. Several new procedures for working with transportation related data are then covered. These procedures, which include dynamic segmentation, milepost geocoding, and address matching, are necessary for building an incident management GIS. The necessity arises from the fact that transportation data is usually located by route name and milepost, while GIS typically work in real world coordinate systems. Without procedures to convert between the two, it would not be possible to use the existing data sources.

Table 1. MicroCARS Variables

FIELD #	ACCIDENT DATA ELEMENT & SPSSPC NAME
1	Year - YEAR
2	Month - MONTH
3	Day of Month - DAY
4	Day of Week - WEEKDAY
5	Hour - HOUR
6	Minute - MIN
7	County Number - COUNTY
8	City Number - CITY
9	State Route Number - SR
10	State Route Additional Identifier - ADID (A)
11	State Route Sequence Number - SEQ
12	State Route Milepost - MP (No Decimal Point)
13	Ahead / Back Equation - EQT (A)
14	WSDOT District Number - DIST
15	Urban / Rural Location - UR (A)
16	Functional Class of Road - FC
17	Administrative Class of Road - ADM
18	Prefix 1 - PREFIX1
19	Prefix 2 - PREFIX2 (A)
20	Accident Severity - SEVERITY
21	Number of Injuries - INJURYS
22	Number of Fatalities - FATALS
23	Most Severe Injury of Accident - MSVJ
24	Number of Vehicles in Accident - VEH
25	Amount of Property Damage $ - PDO
26	Character of Roadway - RDCH
27	Location of Roadway - LOCATION
28	Roadway Surface Conditions - SURFACE
29	Weather Conditions - WEATHER
30	Light Conditions - LIGHT
31	Ramp Location - RAMP (A)
32	Vehicle 1's Compass Direction - COMP1
33	Vehicle 1's Milepost Direction - DIR1 (A)
34	Vehicle 1's Movement - VMVT1 (A)

Table 1. (continued)

35	Diagram Accident Type - COLDD (A)
36	Vehicle 2's Compass Direction - COMP2
37	Vehicle 2's Milepost Direction - DIR2 (A)
38	Vehicle 2's Movement - VMVT2 (A)
39	Impact Location - IMPLOC (A)
40	Collision Type - COL
41	Object Struck - OBJ
42	Junction Relationship - JUNC
43	Accident Occurred On or Off Road - ONOFFRD
44	Proximity of Driver 1's Residence - RESPROX1
45	Proximity of Driver 2's Residence - RESPROX2
46	Proximity of Driver 3's Residence - RESPROX3
47	Sobriety of Driver 1 - SOB1
48	Sobriety of Driver 2 - SOB2
49	Sobriety of Driver 3 - SOB3
50	Driver 1's 1st Contributing Cause - DR1CC1
51	Driver 1's 2nd Contributing Cause - DR1CC2
52	Driver 2's 1st Contributing Cause - DR2CC1
53	Driver 2's 2nd Contributing Cause - DR2CC2
54	Driver 3's 1st Contributing Cause - DR3CC1
55	Driver 3's 2nd Contributing Cause - DR3CC2
56	Driver 1's Vehicle Actions - DR1VAC
57	Driver 2's Vehicle Actions - DR2VAC
58	Driver 3's Vehicle Actions - DR3VAC
59	Investigating Agency - INVEST
60	(BLANK SPACE)
61	Vehicle 1's Type - VT1
62	Vehicle 2's Type - VT2
63	Vehicle 3's Type - VT3
64	State Patrol Accident Report Number - ACCRPT
65	Most Alcohol Impaired Driver - ALCOHOL
66	Driver 1's Age - DR1AGE
67	Driver 2's Age - DR2AGE
68	Driver 3's Age - DR3AGE
69	Hazardous Materials Being Transported - HAZMAT

Table 1. (continued)

70	Fuel Spillage Due to Collision - SPILLAGE
71	Fire Due to Collision - FIRE
72	Vehicle 1's 1st Miscellaneous Action - V1MISAC1 (A)
73	Vehicle 1's 2nd Miscellaneous Action - V1MISAC2 (A)
74	Vehicle 2's 1st Miscellaneous Action - V2MISAC1 (A)
75	Vehicle 2's 2nd Miscellaneous Action - V2MISAC2 (A)
76	Vehicle 3's 1st Miscellaneous Action - V3MISAC1 (A)
77	Vehicle 3's 2nd Miscellaneous Action - V3MISAC2 (A)
78	Vehicle 1 Additional Information - V1INFO
79	Vehicle 2 Additional Information - V2INFO
80	Vehicle 3 Additional Information - V3INFO
81	Pedestrian / Pedalcyclist 1's Injury - PED1INJ
82	Pedestrian / Pedalcyclist 1's Age - PED1AGE
83	Pedestrian / Pedalcyclist 1's Actions - PED1ACTS
84	Pedestrian / Pedalcyclist 2's Injury - PED2INJ
85	Pedestrian / Pedalcyclist 2's Age - PED2AGE
86	Pedestrian / Pedalcyclist 2's Actions - PED2ACTS
87	Year / Month / Day - DATE
88	Hour / Minute - TIME
89	SR Milepost in Whole Numbers - WHOLEMP
90	SR Sequence Number + Milepost - MPRANGE (SEQ+MP)

Table 2. Data Collected by the Incident Response Team

Route and Milepost
Date and Time
Weather Conditions
Road Conditions
Road Closure Information
Type of Accident
Material Spill Information
Type of Vehicles Involved
Equipment Used
IRT Responsibility
Agencies Involved
Vehicle and Driver Identification
Fatal Accident Information

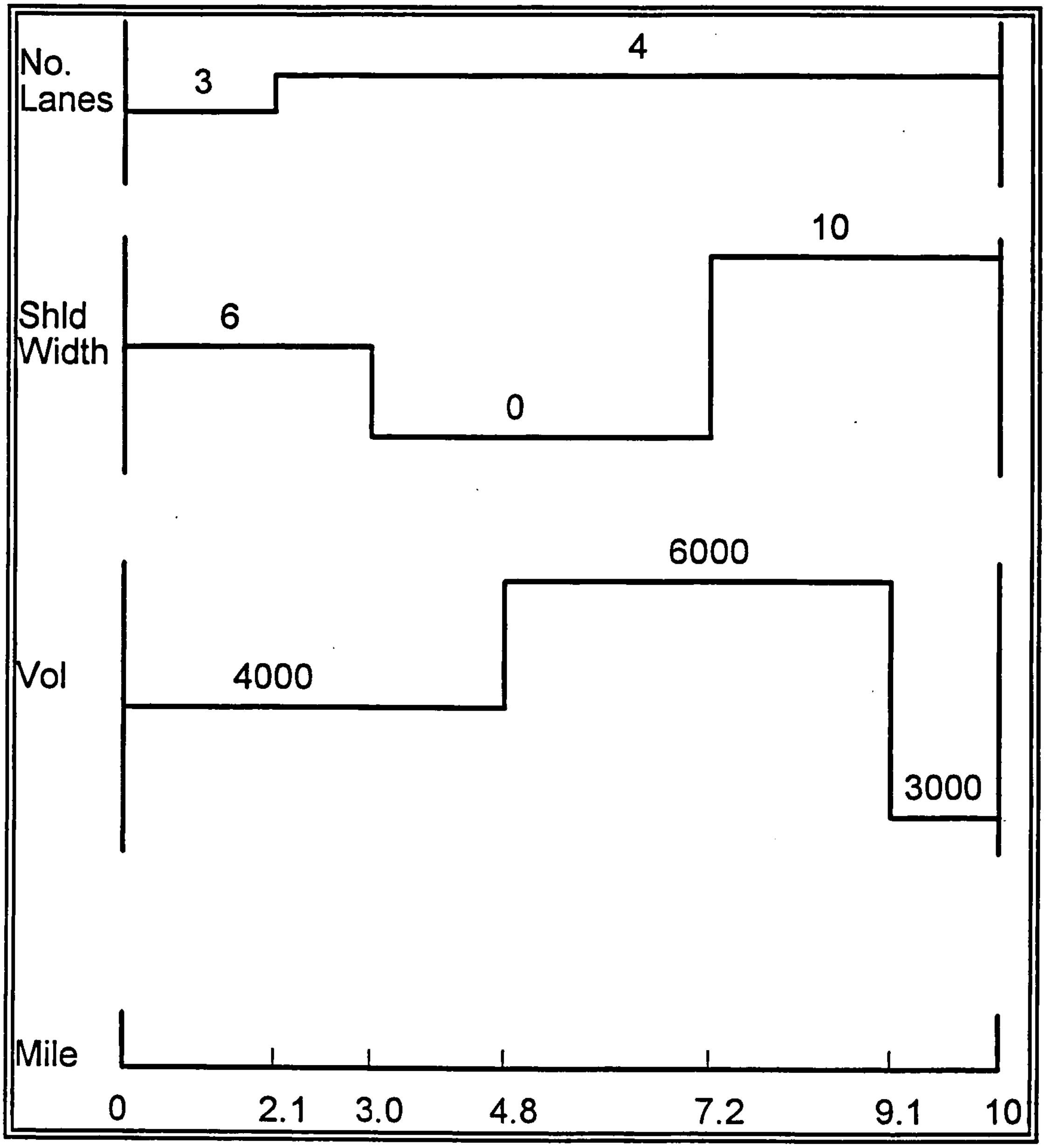

Figure 1. Dynamic Segmentation

CHAPTER 3 METHODOLOGY

INTRODUCTION

This chapter explains the procedures used to create the incident application in a geographic information system. The steps necessary to produce the geographic base file (GBF) are discussed along with the procedures necessary to input the incident data bases.

TransCAD, developed by Caliper Corporation is the geographic information system used in this project. This product is an enhancement of their Gisplus software. It has all the capabilities of a GIS, but also has additional procedures included which are designed specifically for transportation specialists. These procedures include traffic assignment models, routing and scheduling models, and shortest path routines.

GEOGRAPHIC BASE FILE

The information for the geographic base file (GBF) used in this project came from the King County TIGER Line File. The Department of Geography at the University of Washington had a previously edited a copy of the TIGER Line File where city and county streets had been removed. After being edited, the data was stored in two comma delimited, ASCII files. One file (Kingnod.txt) contains the ID number, longitude and latitude of the points. Its format is given in table 3.

The second file (Kinglnk.txt) contains the information necessary to produce the road segments. The FROM and TO columns indicate which points are to be used to connect the segments. The coordinates for these points are given in the Point Coordinate Table. The ID column uniquely identifies each segment, and allows attributes to be associated with a particular segment. The other columns contain attribute data for each segment. The length column contains the length of each segment, although this value is recalculated when the GBF is built in TransCAD. The direction column describes which way traffic can flow on a segment. A zero indicates two-way travel, while a value of 1 or -1 allows traffic to only flow in one direction only. Positive indicates traffic can move from the FROM node to the TO node, while negative indicates reversed traffic flow. The CODE column describes the type of roadway segment, whether it is a freeway, a ramp, or a dirt road. A sample of the file is given in table 4.

TransCAD has a specific module for building geographic base files called TCBUILD. It is capable of directly converting TIGER/Line files into a base map for TransCAD applications, or it can be instructed on how to convert ASCII files into a Geographic Base File (GBF). TCBUILD simply converts the spatial information stored in the TIGER/Line or ASCII file into the format TransCAD uses.

TCBUILD works by first storing the point information for each node and then connecting the line segments to each point. The results are two databases or layers. The point layer is named intersections and contains the information for each point. Points represent intersections, dead-ends, and shape points. The segment layer is named highways and contains the roadway data.

The version of TransCAD used in this project does not support dynamic segmentation or milepost geocoding. It does, however, support address matching. Since mileposts are a linear proportioned form of address, the address matching procedure available will allow the incidents to be located accurately on the geographic base file.

In addition to having the name of the route; including prefix, name, type, and suffix, the GBF must also have the address ranges for each segment. This data was obtained from the WSDOT Route Log. The Route Log contains the milepost value of each point of interest along all of the state highways. Typically, mileposts are given for all intersections, bridges, and boundaries.

Since the address matching procedure has the capability of determining which side of the segment to place the incident, the milepost ranges were coded to allow for odd and even events. This was done be carrying the milepost ranges to the thousandth decimal place. The decreasing mileposts sides of the segments were coded as odd numbers by adding one thousandth to their ranges. The increasing milepost ranges were kept as even numbered ranges.

The error introduced by adding the thousandth is only 5.3 feet. This can be considered negligible when other sources of errors are considered. Since the Route Log only carried locations to the nearest hundredth of a mile, this implies a 52.8 foot inherent error. Additional errors in the measuring devices and human error allow this coding scheme to be used.

MICROCARS

To prepare the MicroCARS data for the project, it was first necessary to collect the data from a computer set up to run the program. MicroCARS was queried to select accident data for WSDOT District 1 during the months of Jan 91 and Jul 91. Instead of having the records printed, the output was captured in an intermediate file (C:\DBASE\ACCSYS\SPSS.DBF), which has a dBASE format. The file was then read into a spreadsheet where undesired records were deleted. The undesired records included those which occurred outside of King County, and those on routes in King County not covered in this project,

To use the address matching procedure in TransCAD, it was necessary to modify the MicroCARS database. The modifications included adding three fields; NUMBER, STREET, and TYPE.

The NUMBER field typically contains the address to be matched. However, since mileposts are being used in the project, it was necessary to convert the mileposts to the address format. In MicroCARS, the milepost is stored as an integer with an implied decimal place of two. To convert the milepost to the address format, each record was multiplied by 10. If the field DIR1 (Appendix A) indicated that the first vehicle was traveling in the decreasing milepost direction, one was added to the value. In those cases where no value was given for DIR1, the field COMP1 which shows the vehicles compass direction, was used to determine the direction of travel. This is because increasing mileposts run in the North and East direction.

The STREET field is simply the name of the highway. The field was obtained by simply copying the state route name and adding SR to the beginning. The TYPE field can include any Census approved code such as AVE, or BLVD. For this project, HWY was used for all the roads.

INCIDENT RESPONSE TEAM

The preparation for this database was the same as for MicroCARS except there was no provision for showing the direction of travel. This is because the IRT does not typically collect this information.

WASHINGTON STATE PATROL COMPUTER AIDED DISPATCH

Because of difficulties described earlier in obtaining access to and structuring the CAD data, this information was not included in the geographic information system. If this data had been obtained, the methodology for geocoding this data would be the same as for the previous two databases.

GIS CONSTRUCTION

After using TCBUILD to build the respective databases, the address matching procedure in TransCAD was used to geocode the data. The process involved simply selecting all of the incident records in the data editor and running the address matching procedure. All of the data was successfully located.

GIS ANALYSIS

After constructing the geographic information system, it was possible to analyze the incident data using traditional database functions or statistical analysis. Also, using the spatial capabilities of the GIS, spatial patterns were analyzed to indicate where severe problems are occurring. The spatial capabilities of TransCAD included showing incidents which met one or more specific criteria. Thematic maps were also produced using different data categories to show spatial trends.

Table 3. Point Coordinate Table

ID	Longitude	Latitude
1	-121659949	47498872
2	-121661870	47499677
3	-121659787	47499514
4	-121633146	47495342
5	-121632235	47495502

Table 4. Road Segment Table

From	To	ID	Length	Direction	Prefix	Name	Type	Suffix	Code
61	62	57	0.486	0	--	I-90	--	--	A11
65	61	60	0.030	0	--	I-90	--	--	A11
112	113	103	0.116	0	--	I-90	--	--	A11
119	112	114	0.191	0	--	I-90	--	--	A11
127	128	124	0.086	0	--	I-90	--	--	A11
132	127	130	0.446	0	--	I-90	--	--	A11
148	149	142	0.461	0	--	I-90	--	--	A11

CHAPTER 4 RESULTS

INTRODUCTION

The purpose of this chapter is demonstrate how geographic information systems can be used to analyze incidents. Using the data which has been inputted into the GIS, cross tabulations and thematic maps were produced to show the effects of different variables on the frequency of incidents. Also, thematic maps will show where incidents that are affected by different variables occur.

ANALYSIS

The chart in Figure 2 shows that the largest number of incidents occur on SR 5. By not giving spatial details, however, it implies that the number of incidents occurring on each route is uniform. It does give the added information of showing that more incidents occur in July than in January. One would expect that more events would take place during the winter months because of poor weather conditions. The logical reason is that there are more travelers in summer, many of which are tourists who are unfamiliar with the area. Since the volume of the routes were not included in the GIS, it is not possible to determine this.

The first thematic map produced was that showing all of the MicroCARS incidents in the study area. Figure 3 shows the results. Analysis of this plot shows several relationships. One being the lack of uniformity of the incidents. This is to be expected, but by examining plots such as this it is relatively easy to determine where trouble spots are and to take actions to remove the incident cause.

On SR 5 it is obvious there are many stretches where a high number of incidents occur. Particularly, the areas between SR 90 and SR 520, and the SR 5/SR 520 interchange have a high number of accidents. This is to be expected since there is a high volume of traffic on this stretch. There are, however, some parts of the route where there are few if any incidents. The segments of particular note are the bridges on SR 90 and SR 520 crossing Lake Washington. One reason for this may be the fact there are no merging flows of traffic to cause conflicts.

Another interesting point is the apparent relationship between horizontal curvature and the number of incidents. It has already been noted the small amount of incidents on the bridges crossing Lake Washington. Not only do these bridges lack merging movements, they are also on tangent sections of the highway. The plot shows there are a relatively large number of incidents occurring on segments of the highway with horizontal curves. This is probably due to the fact that there are interchanges at most of the horizontal curves, which means there are merging movements.

Next, the day of the week was examined to determine how it affected the number of incidents. The chart in figure 4 again reflects the higher number of accidents on SR 5 than on any of the other routes. There is also a smaller number of events per day on Saturday and Sunday than on the weekdays.

Figure 5 shows the incidents occurring on weekdays. The spatial pattern seems to mirror that of the total incident plot with SR 5 and horizontal curves having the highest density of incidents.

Figure 6 shows the result of selecting weekend events. Since the total volume of traffic is normally less on weekends than weekdays, the plot reflects a similar reduction in accidents. However, there does appear to be a more than proportional decrease in the number of events occurring on the East-West routes. These routes are normally used by commuters who work in the downtown Seattle area, and not unexpectedly there is less traffic on these routes during the weekends.

The chart in figure 7 shows the relative distribution of incidents by day and time of day. During the week, the highest number occurs from 3 PM to 6 PM. The morning peak period and the early afternoon period also show a high occurrence of incidents. During the weekend, the pattern of incidents changes. This is to be expected since travel patterns also change. The period of peak incidence occurrence is now between noon and 3 PM.

Comparing figure 8 which contains the incidents that occurred between 6 AM and 9 AM on weekdays, with figure 9 that represents the events for 3 PM to 6 PM, shows there is a larger number of accidents for the afternoon peak period. The morning peak shows a definite concentration on SR 5 North of Marion St. and South of milepost 166.25. The afternoon period shows the highest concentration on SR 5 between Marion and SR 520. There are also segments of high incident density at milepost 1 on SR 520 and milepost 13.6 on SR 405.

One noticeable point in figure 7 is the number of incidents occurring on the weekend between the hours of midnight and 3 AM. Figure 10 shows the majority of occurrences of these accidents are in the vicinity of the SR 5 / SR 520 interchange. This part of the transportation network serves the University of Washington and Seattle University.

Figures 11 and 12 show how road surface condition effect incidents. There are a larger number of events occurring when the pavement is dry than when it is wet or icy. The plot showing where accidents occur due to a wet surface may indicate road segments which may need to be resurfaced.

Next, the effect of alcohol on incidents was analyzed. Figure 13 shows that alcohol was known to be involved in 9% of all the incidents. While figure 14 shows the largest concentration of alcohol at the SR 5 and SR 520 interchange.

Figure 15 shows how a more detailed analysis of a smaller geographic area can be accomplished. By simply selecting a point (in this case the intersection of SR 520 and SR 405) and defining a radius, events can be selected by their location.

One of the problems with trying to obtain information concerning incidents is that of matching up data from different data sources. Since they are normally coded by mileposts and these are usually estimated to the hundredth of a mile, the accuracy does not allow matching based on this attribute alone.

Geographic information systems allow a way around this through interactive querying and manipulations. As shown in figure 16, events from different data sources can be depicted together. This plot shows both the MicroCARS and IRT data plotted together. Figure 17 shows the IRT data separately for reference. Since TransCAD allows interactive querying, it is possible to visually search for incidents that appear to be the same. Then by selecting and querying possible matches, equivalent events can be joined with selected attributes from one data source being merged into the other data source.

Figure 17 shows the incidents the IRT responded to. Again the vast majority occurred on SR 5, with few happening on the East-West routes. Since the incidents in which the IRT are involved are typically those of long duration, it is obvious that the allocation of resources for managing incidents should be concentrated in this area.

Using the IRT database, the involvement of tractor-trailers in incidents was examined. Figure 18 shows where these incidents occurred. Although these events occurred on SR 5, the locations are different than that of other vehicles. As can be seen, few occurred between SR 90 and SR 520. In fact, the majority occurred above and below these interchanges on SR 5.

Besides being able to select and depict the location of incidents based on a single attribute, geographic information systems are capable of display thematic maps. Figure 19 shows the events the IRT responded as a thematic map based on the expected duration of the incident. The values used are given in Appendix B.

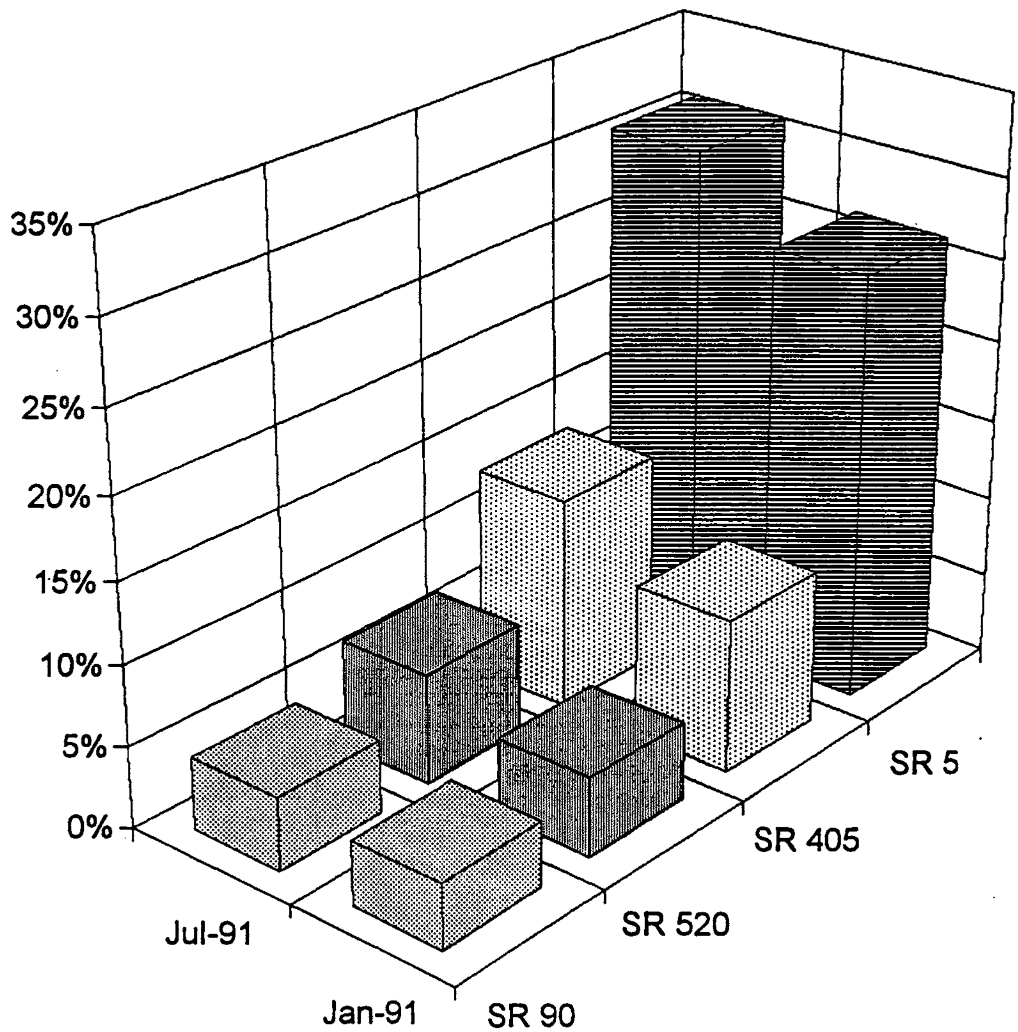

Figure 2. Percent of Accidents by Month and Route Using MicroCARS Data for January and July, 1991.

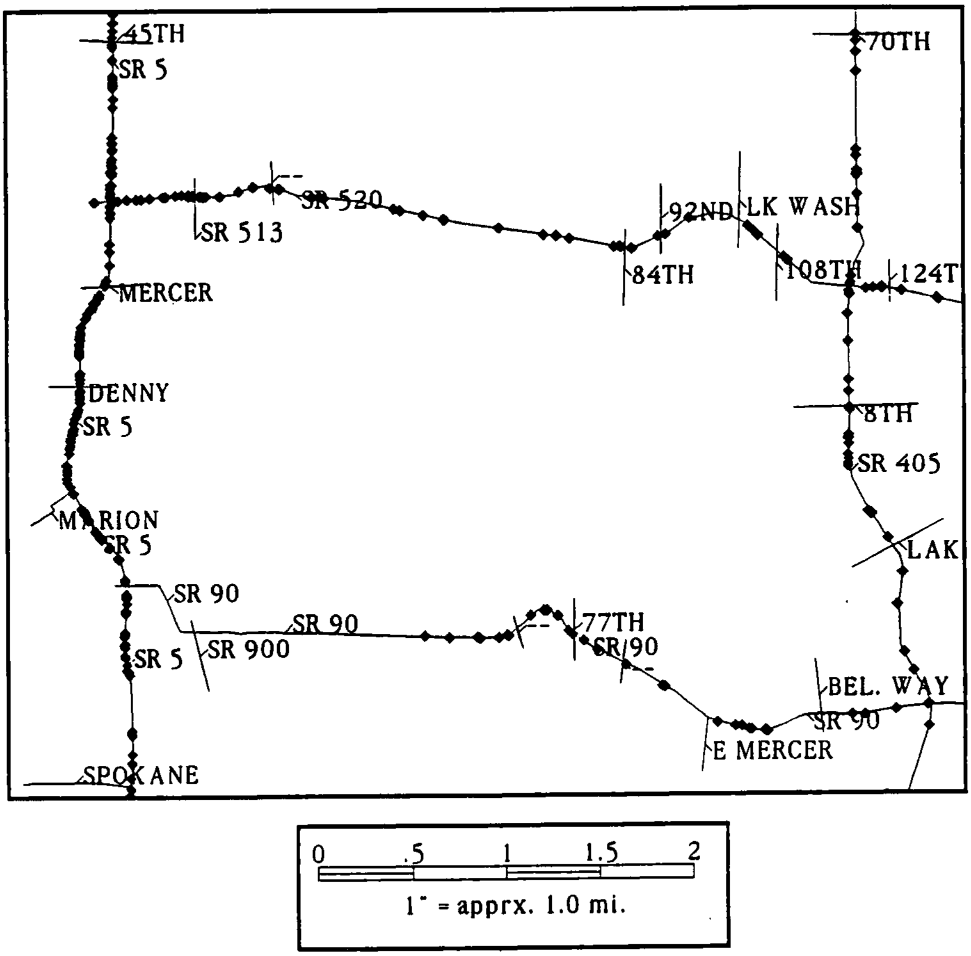

Figure 3. MicroCARS Accidents Occurring in Jan 91 and Jul 91.

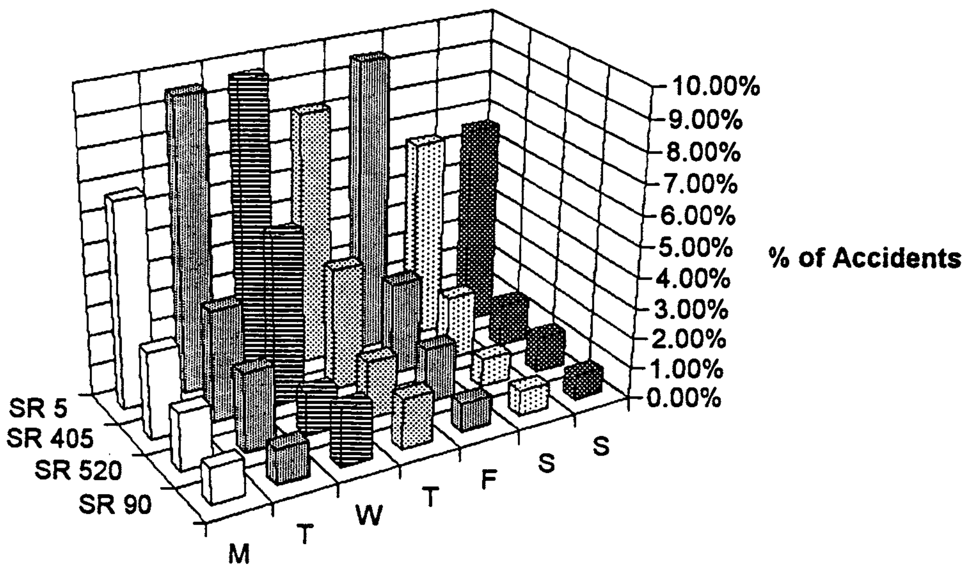

Figure 4. Percent of Accidents by Weekday and Route Using MicroCARS Data for January and July, 1991.

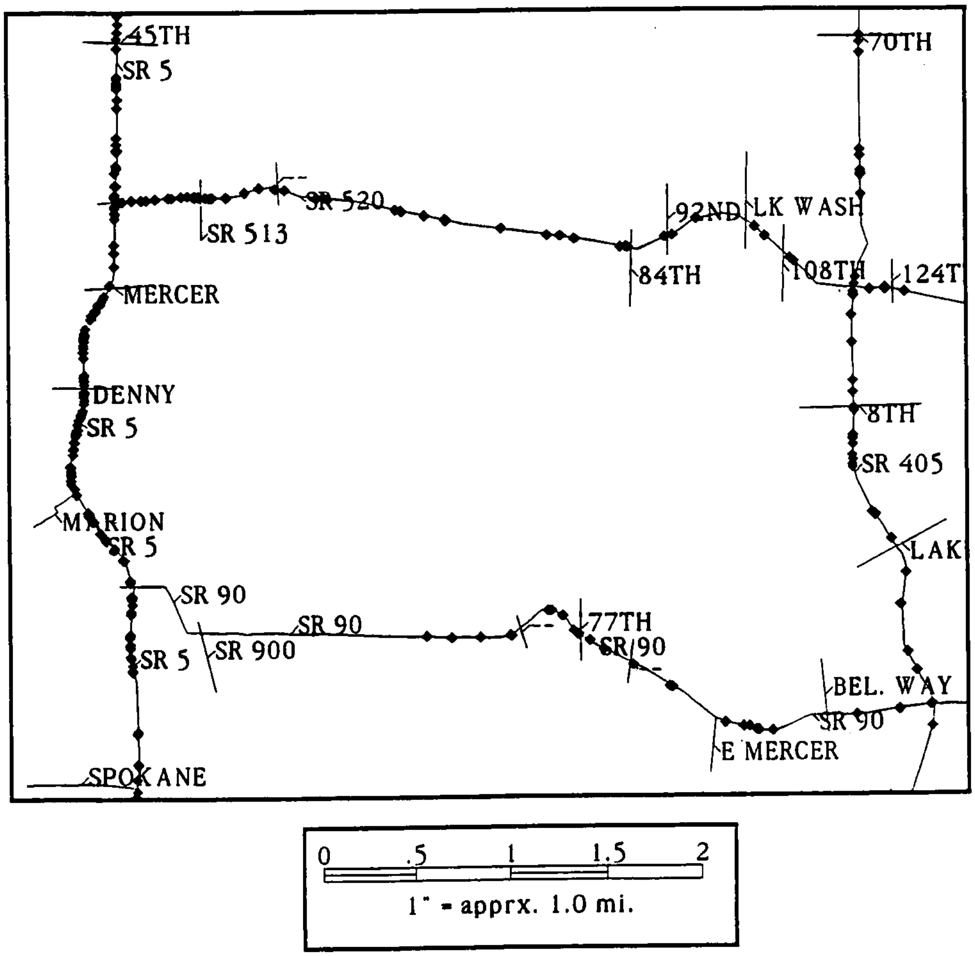

Figure 5. Weekday Accidents Using MicroCARS Data for January and July, 1991.

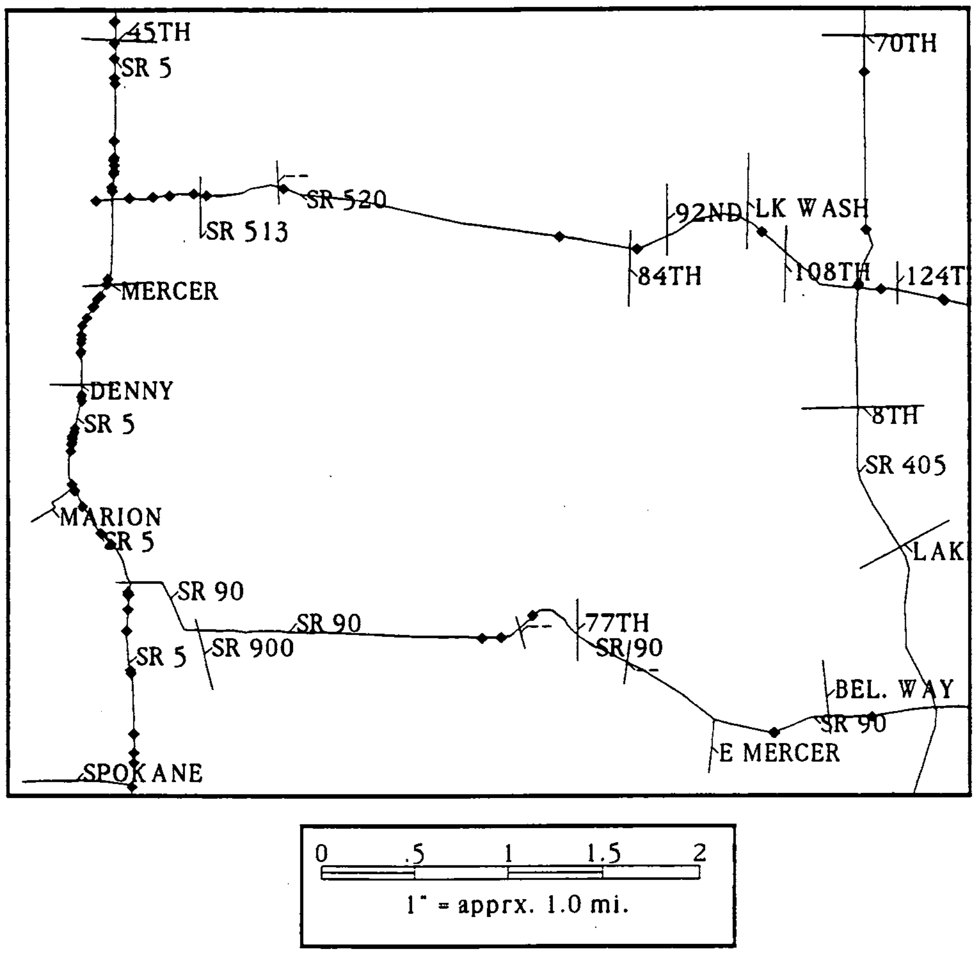

Figure 6. Weekend Accidents Using MicroCARS Data for January and July, 1991

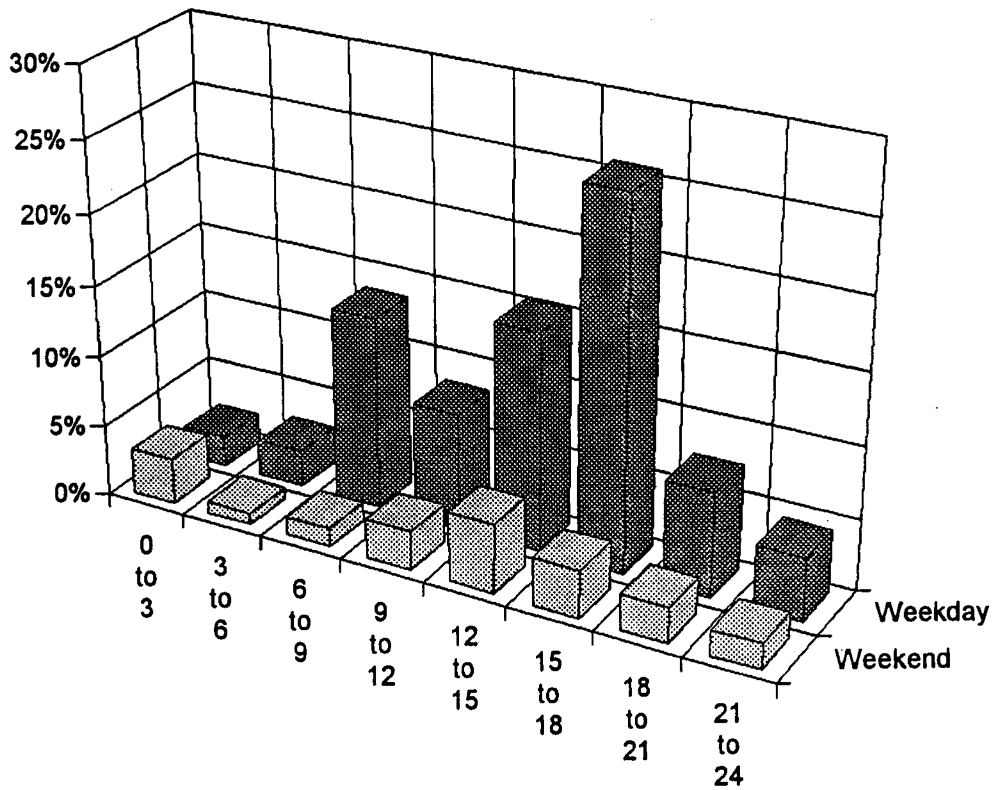

Figure 7. Percent of Accidents by Time and Day Using MicroCARS Data for January and July, 1991.

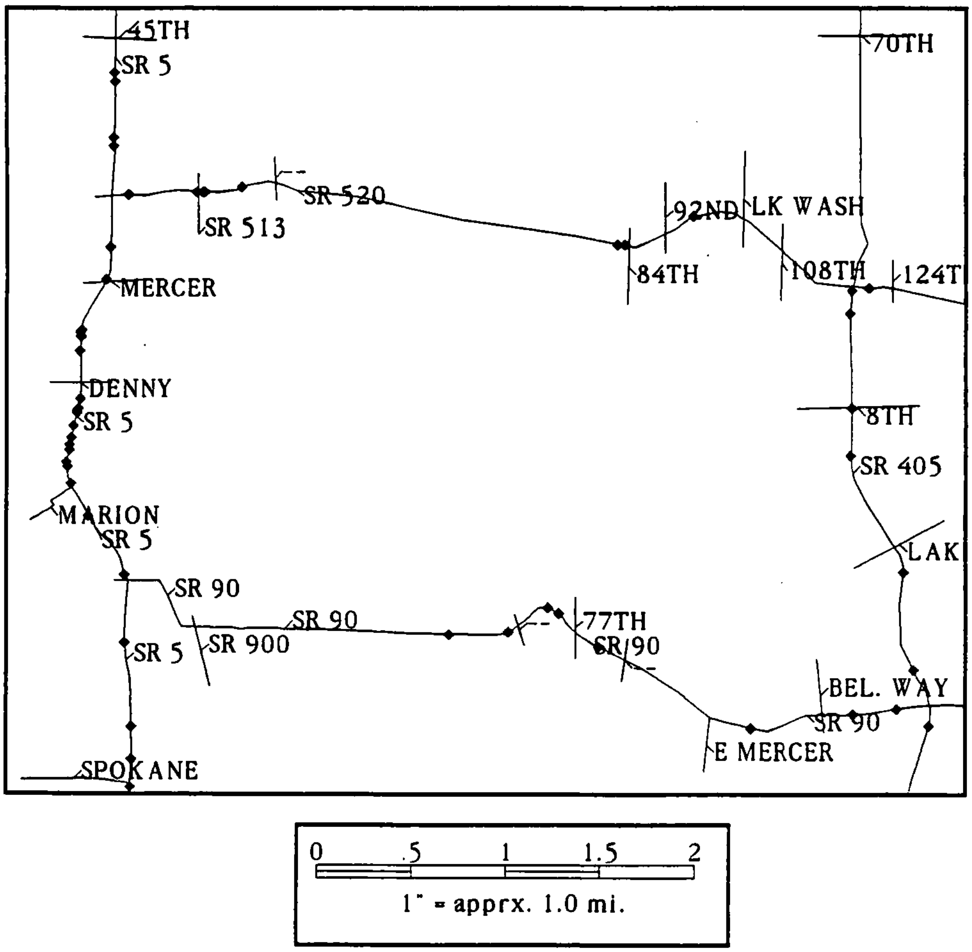

Figure 8. Morning Peak Period Accidents Using MicroCARS Data for January and July, 1991.

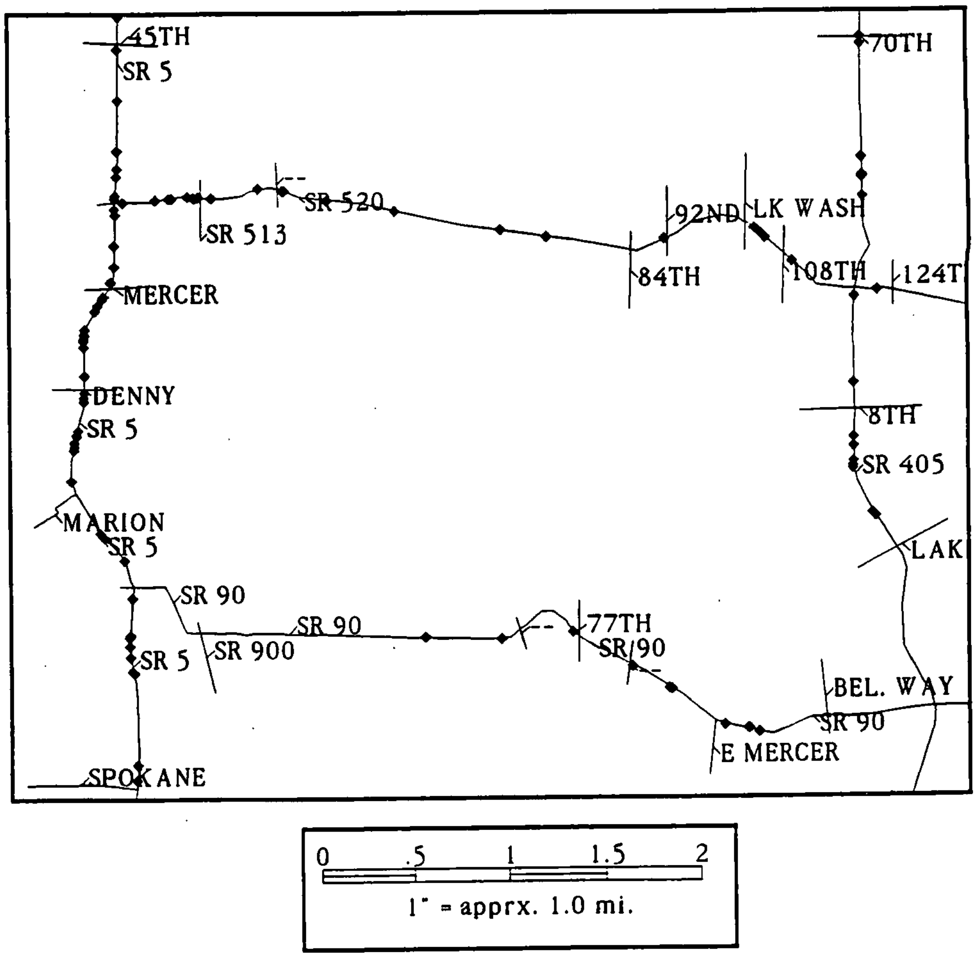

Figure 9. Afternoon Peak Period Accidents Using MicroCARS Data for January and July, 1991.

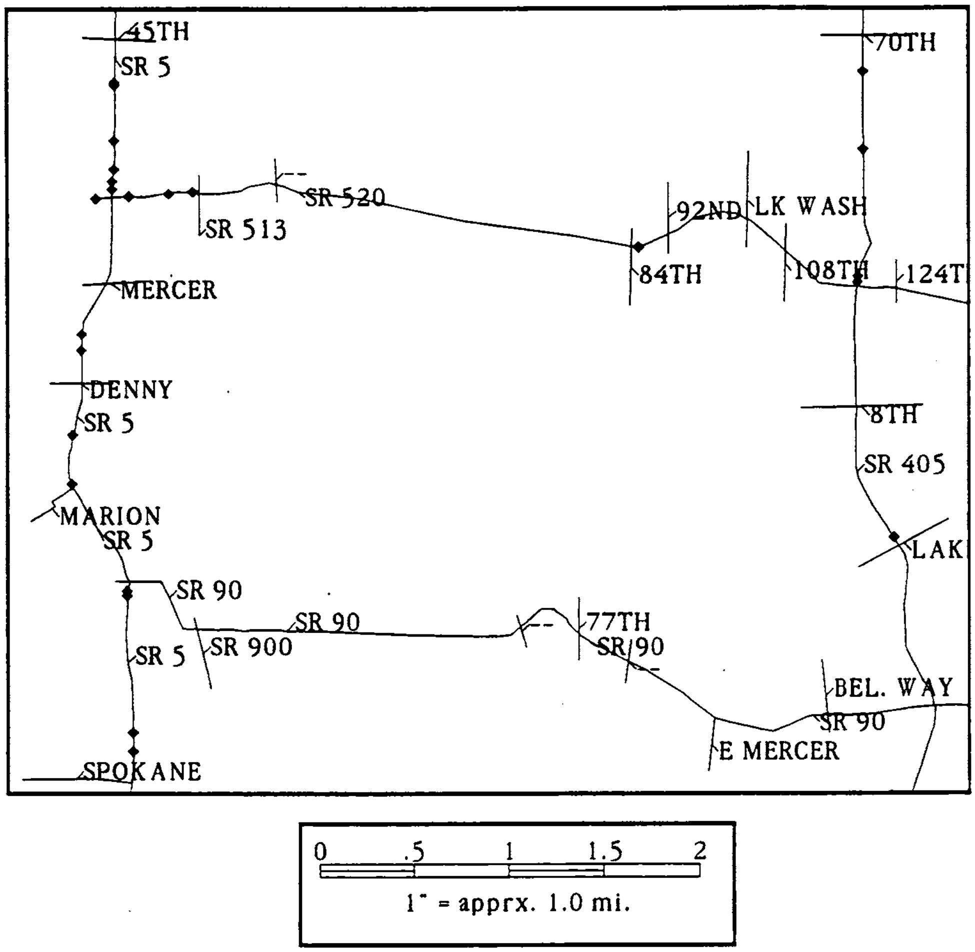

Figure 10. Weekend Accidents Between Midnight and 3 AM Using MicroCARS Data for January and July, 1991.

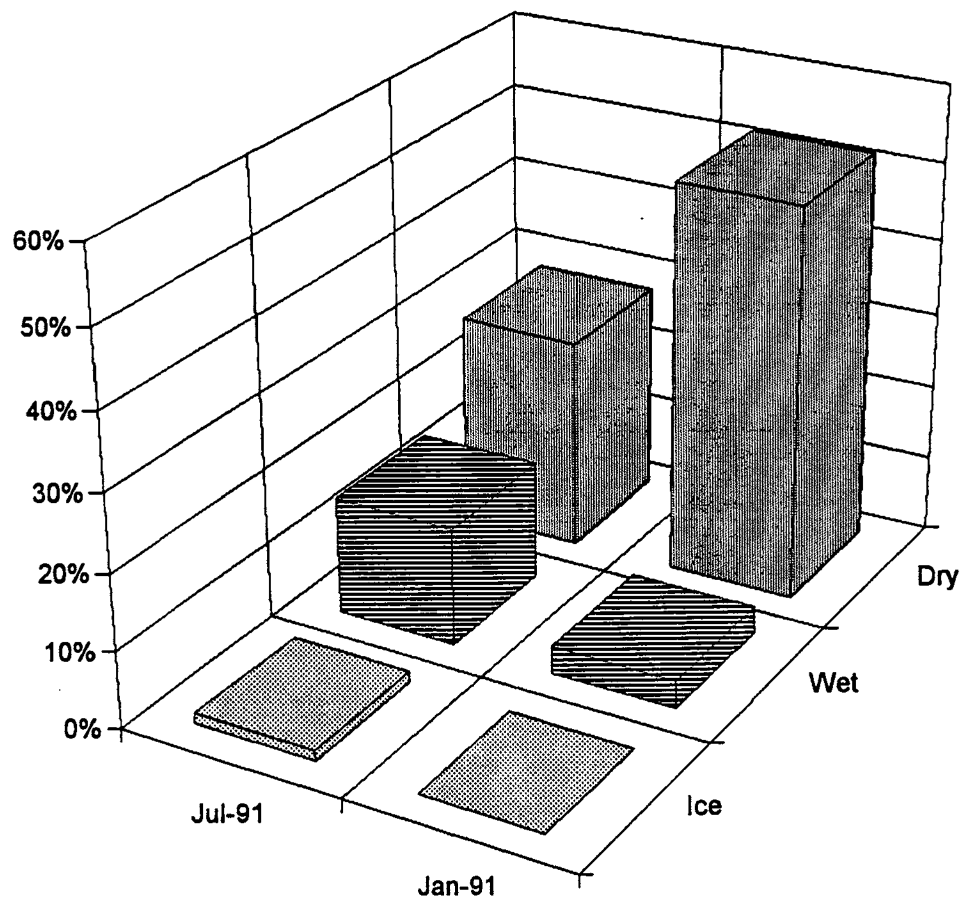

Figure 11. Percent of Accidents by Month and Roadway Surface Using MicroCARS Data for January and July, 1991.

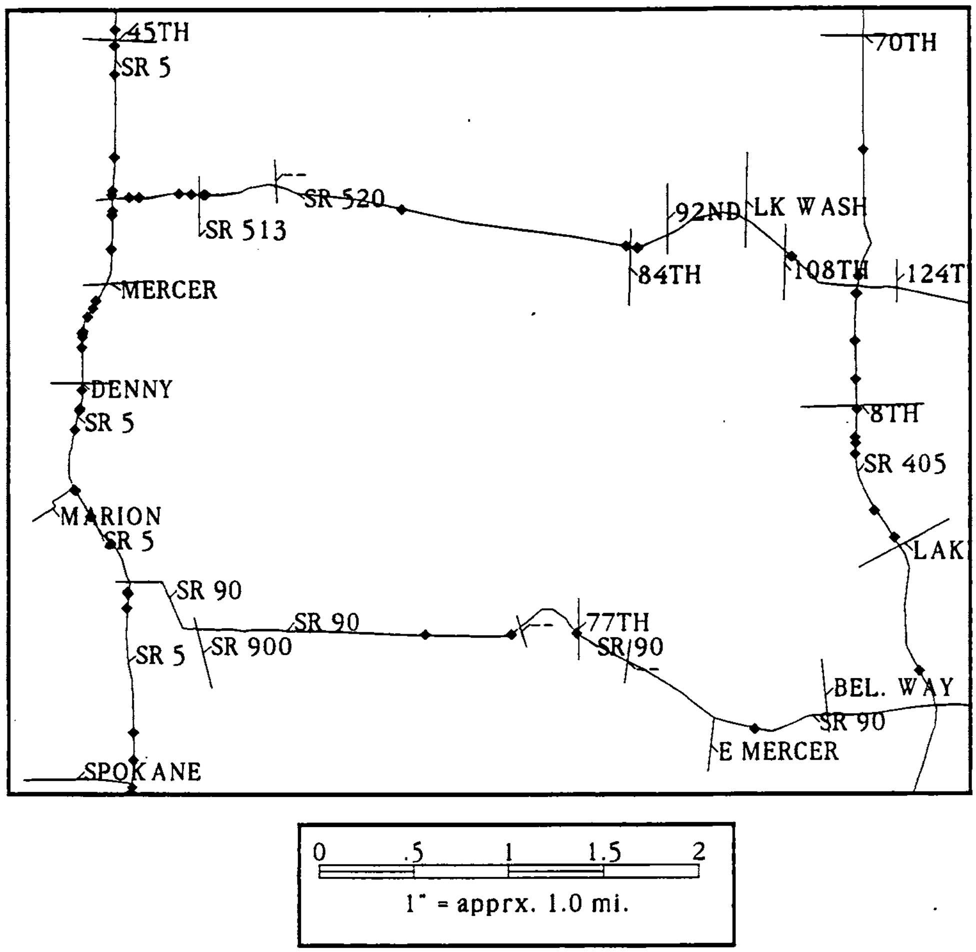

Figure 12. Accidents Involving Wet/Icy Roads Using MicroCARS Data for January and July, 1991.

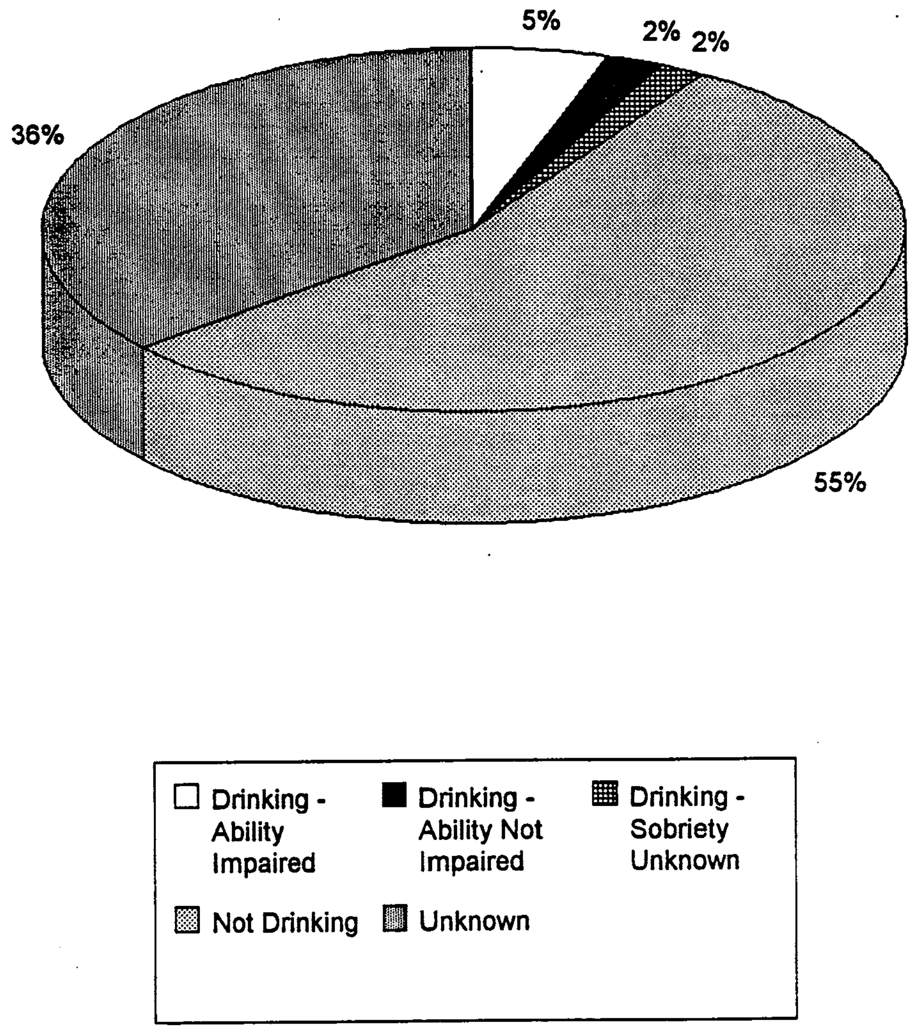

Figure 13. Percent of Accidents by Sobriety of Driver Using MicroCARS Data for January and July, 1991.

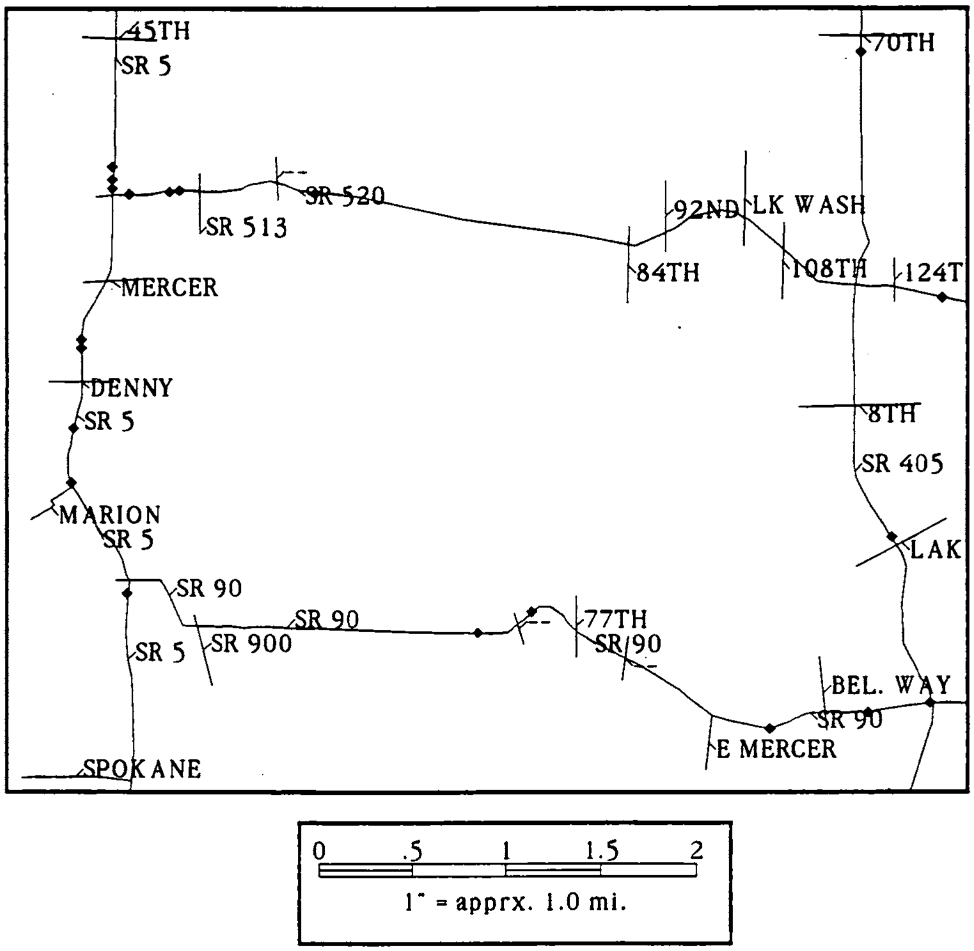

Figure 14. Accidents Involving Alcohol Impaired Drivers Using MicroCARS Data for January and July, 1991.

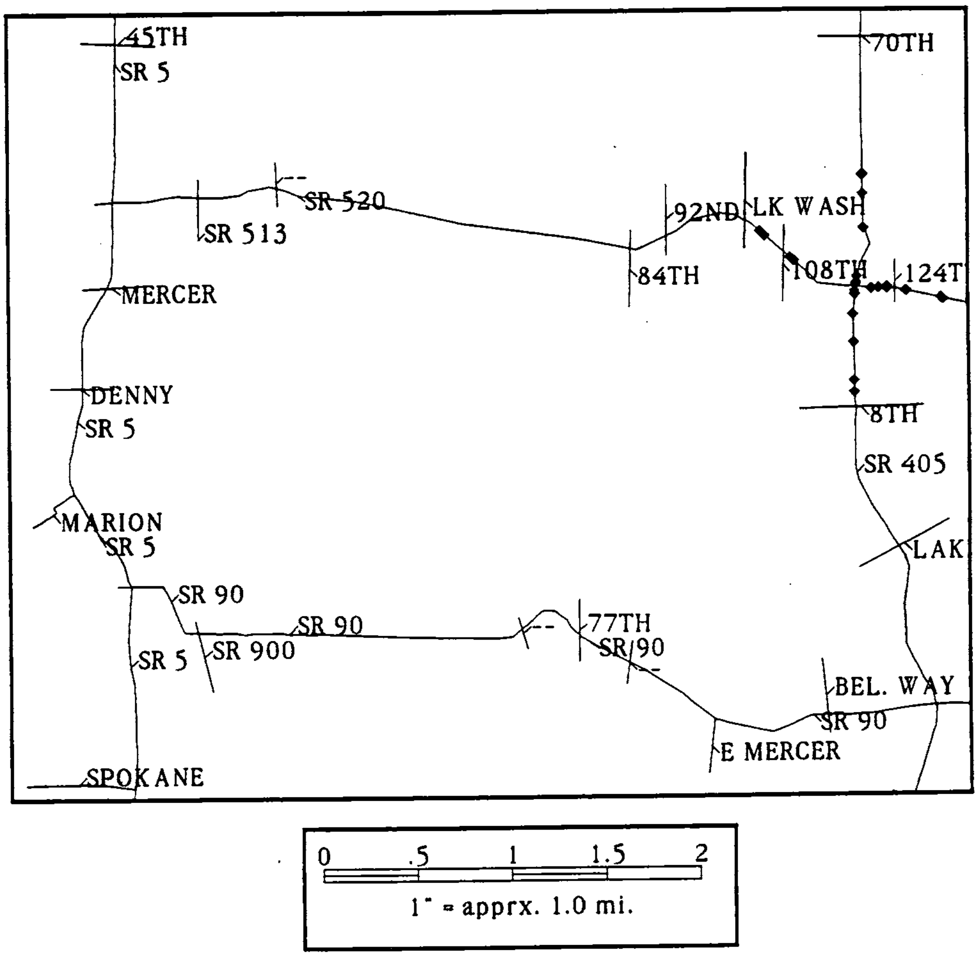

Figure 15. Accidents Within a One Mile Radius of the SR 520 and SR 405 Interchange Using MicroCARS Data for January and July, 1991.

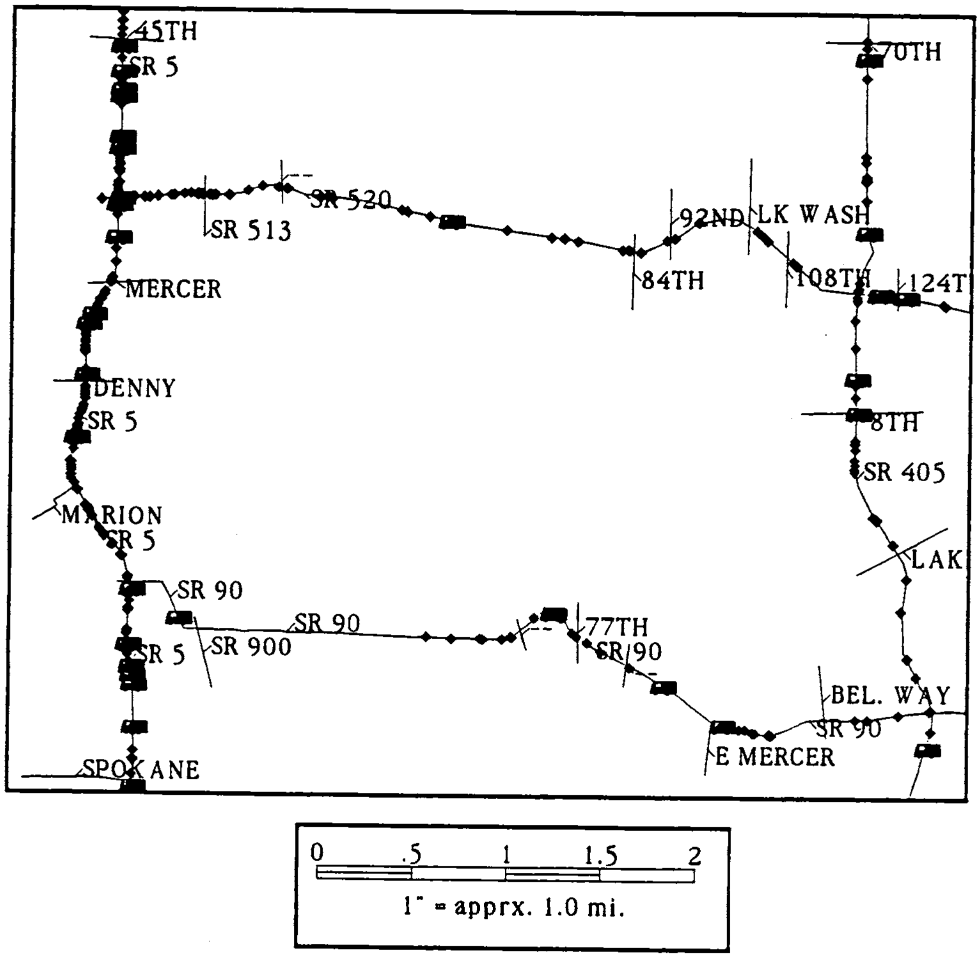

Figure 16. MicroCARS Accidents for January and July, 1991, and Incident Response Team Accidents for all of 1991.

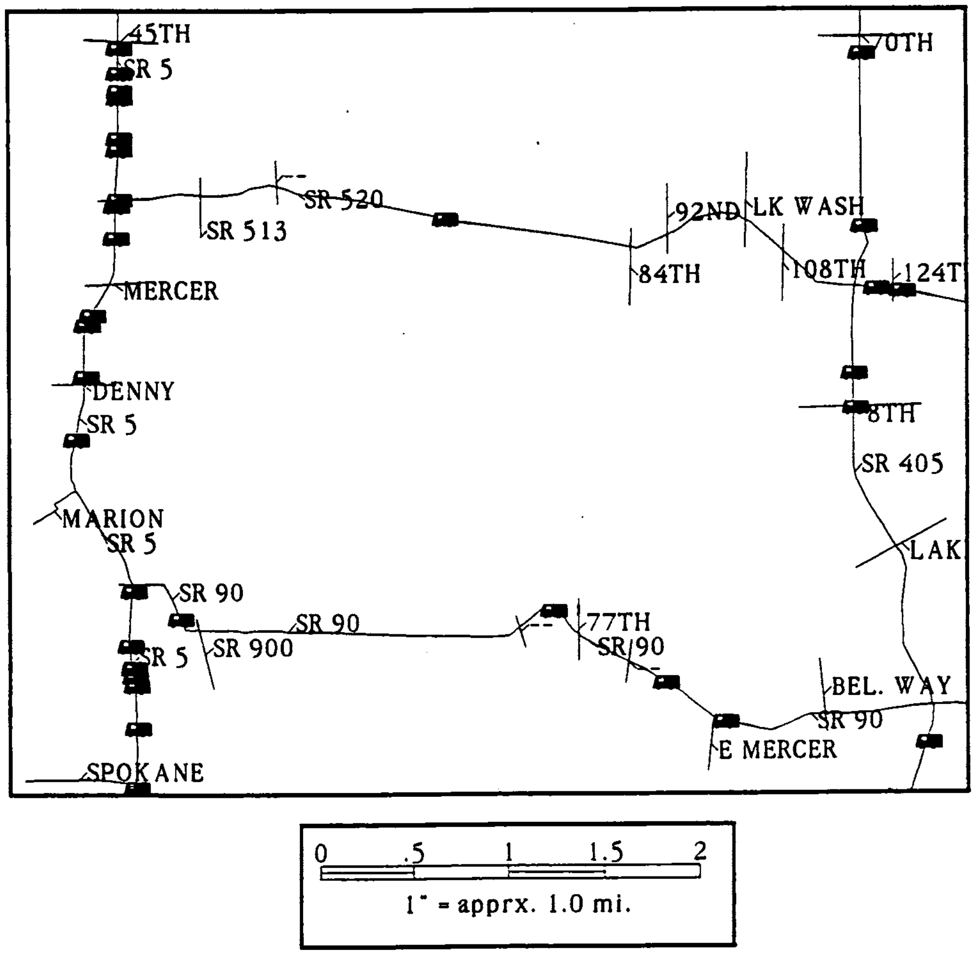

Figure 17. Incident Response Team Accidents for All of 1991.

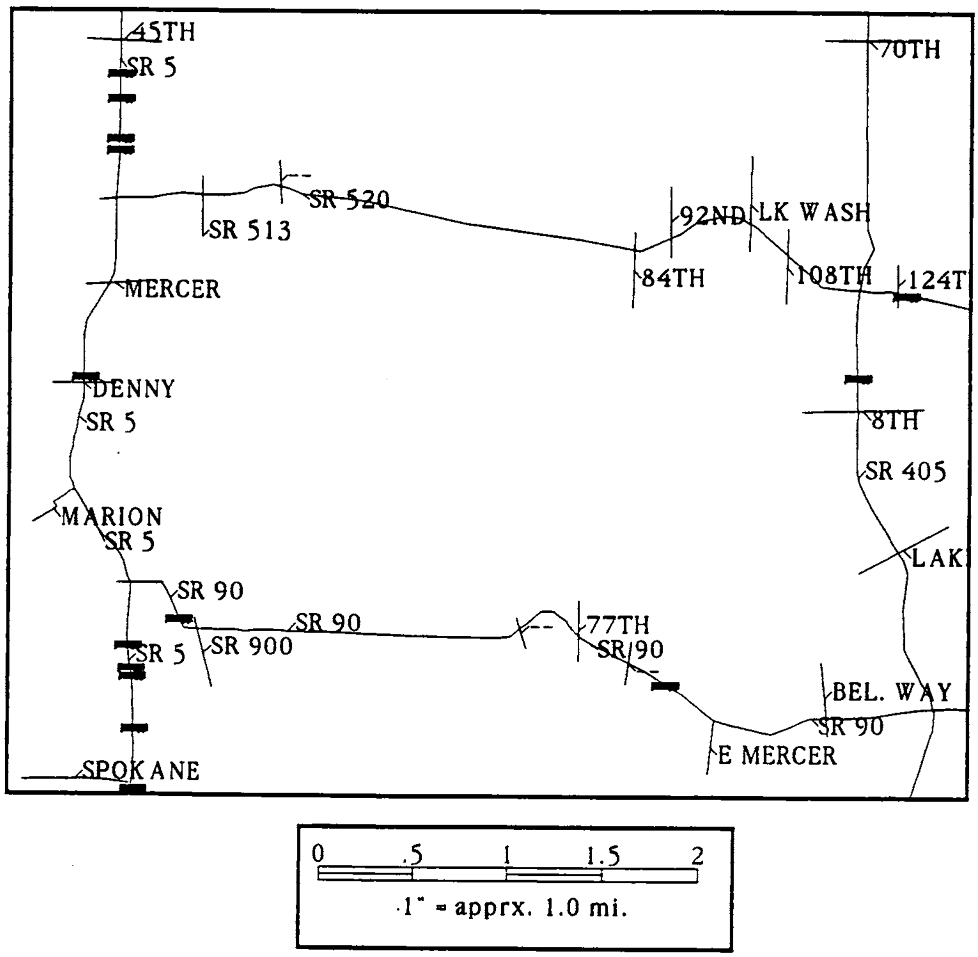

Figure 18. Incident Response Team Accidents Involving Tractor-Trailers for All of 1991.

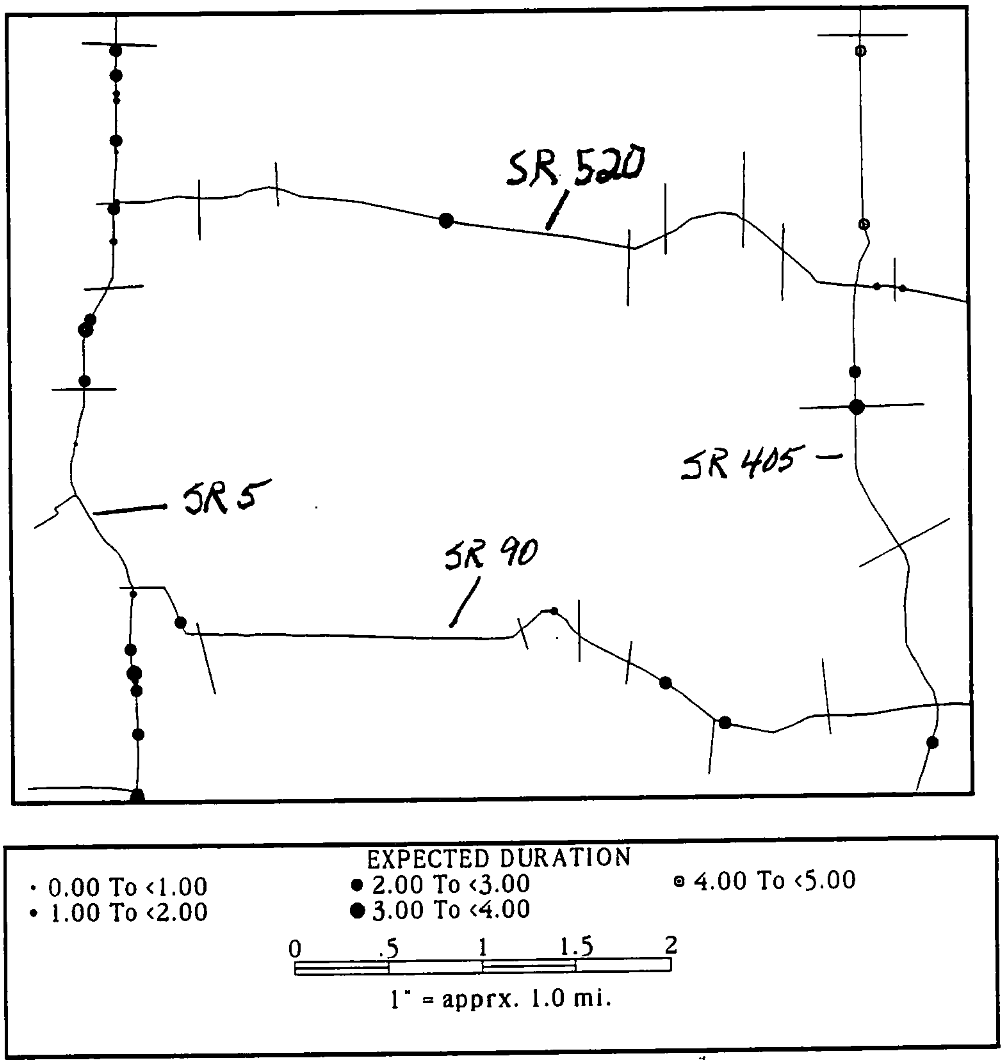

Figure 19. Thematic Map of Incident Response Team Accidents for All of 1991 Depicting Expected Duration of the Events.

CHAPTER 5 CONCLUSION

The results of this project show that geographic information systems are an asset in studying incidents. Not only is it capable of displaying and analyzing information spatially, but it is also beneficial in storing and combining different data sources based on their locations.

Unfortunately, the GIS software used in this project did not contain procedures for dynamic segmentation and milepost geocoding because it would have enabled a more detailed look at the variables effecting incidents. These variables, which are normally associated with segments of road include pavement condition, roadway geometrics, traffic volumes, signage, signalization, shoulder width, and capacity. By combining the different data sources based on their spatial location, analysis such as those performed in the Generation and Assessment of Incident Management Strategies [11] can produce more accurate models because of the availability of more data.

New incident databases should consider the potential of geographic information systems in their development. A fully developed system will be able to store, combine, and analyze all the data relevant to incidents, and also display this information spatially. Since the networks stored in the GIS are topologically correct, the effects of incidents on traffic assignment can be analyzed using user equilibrium or other models. This would allow transportation officials to be able to immediately locate on a preexisting model where an incident has occurred, run a traffic assignment simulation to determine the effect the incident will have, and then take appropriate actions to mitigate the incident's effect. The actions might include public notification, retiming signals and ramp meters to direct traffic away from the effects of the incidents, and locating and directing equipment to the site on the shortest path.

As previously noted, one of the problems with this project was that the software used was an older version that did not support some of the newer GIS procedures. This made it impossible to fully develop the incident application. Having a dynamic segmentation routine would have allowed additional data sources, such as WSDOT TRIPS database, to be incorporated.

Two of the three data sources examined in this project had designs which were not conducive to integration with the GIS. The Incident Response Team's database is currently being redesigned in a database software program. The ability to download data to an ASCII file will be extremely helpful. Also, if a unique field such as the accident report number is included in the database, matching records with MicroCARS will be much simpler.

The Washington State Patrol CAD system is much harder to integrate. Not only must a way be found to obtain digital copies of the data, but the coding must be improved so that a consistent method of determining locations is found. For this to happen, WSP must allow researchers greater access to the system. Also, the use of a Global Positioning System (GPS) in the patrol cars will enable a consistent and accurate location to be determined.

The results of this project lead to the recommendation that a full scale geographic information system be set up for incident management. A complete and fully detailed geographic base map should be constructed. It should include all the state routes in the Greater Seattle area, and also ramps, interchanges, and the express lanes.

The data sources should include MicroCARS, the Incident Response Team, and the Washington State Patrol Computer Aided Dispatch System. Consideration should also be given to including other databases such as WSDOT's TRIPS database so that information relating to highway segments can be included.

Additional work will be needed in order to find the optimum method of including the CAD System. Possible answers include using scanners with Optical Character Recognition (OCR) software to convert the printouts into ASCII files, manually coding the data into a database, or having the WSP provide the needed information on files.

The GIS should have built in procedures for incident analysis in order to allow for a systematic evaluation. It should also have the newer GIS procedures of dynamic segmentation and milepost geocoding so that the existing databases can be used and additional data can be easily included.

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APPENDIX A

MICROCARS CODED VARIABLE DESCRIPTION

DATA ELEMENT (SPSSPC+ NAME)	CODES AND DESCRIPTIONS
Year (YEAR)	Last 2 digits of year
Month (MONTH)	2 digit number January=01 June=06, etc.
Day of Month (DAY)	Self-explanatory
Day of Week (WEEKDAY)	1=Monday 2=Tuesday 3=Wednesday
	4=Thursday 5=Friday 6=Saturday
	7=Sunday
Hour (HOUR)	Using 24 hour military time
	6 am=06 3 pm=15, etc.
Minute (MINUTE)	Time of accident in minutes
County Number (COUNTY)	Adams=01 Asotin=02 Benton=03 Chelan=04
	Clallam=05 Clark=06 Columbia=07 Cowlitz=08
	Douglas=09 Ferry=10 Franklin=11 Garfield=12
	Grant=13 Grays Harbor=14 Island=15
	Jefferson=16 King=17 Kitsap=18 Kittitas=19
	Klickitat=20 Lewis=21 Lincoln=22 Mason=23
	Okanogan=24 Pacific=25 Pend Oreille=26
	Pierce=27 San Juan=28 Skagit=29 Skamania=30
	Snohomish=31 Spokane=32 Stevens=33
	Thurston=34 Wahkiakum=35 Walla Walla=36
	Whatcom=37 Whitman=38 Yakima=39
City Numbers (CITY)	Aberdeen=0005 Airway Heights=0010 Albion=0015

	Algona=0020 Almira=0025 Anacortes=0030
	Arlington=0045 Asotin=0050 Auburn=0055
	Battleground=0060 Beaux Arts Village=0070
	Bellevue=0075 Bellingham=0080
	Benton City=0085 Bingen=0090
	Black Diamond=0095 Blaine=0100 Bonney Lake=0105
	Bothell=0110 Bremerton=0115 Brewster=0120
	Bridgeport=0125 Brier=0127 Buckley=0130
	Bucoda=0135 Burlington=0140 Camas=0145
	Carbonado=0150 Carnation=0155 Cashmere=0165
	Castle Rock=0170 Cathlamet=0175 Centralia=0180
	Chehalis=0190 Chelan=0195 Cheney=0200
	Chewelah=0205 Clarkston=0215 Cle Elum=0220
	Clyde Hill=0225 Colfax=0230 College Place=0235
	Colton=0240 Colville=0250 Conconully=0255
	Concrete=0260 Connell=0265 Cosmopolis=0270
	Coulee City=0275 Coulee Dam (Okanogan Co.)=0280
	Coulee Dam (Douglas Co.)=0285 Coupeville=0290
	Creston=0295 Cusick=0300 Darrington=0305
	Davenport=0310 Dayton=0315 Deer Park=0320
	Des Moines=0325 DuPont=0330 Duvall=0335
	East Wenatchee=0350 Eatonville=0360

	Edmonds=0365 Electric City=0375 Ellensburg=0380
	Elma=0385 Elmer City=0390 Endicott=0395
	Entiat=0405 Enumclaw=0410 Ephrata=0415
	Everett=0420 Everson=0425 Fairfield=0430
	Farmington=0440 Federal Way=0443 Ferndale=0445 Fife=0450
City Numbers (CITY)	Fircrest=0455 Forks=0465 Friday Harbor=0470
	Garfield=0480 George=0488 Gig Harbor=0490
	Gold Bar=0495 Goldendale=0500 Grand Coulee=0510
	Grandview=0515 Granger=0520 Granite Falls=0525
	Hamilton=0535 Harrah=0540 Harrington=0545
	Hartline=0550 Hatton=0555 Hoquiam=0560
	Hunts Point=0570 Ilwaco=0575 Index=0580
	Ione=0585 Issaquah=0590 Kahlotus=0595
	Kalama=0600 Kelso=0605 Kennewick=0610
	Kent=0615 Kettle Falls=0620 Kirkland=0625
	Kittitas=0630 Krupp=0635 LaCenter=0640
	Lacey=0645 La Conner=0650 LaCrosse=0655
	Lake Forest Park=0658 Lake Stevens=0660
	Lamont=0665 Langley=0670 Latah=0675
	Leavenworth=0680 Lind=0685 Long Beach=0690
	Longview=0695 Lyman=0705 Lynden=0710

	Lynnwood=0715 McCleary=0720 Mabton=0725
	Malden=0730 Mansfield=0735 Marcus=0740
	Marysville=0745 Mattawa=0750 Medical Lake=0755
	Mercer Island=0757 Medina=0760 Mesa=0765
	Metaline=0770 Metaline Falls=0775
	Mill Creek=0778 Millwood=0780
	Milton=0785 Monroe=0790 Montesano=0795
	Morton=0800 Moses Lake=0805 Mossy Rock=0810
	Mountlake Terrace=0815 Mount Vernon=0820
	Moxee=0825 Mukilteo=0830 Naches=0835
	Napavine=0840 Nespelem=0855 Newport=0860
	Nooksack=0865 Normandy Park=0870
	North Bend=0875 North Bonneville=0880
	Northport=0885 Oakesdale=0890 Oak Harbor=0895
	Oakville=0900 Ocean Shores=0908 Odessa=0910
	Okanogan=0915 Olympia=0920 Omak=0925
	Oroville=0935 Orting=0940 Othello=0945
	Pacific=0950 Palouse=0955 Pasco=0960
	Pateros=0970 Pe Ell=0975 Pomeroy=0985
	Port Angeles=0990 Port Orchard=1000
	Port Townsend=1005 Poulsbo=1010 Prescott=1015
	Prosser=1020 Pullman=1025 Puyallup=1030
	Quincy=1040 Rainier=1050 Raymond=1055

	Reardan=1060 Redmond=1065 Renton=1070
	Republic=1075 Richland=1080 Ridgefield=1085
	Ritzville=1090 Riverside=1095 Rockford=1100
	Rock Island=1105 Rosalia=1115 Roslyn=1120
	Roy=1125 Royal City=1127 Ruston=1130
	St. John=1135 Sea Tac=1139 Seattle=1140 Sedro Woolley=1150
	Selah=1155 Sequim=1160 Shelton=1165
	Skykomish=1175 Snohomish=1180 Snoqualmie=1185
	Soap Lake=1190 South Bend=1195 S. Cle Elum=1205
	South Prairie=1210 Spangle=1215 Spokane=1220
	Sprague=1225 Springdale=1230 Stanwood=1235
City Numbers (CITY)	Starbuck=1240 Steilacoom=1245 Stevenson=1250
	Sultan=1255 Sumas=1265 Sumner=1270
	Sunnyside=1275 Tacoma=1280 Tekoa=1285
	Tenino=1290 Tieton=1295 Toledo=1300
	Tonasket=1305 Toppenish=1310 Tukwila=1320
	Tumwater=1325 Twisp=1330 Union Gap=1335
	Uniontown=1340 Vader=1345 Vancouver=1350
	Waitsburg=1360 Walla Walla=1365 Wapato=1375
	Warden=1380 Washougal=1385 Washtucna=1390
	Waterville=1395 Waverly=1400 Wenatchee=1405

	Westlake=1415 Westport=1420 West Richland=1425
	White Salmon=1435 Wilbur=1440 Wilkeson=1445
	Wilson Creek=1450 Winlock=1455 Winslow=1460
	Winthrop=1465 Woodland=1470 Woodway=1475
	Yacolt=1480 Yakima=1485 Yarrow Point=1490
	Yelm=1495 Zillah=1500
SR Number (SR)	Three digit number 002, 016, 395, etc.
SR Additional	
Identifier (ADID)	Identifies locations which are assigned to SR but
	not physically on mainline
	FRI=frontage road, increasing milepost side of SR
	FRD=frontage road, decreasing milepost side of SR
	CDI=collector-distributor on increasing
	milepost side of SR
	CDD=collector-distributor on decreasing
	milepost side of SR
	SHI=scale house area on increasing
	milepost side of SR
	SHD=scale house area on decreasing
	milepost side of SR
	RAI=rest area on increasing milepost side of SR
	RAD=rest area on decreasing milepost side of SR
	SVI=scenic viewpoint on increasing
	milepost side of SR
	SVD=scenic viewpoint on decreasing
	milepost side of SR
	CLV=cloverleaf within interchange area - added 1/1/83
	SCA=special coding area (very complex interchange)

	FSI=flyer stop on increasing milepost side of SR
	FSD=flyer stop on decreasing milepost side of SR
	UTI=u-turn area on increasing milepost side of SR
	UTD=u-turn area on decreasing milepost side of SR
SR Sequence Number (SEQ)	2 digit number used in conjunction with SR
	milepost to properly sequence mileposts
	in such areas as equations and spurs
SR Milepost (MP)	5 digit number
Equation (EQT)	A=ahead B=back
WSDOT District Number (DIST)	Self-explanatory
Urban or Rural (UR)	U=urban R=rural
Functional Class (FC)	0=ferry or ferry terminal
	1=interstate highway
	2=other fully controlled state highway
	3=U.S. Route
	4=state highway
	6=county road
	7=city street
	8=all other trafficways
Administrative Class (ADM)	1=state
	2=city
	3=county
	4=federal (parks, reservations, etc.)
	5=other
Prefix 1 (PREFIX1)	Numeric code used to further identify
	locations on a state highway
	1=couplet, used on decreasing milepost side only
	2=reversible lanes
	3=spur
	4=temporary route, detour
	5=construction area
	6=new route, open in both directions
	7=new route, open in one direction only
	8=old route, one direction only

	9=old route, replaced but still carried on system - deleted 1/1/88
	9=high occupancy vehicle (HOV) lanes - added 1/1/88
Prefix 2 (PREFIX2)	Alpha code used when an approximate accident
	location is used
	V=reported location is vague
	M=reported location is clear,
	but Accident Location Manual is incomplete
	X=unable to locate accident
	N=no location given on accident report
Severity of Accident (SEVERITY)	1=property damage only
	2=injury involved
	3=fatality involved
Number of Injuries (INJURYS)	Self-explanatory
Number of Fatalities (FATALS)	Self-explanatory
Most Severe Injury	
of the Accident (MSVJ)	0=not stated
	1=no injury
	2=dead
	5=disabling injury
	6=evident injury
	7=possible injury
Number of Vehicles	
Involved in Accident (VEH)	Self-explanatory
Property Damage Amount (PDO)	Total amount of property damage reported for the
	accident, as estimated by the
	investigating officer
Roadway Character (RDCH)	0=not stated 1=straight and level
	2=straight and grade 3=straight and hillcrest
	4=straight in sag 5=curve and level
	6=curve and grade 7=curve and hillcrest
	8=curve in sag
Character of Location (LOCATION)	1=street intersection 2=alley intersection
	3=driveway access 4=railroad crossing

	5=bridge, overpass or ferry dock
	6=underpass or tunnel
	7=rest area, turn-out or weigh station
	8=shopping plaza 9=other
Roadway Surface (SURFACE)	0=not stated 1=dry 2=wet 3=snow 4=ice 5=other
Weather (WEATHER)	0=not stated 1=clear/cloudy 2=raining
	3=snowing 4=foggy 5=other
Light (LIGHT)	1=daylight 2=dawn 3=dusk
	4=dark, street lights on 5=dark street lights off
	6=dark, no street lights 7=other
Ramp Code, 1970-85 (RAMP)	Prior to 1986 this was a 2 digit numeric code
	indicating the movement of a vehicle through an interchange.
	The first digit indicates the direction from which
	the vehicle entered the interchange area.
	The second digit indicates the direction in which
	the same vehicle was to leave the interchange area.
	Each point of the compass is represented by a different
	number. North=1 East=3 South=5 West=7
Ramp Code, 1986-Current (RAMP)	Beginning January 1, 1986, the ramp codes are:
	MM=on the mainline XX=on the crossroad RR=on a ramp
Vehicle 1's	
Compass Direction (COMP1)	1=north 2=northeast 3=east 4=southeast
	5=south 6=southwest 7=west 8=northwest
Vehicle 1's	
Milepost Directon (DIR1)	A=increasing direction B=decreasing direction
	C=entering major roadway from right
	D=entering major roadway from left

	E=vehicle traveling wrong way in the increasing
	direction of major roadway
	F=vehicle traveling wrong way in the decreasing
	direction of major roadway
	H=wrong way on ramp or collector road
Vehicle 1's Movement (VMVT1)	A=moving straight B=turning right C=turning left
	D=making u-turn E=parking F=passing on right
	G=passing on left H=backing
	J=merging due to lane reduction
	K=merging from one road to another, including ramps
	L=driverless moving vehicle, not in tow
Vehicle 1's Movement (VMVT1)	M=vehicle in tow, including trailers
	N=vehicle position is due to previous accident
	P=parked Q=stopped in traffic
	R=changing lanes to the right S=changing lanes to the left
	T=crosses centerline
Diagram Accident Type (COLDD)	01=strikes other vehicle head on
	02=strikes left side of other vehicle at angle
	03=strikes right side of other vehicle at angle
	04=sideswipes left side of other vehicle
	05=sideswipes right side of other vehicle
	06=strikes rear end of other vehicle
	07=strikes front end of other vehicle, not head on
	11=was struck by other vehicle head on
	12=was struck on left side at angle by other vehicle
	13=was struck on right side at angle by other vehicle
	14=was sideswiped on left side by other vehicle

	15=was sideswiped on right side by other vehicle
	16=was struck in rear end by other vehicle
	17=was struck in front end by other vehicle, not head on
	29=all other multi-vehicle involvements
	32=collision with animal or bird
	33=highway appurtenance
	34=other object
	40=strikes railroad train
	41=struck by railroad train
	50=overturn
	54=non-collision fire
	60=ran into roadway ditch
	61=ran into river, lake, slough, etc.
	62=ran over embankment, no guardrail
	71=pedestrian struck by vehicle
	72=pedestrian strikes vehicle
	73=pedalcyclist struck by vehicle
	74=pedalcyclist strikes vehicle
	99=all other single vehicle involvements
Vehicle 2's	
Compass Direction (COMP2)	1=north 2=northeast 3=east 4=southeast
	5=south 6=southwest 7=west 8=northwest
Vehicle 2's	
Milepost Directon (DIR2)	A=increasing direction B=decreasing direction
	C=entering major roadway from right
	D=entering major roadway from left
	E=vehicle traveling wrong way in the increasing
	direction of major roadway
	F=vehicle traveling wrong way in the decreasing
	direction of major roadway
	H=wrong way on ramp or collector road
Vehicle 2's Movement (VMVT2)	A=moving straight B=turning right C=turning left

	D=making u-turn E=parking F=passing on right
	G=passing on left H=backing
	J=merging due to lane reduction
Vehicle 2's Movement (VMVT2)	K=merging from one road to another, including ramps
	L=driverless moving vehicle, not in tow
	M=vehicle in tow, including trailers
	N=vehicle position is due to previous accident
	P=parked Q=stopped in traffic
	R=changing lanes to the right S=changing lanes to the left
	T=crosses centerline
Impact Location (IMPLOC)	A1=lane 1, increasing milepost direction
	A2=lane 2, increasing milepost direction
	A3=lane 3, increasing milepost direction
	A4=lane 4, increasing milepost direction
	A5=lane 5, increasing milepost direction
	A6=left turn lane, increasing milepost direction
	A7=right shoulder or parking lane, increasing milepost direction
	A8=median shoulder, increasing milepost direction
	A9=in median, increasing milepost direction
	A0=off the road past the shoulder, increasing milepost direction
	B1=intersecting road within 20 feet of major roadway,
	increasing milepost direction
	C1=on another road, increasing milepost side
	of major roadway
	C2=on frontage road, increasing milepost side

	of major roadway
	D1=lane 1, decreasing milepost direction
	D2=lane 2, decreasing milepost direction
	D3=lane 3, decreasing milepost direction
	D4=lane 4, decreasing milepost direction
	D5=lane 5, decreasing milepost direction
	D6=left turn lane, decreasing milepost direction
	D7=right shoulder or parking lane, decreasing milepost direction
	D8=median shoulder, decreasing milepost direction
	D9=in median, decreasing milepost direction
	D0=off the road past the shoulder, decreasing milepost direction
	E1=intersecting road within 20 feet of major roadway,
	decreasing milepost direction
	F1=on another road, decreasing milepost side
	of major roadway
	F2=on frontage road, decreasing milepost side
	of major roadway
	J1 to J9=major junction points on the increasing
	milepost side of the interchange
	K1 to K9=major junction points on the decreasing
	milepost side of the interchange
	L1 to L9=crossroad within the interchange area
	M1 to M9=collector road on the increasing
	milepost side of the interchange

	N1 to N9=collector road on the decreasing
	milepost side of the interchange
Impact Location (IMPLOC)	P1 to P9=off ramp on the increasing
	milepost side of the interchange
	Q1 to Q9=on ramp on the increasing
	milepost side of the interchange
	R1 to R9=off ramp on the decreasing
	milepost side of the interchange
	S1 to S9=on ramp on the decreasing
	milepost side of the interchange
Impact Combination Codes (IMP)	IN=all increasing milepost direction locations
"IN" AND "DE" CODES	DE=all decreasing milepost direction locations
NOT AVAILABLE IN SPSSPC+	MM=all mainline locations
	OF=all offroad locations
	RR=all ramp locations
	SH=all shoulder locations
	XX=all crossroad locations
Collision Type (COL)	00=pedestrian involved, vehicle moving straight
	01=pedestrian involved, vehicle turning right
	02=pedestrian involved, vehicle turning left
	03=pedestrian involved, vehicle backing
	04=pedestrian involved, all other vehicle movements
	05=pedestrian involved, vehicle movement not stated
	10=right angle
	11=same direction, both straight, both moving, sideswipe
	12=same direction, both straight, one stopped, sideswipe
	13=same direction, both straight, both moving, rear end
	14=same direction, both straight, one stopped, rear end

	15=same direction, one left turn, one straight
	16=same direction, one right turn, one straight
	17=same direction, both right turn - deleted 1/1/72
	18=same direction, both left turn - deleted 1/1/72
	19=entering parked position
	20=leaving parked position
	21=entering driveway
	22=leaving driveway
	23=same direction, all others
	24=opposite direction, both moving, head on
	25=opposite direction, one stopped, head on
	26=opposite direction, both straight, both moving, sideswipe
	27=opposite direction, both straight, one stopped, sideswipe
	28=opposite direction, one left turn, one straight
	29=opposite direction, one left turn, one right turn
	30=opposite direction, all others
	31=not stated
	32=moving vehicle strikes parked vehicle
	40=railroad train strikes moving vehicle
	41=railroad train strikes stalled or stopped vehicle
	42=vehicle strikes moving railroad train
	43=vehicle strikes stopped railroad train
	44=collision with unicyclist
	45=collision with bicyclist
	46=collision with tricyclist
Collision Type (COL)	47=collision with large domestic animal (horse, cow, sheep, etc.)
	48=collision with small domestic animal (cat, dog, etc.)

	49=collision with non-domestic animal (deer, bear, elk, etc.)
	50=vehicle strikes fixed object
	51=vehicle strikes other object
	52=vehicle overturned
	53=occupant fell, jumped or was pushed from vehicle
	54=fire started in vehicle
	55=occupants overcome by carbon monoxide
	56=breakage of any part of the vehicle resulting in
	injury or further property damage
	57=all other non-collision
	58=vehicle strikes object, then another vehicle
	71=same direction, both turning right, both moving, sideswipe
	72=same direction, both turning right, one stopped, sideswipe
	73=same direction, both turning right, both moving, rear end
	74=same direction, both turning right, one stopped, rear end
	81=same direction, both turning left, both moving, sideswipe
	82=same direction, both turning left, one stopped, sideswipe
	83=same direction, both turning left, both moving, rear end
	84=same direction, both turning left, one stopped, rear end
Collision Combination Codes	AA=all pedestrian accidents (codes 00-05)
NOT AVAILABLE IN SPSSPC+	BB=all rear end accidents (codes 13, 14, 73-74, 83-84)
	CC=all opposite direction accidents (codes 24-30)
	DD=all railroad train accidents (codes 40-43)
	EE=all pedacyclist accidents (codes 44-46)

	FF=all animal accidents (codes 47-49)
	GG=all object struck accidents (codes 50-51)
	HH=all parking related accidents (codes 19-20)
	JJ=all driveway related accidents (codes 21-22)
Object Struck (OBJ)	08=retaining wall
	09=curb, raised traffic island or raised median curb
	11=bridge abutment
	12=bridge column, pier or pillar
	13=wood sign post
	14=metal sign post
	15=guide post
	16=luminaire pole or base
	17=railway signal or pole
	18=utility pole
	19=traffic signal pole and/or control equipment
	20=culvert and/or other appurtenance in ditch
	22=overhead sign support
	23=toll booth
	24=toll booth island
	25=closed toll gate
	26=railway crossing gate
	27=reversible lane control gate
	28=underside of bridge
Object Struck (OBJ)	30=crash cushions
	31=guardrail, leading end
	32=guardrail, face of rail (did not go through, over or under)
	33=guardrail, face of rail (did go through, over or under)
	34=concrete barrier, leading end
	35=concrete barrier, face of barrier (did not go through, over or under)
	36=concrete barrier, face of barrier (did go through, over or under)
	37=bridge rail, leading end

	38=bridge rail, face of rail (did not go through, over or under)
	39=bridge rail, face of rail (did go through, over or under)
	49=manhole cover - added 1/1/89
	50=temporary traffic sign or barricade
	51=road or construction machinery - deleted 1/1/81
	52=construction materials
	53=miscellaneous objects or debris on road surface
	54=falling rock or tree fell on vehicle
	55=fallen tree or rock
	56=tree or stump (stationary)
	57=boulder (stationary)
	58=rock bank or ledge
	59=earth bank or ledge
	60=mud or land slide
	61=snow bank
	62=snow slide
	63=building
	64=fire plug
	65=parking meter
	66=fence
	67=domestic animal (ridden)
	68=animal-drawn vehicle
	69=ran over embankment, no guardrail present
	70=ran into river, lake, slough, etc.
	71=other objects
	72=not stated
	73=mail box
	74=roadway ditch
	75=state road or construction machinery - added 1/1/81
	76=county road or construction machinery - added 1/1/81
	77=city road or construction machinery - added 1/1/81
	78=other road or construction machinery - added 1/1/81

Object Struck Combination Codes	AA=all guardrail accidents (codes 31-33)
NOT AVAILABLE IN SPSSPC+	BB=all concrete barrier accidents (codes 34-36)
	CC=all bridge rail accidents (codes 37-39)
Junction Relationship (JUNC)	1=at intersection and related
	2=intersection related, but not at intersection
	3=at driveway and related
	4=non-intersection and not related
	5=at intersection but not related
	6=driveway within intersection
	7=driveway related but not at driveway
Accident Occurred	
On or Off Roadway (ONOFFRD)	1=on roadway
	2=off roadway
	3=on another roadway
Driver 1's	
Residence Proximity (RESPROX1)	
Driver 2's	
Residence Proximity (RESPROX2)	
Driver 3's	
Residence Proximity (RESPROX3)	0=not stated
	1=resident within 15 miles
	2=resident elsewhere in state
	3=non-resident of state
Sobriety of Driver 1 (SOB1)	
Sobriety of Driver 2 (SOB2)	
Sobriety of Driver 3 (SOB3)	1=had been drinking, ability impaired
	2=had been drinking, ability not impaired
	3=had been drinking, sobriety unknown
	4=had not been drinking
	5=unknown
Driver 1's 1st	
Contributing Cause (DR1CC1)	
Driver 1's 2nd	
Contributing Cause (DR1CC2)	
Driver 2's 1st	
Contributing Cause (DR2CC1)	
Driver 2's 2nd	

Contributing Cause (DR2CC2)	
Driver 3's 1st	
Contributing Cause (DR3CC1)	
Driver 3's 2nd	
Contributing Cause (DR3CC2)	01=under influence of alcohol
	02=under influence of drugs
	03=exceeded stated speed limit
	04=exceeded reasonable safe speed for conditions
	05=did not grant right of way to vehicle
	06=immproper passing
	07=following too closely
	08=over centerline
	09=failing to signal
	10=improper turning
	11=disregarded stop and go light
Driver 1's 1st	
Contributing Cause (DR1CC1)	
Driver 1's 2nd	
Contributing Cause (DR1CC2)	
Driver 2's 1st	
Contributing Cause (DR2CC1)	
Driver 2's 2nd	
Contributing Cause (DR2CC2)	
Driver 3's 1st	
Contributing Cause (DR3CC1)	
Driver 3's 2nd	
Contributing Cause (DR3CC2)	12=disregarded stop sign or red flashing light
	13=disregarded warning signal
	14=apparently asleep
	15=improper parking location
	16=operating defective equipment
	17=other cause
	18=no violation
	19=improper signal
	20=improper u-turn
	21=headlight violation (no lights or failed to dim)
	22=did not grant right of way to pedestrian or pedalcyclist
	23=inattention

Driver 1's	
Vehicle Actions (DR1VAC)	
Driver 2's	
Vehicle Actions (DR2VAC)	
Driver 3's	
Vehicle Actions (DR3VAC)	01=going straight
	02=overtaking and passing
	03=making right turn
	04=making left turn
	05=making u-turn
	06=slowing
	07=stopped for traffic
	08=stopped at signal or stop sign
	09=stopped in roadway
	10=starting in traffic lane
	11=starting from parked position
	12=merging (entering traffic)
	13=legally parked, vehicle occupied
	14=legally parked, vehicle unoccupied
	15=backing
	16=going wrong way on divided highway
	17=going wrong way on ramp
	18=going wrong way on one-way street or road
	19=other
	20=changing lanes
Driver 1's	
Vehicle Actions (DR1VAC)	
Driver 2's	
Vehicle Actions (DR2VAC)	
Driver 3's	
Vehicle Actions (DR3VAC)	21=illegally parked, vehicle occupied
	22=illegally parked, vehicle unoccupied
Investigating Agency (INVEST)	0=not stated
	1=state patrol
	2=city police
	3=county sheriff
	4=other agency
	5=not stated
Vehicle 1's Type (VT1)	
Vehicle 2's Type (VT2)	

Vehicle 3's Type (VT3)	00=not stated
	01=passenger car
	02=truck (pickup or panel delivery under 10,000lbs.)
Codes 03 to 07 are used to	03=truck (flatbed, van etc.)
select trucks over 10,000 lbs.	04=truck and trailer
	05=truck tractor
	06=truck tractor and semi-trailer
	07=other truck combinations
	08=farm tractor and/or equipment
	09=taxi
	10=bus or motor stage
	11=school bus
	12=motorcycle
	13=scooter bike
	14=other
	15=moped
State Patrol	
Accident Report Number (ACCRPT)	6 digit number assigned to each accident report
	upon receipt by State Patrol
Most Alcohol Impaired	
Driver of the Accident (ALCOHOL)	1=had been drinking, ability impaired
	2=had been drinking, ability not impaired
	3=had been drinking, sobriety unknown
	4=had not been drinking
	5=unknown
Driver 1's Age (DR1AGE)	
Driver 2's Age (DR2AGE)	
Driver 3's Age (DR3AGE)	actual age of driver from accident report
Hazardous Materials	
Being Transported (HAZMAT)	1=flammable liquid
	2=corrosive material
	3=explosive material
	4=radioactive material
	5=ammonia
	6=chlorine
	7=other
Fuel Spillage	
Due to Collision (SPILLAGE)	1=yes 2=no

Fire Resulted	
Due to Collision (FIRE)	1=yes 2=no
Vehicle 1's 1st	
Miscellaneous Action (V1MISAC1)	
Vehicle 1's 2nd	
Miscellaneous Action (V1MISAC2)	
Vehicle 2's 1st	
Miscellaneous Action (V2MISAC1)	
Vehicle 2's 2nd	
Miscellaneous Action (V2MISAC2)	
Vehicle 3's 1st	
Miscellaneous Action (V3MISAC1)	
Vehicle 3's 2nd	
Miscellaneous Action (V3MISAC2)	01=skidded attempting to slow or stop
	02=skidded attempting to avoid collision
	03=other skidding
	05=avoiding another vehicle
	06=avoiding a pedestrian
	07=avoiding a domestic animal (livestock)
	08=avoiding a domestic animal (other)
	09=avoiding a non-domestic animal
	10=avoiding other object in roadway
	11=avoiding a previous accident
	12=slowing for traffic signal or sign
	13=slowing for pedestrian/pedalcyclist
	14=slowing for another vehicle
	15=slowing for animal
	16=slowing prior to making a turn
	17=stopped for hitchhiker
	18=stopped on shoulder
	19=stopped for signal or sign
	20=stopped for pedestrian/pedalcyclist
	21=stopped for another vehicle
	22=stopped for animal
	23=stopped for railroad train or at railroad crossing
	24=stopped for previous accident
	25=stopped in line of traffic
	26=stopped for obstruction in roadway
	27=stopped prior to turning right

Vehicle 1's 1st	
Miscellaneous Action (V1MISAC1)	
Vehicle 1's 2nd	
Miscellaneous Action (V1MISAC2)	
Vehicle 2's 1st	
Miscellaneous Action (V2MISAC1)	
Vehicle 2's 2nd	
Miscellaneous Action (V2MISAC2)	
Vehicle 3's 1st	
Miscellaneous Action (V3MISAC1)	
Vehicle 3's 2nd	
Miscellaneous Action (V3MISAC2)	28=stopped prior to turning left
	29=stopped in process of turning
	30=stopped to load or unload
	31=stopped in roadway
	32=parking maneuver - parallel parking
	33=parking maneuver - angle parking
	36=forced off roadway
	37=lost control in passing maneuver
	38=forced into opposing lane
	39=attempting u-turn in mid-block
	40=turn after stopping at red flashing light or stop sign
	41=started to overtake - struck by overtaken vehicle
	42=car ran away - no driver
	43=proceeded after stopping for flashing red light or stop sign
	44=starting or stopping for hitchhiker
	46=hood flew open
	47=chain broke, releasing logs
	48=lost part of load
	49=shifting load caused injury or damage within vehicle
	50=overhanging load struck another vehicle or object
	51=object set in motion by another vehicle
	53=trailer jackknifed
	54=trailer connection broke
	55=trailer or towed vehicle struck towing vehicle

	56=tow chain broke
	57=trailer overturned
	58=attached trailer struck or sideswiped another vehicle
	61=pushing another vehicle
	63=towing, or had been towing, another vehicle
	64=wrecker in roadway
	65=vehicle stalled in roadway
	66=vehicle abandoned in roadway
	68=vehicle being pushed, or had been pushed, by pedestrian
	69=pedestrian struck by vehicle from which he or she had just alighted
	70=pupil struck by school bus while entering or leaving
	71=pupil struck on road while approaching or leaving
	stopped school bus in loading zone
Vehicle 1's 1st	
Miscellaneous Action (V1MISAC1)	
Vehicle 1's 2nd	
Miscellaneous Action (V1MISAC2)	
Vehicle 2's 1st	
Miscellaneous Action (V2MISAC1)	
Vehicle 2's 2nd	
Miscellaneous Action (V2MISAC2)	
Vehicle 3's 1st	
Miscellaneous Action (V3MISAC1)	
Vehicle 3's 2nd	
Miscellaneous Action (V3MISAC2)	72=pupil struck by other vehicle on road
	while approaching or leaving school bus
	that is entering or leaving loading area
	73=pedestrian struck by object set in motion by vehicle
	74=pedestrian struck while hitchhiking
	76=occupant fell or jumped from vehicle
	77=passenger interfered with driver

	78=occupant of parked or stopped vehicle opened door and
	was struck by moving vehicle
	79=animal inside of vehicle interfered with driver
	80=dust storm
	81=smoke or smog condition
	82=road washed out
	83=bridge washed out
	84=high water on roadway
	85=hazardous materials on road surface
	86=mud and/or debris on roadway
	87=construction area
	88=foot slipped off clutch or brake
	89=gust of wind
	90=blinded by sun
	91=blinded by headlights
	92=view obscured by other vehicle
	93=fire started after collision
	94=drowned after running into water
	95=physical illness
	96=stolen vehicle involved
	97=hit and run
	98=view obscured by frost, ice, etc. on windshield
	99=struck an object before impact (curb)
Vehicle 1's 1st	
Miscellaneous Action (V1MISAC1)	
Vehicle 1's 2nd	
Miscellaneous Action (V1MISAC2)	
Vehicle 2's 1st	
Miscellaneous Action (V2MISAC1)	
Vehicle 2's 2nd	
Miscellaneous Action (V2MISAC2)	
Vehicle 3's 1st	
Miscellaneous Action (V3MISAC1)	
Vehicle 3's 2nd	
Miscellaneous Action (V3MISAC2)	A1=volcanic ash on roadway
	A2=accumulation of dry volcanic ash on roadway

	A3=accumulation of wet volcanic ash on roadway
Codes A1 to C3 were added	A4=accumulation of mixed debris on roadway caused by volcanic activity
in June of 1980 in response	A5=volcanic lava on roadway
to the eruption of Mt. St. Helens	A6=flooded due to volcanic activity
	B1=windshield obstructed by volcanic ash
	B2=vehicle mechanically incapacitated by ash
	C1=sight obstructed by volcanic ash in the air
	C2=sight obstructed by volcanic ash in the eyes
	C3=coughing or other reflex distraction due to volcanic ash
Vehicle 1	
Additional Information (V1INFO)	
Vehicle 2	01=commercial motor vehicle
Additional Information (V2INFO)	02=emergency vehicle (including private)
Vehicle 3	03=army vehicle
Additional Information (V3INFO)	04=navy vehicle
	05=other military vehicle
	06=logging truck
	07=foreign car
	08=state exempt license vehicle
	09=county exempt license vehicle
	10=municipal exempt license vehicle
	11=other government
	12=overwidth mobile home - 12 foot
	13=overwidth mobile home - 14 foot
	14=all other mobile homes
Pedestrian /	
Pedalcyclist 1's Injury (PED1INJ)	0=not stated
Pedestrian /	1=no injury
Pedalcyclist 2's Injury (PED2INJ)	2=dead
	5=disabling injury
	6=evident injury
	7=possible injury
Pedestrian /	

Pedalcyclist 1's Age (PED1INJ)	
Pedestrian /	
Pedalcyclist 2's Age (PED2INJ)	actual age from accident report
Pedestrian /	
Pedalcyclist 1's Actions (PED1ACTS)	
Pedestrian /	
Pedalcyclist 2's Actions (PED2ACTS)	
Pedestrian Actions	00=not stated
	01=crossing at intersection with signal
	02=crossing at intersection against signal
	03=crossing at intersection, no signal
	04=crossing at intersection, diagonally
	05=coming from behind parked vehicle
	06=crossing not at intersection, no crosswalk
	07=crossing not at intersection, in crosswalk
	08=walking in roadway with traffic
	09=walking in roadway against traffic
	10=walking on roadway shoulder with traffic
	11=walking on roadway shoulder against traffic
	12=standing or working on vehicle
	13=pushing or working on vehicle
	14=playing in roadway
	15=lying in roadway
	16=not in roadway
	17=all others
	18=fell or was pushed into path of vehicle
	19=at intersection, not using crosswalk
Pedestrian /	
Pedalcyclist 1's Actions (PED1ACTS)	
Pedestrian /	
Pedalcyclist 2's Actions (PED2ACTS)	
Pedalcyclist Actions	40=not stated

	43=crossing diagonally
	44=riding with traffic
	45=riding against traffic
	46=fell or was pushed into path of vehicle
	47=turned into path of vehicle, same direction
	48=turned into path of vehicle, opposite direction
	49=all others
	50=crossing or entering the trafficway

APPENDIX B

INCIDENT RESPONSE TEAM DATA

ROW NUMBER	RECORD #	STATE ROUTE	MILE POST	NUMBER	STREET	TYPE
1	82	5	167	167000	SR 5	HWY
2	84	5	155.2	155200	SR 5	HWY
3	85	5	155.2	155200	SR 5	HWY
4	83	5	176.16	176160	SR 5	HWY
5	104	5	163.5	163500	SR 5	HWY
6	107	5	145	145000	SR 5	HWY
7	89	405	4.5	4500	SR 405	HWY
8	90	405	0.27	270	SR 405	HWY
9	91	520	3.07	3070	SR 520	HWY
10	95	5	164	164000	SR 5	HWY
11	92	5	168.6	168600	SR 5	HWY
12	98	5	0.27	270	SR 5	HWY
13	97	5	154.65	154650	SR 5	HWY
14	99	405	10.74	10740	SR 405	HWY
15	110	405	4.5	4500	SR 405	HWY
16	102	90	11	11000	SR 90	HWY
17	127	90	3.91	3910	SR 90	HWY
18	106	5	160.91	160910	SR 5	HWY
19	115	5	155.6	155600	SR 5	HWY
20	112	520	0.17	170	SR 520	HWY
21	114	90	5.01	5010	SR 90	HWY
22	119	5	154	154000	SR 5	HWY
23	121	90	0.7	700	SR 90	HWY
24	122	5	172.65	172650	SR 5	HWY
25	123	5	169.4	169400	SR 5	HWY
26	126	5	162.82	162820	SR 5	HWY
27	125	520	7.29	7290	SR 520	HWY
28	152	5	166.9	166900	SR 5	HWY
29	128	5	161.82	161820	SR 5	HWY
30	130	5	167.72	167720	SR 5	HWY
31	132	5	153.5	153500	SR 5	HWY
32	131	90	9.13	9130	SR 90	HWY
33	133	5	144.65	144650	SR 5	HWY
34	156	5	151.1	151100	SR 5	HWY
35	135	405	4.2	4200	SR 405	HWY
36	136	405	0.00	0	SR 405	HWY

ROW NUMBER	RECORD #	STATE ROUTE	MILE POST	NUMBER	STREET	TYPE
37	139	5	170.76	170760	SR 5	HWY
38	140	5	154.64	154640	SR 5	HWY
39	141	520	7.29	7290	SR 520	HWY
40	142	5	165.9	165900	SR 5	HWY
41	143	5	169.18	169180	SR 5	HWY
42	147	90	9.2	9200	SR 90	HWY
43	159	5	173.15	173150	SR 5	HWY
44	161	5	154	154000	SR 5	HWY
45	162	405	2.34	2340	SR 405	HWY
46	167	405	7.5	7500	SR 405	HWY
47	169	5	164.66	164660	SR 5	HWY
48	170	520	7.09	7090	SR 520	HWY
49	172	5	162.5	162500	SR 5	HWY
50	175	405	23.52	23520	SR 405	HWY
51	177	405	1.3	1300	SR 405	HWY
52	178	405	5.22	5220	SR 405	HWY
53	179	5	153.15	153150	SR 5	HWY
54	180	5	169.18	169180	SR 5	HWY
55	182	5	163.93	163930	SR 5	HWY
56	181	5	169.02	169020	SR 5	HWY
57	183	5	171.47	171470	SR 5	HWY
58	184	5	147.64	147640	SR 5	HWY
59	185	5	161.53	161530	SR 5	HWY
60	186	5	172.76	172760	SR 5	HWY
61	191	405	16.85	16850	SR 405	HWY
62	192	5	162.97	162970	SR 5	HWY
63	194	520	8.59	8590	SR 520	HWY
64	196	5	163	163000	SR 5	HWY
65	197	90	5.01	5010	SR 90	HWY
66	201	5	174.75	174750	SR 5	HWY
67	202	405	14.12	14120	SR 405	HWY
68	203	405	25.02	25020	SR 405	HWY
69	206	405	15.4	15400	SR 405	HWY
70	210	5	145.9	145900	SR 5	HWY
71	208	5	148.6	148600	SR 5	HWY
72	207	5	153.4	153400	SR 5	HWY

ROW NUMBER	RECORD #	STATE ROUTE	MILE POST	NUMBER	STREET	TYPE
73	209	5	162.85	162850	SR 5	HWY
74	213	5	174.31	174310	SR 5	HWY
75	211	90	5.01	5010	SR 90	HWY
76	212	5	166.46	166460	SR 5	HWY
77	216	5	154.2	154200	SR 5	HWY
78	220	5	142.04	142040	SR 5	HWY
79	221	5	168	168000	SR 5	HWY
80	222	5	168.5	168500	SR 5	HWY
81	224	5	162.82	162820	SR 5	HWY
82	229	5	176	176000	SR 5	HWY
83	231	90	12.52	12520	SR 90	HWY
84	236	5	163.86	163860	SR 5	HWY
85	237	5	154	154000	SR 5	HWY
86	238	90	5.6	5600	SR 90	HWY
87	240	5	162.73	162730	SR 5	HWY
88	241	5	162.73	162730	SR 5	HWY
89	242	5	171.62	171620	SR 5	HWY
90	243	5	164	164000	SR 5	HWY
91	248	5	164.01	164010	SR 5	HWY
92	251	405	13.82	13820	SR 405	HWY
93	253	90	16.33	16330	SR 90	HWY
94	254	405	1.8	1800	SR 405	HWY
95	258	90	11.6	11600	SR 90	HWY
96	259	5	164.2	164200	SR 5	HWY
97	261	5	164	164000	SR 5	HWY
98	262	520	8.2	8200	SR 520	HWY
99	263	5	168.96	168960	SR 5	HWY
100	264	5	172.75	172750	SR 5	HWY
101	270	5	163	163000	SR 5	HWY
102	268	5	169.87	169870	SR 5	HWY

ROW NUMBER	DATE	RAIN	SNOW	WIND	CLEA	CLOUDY	FOG	DRY	WET	ICE	SNOW
1	011491	1		1		1			1		
2	011991				1			1			
3	011991				1			1			
4	012191				1			1			
5	020391	1							1		
6	020591				1			1			
7	021391	1				1			1		
8	021691					1		1			
9	021791	1		1		1			1		
10	021991			1		1		1			
11	021991					1		1			
12	022091					1		1			
13	022091	1		1		1			1		
14	022191					1		1			
15	030391	1							1		
16	030991				1			1			
17	031191				1			1			
18	031391				1			1			
19	031991				1			1			
20	031991				1			1			
21	032091				1			1			
22	032991				1	1		1			
23	040391	1		1		1			1		
24	040491	1		1		1			1		
25	040691	1				1			1		
26	041091					1		1			
27	041191					1		1			
28	041391				1			1			
29	041891				1			1			
30	042291				1			1			
31	042491	1		1		1			1		
32	042491					1		1			
33	042591				1			1			
34	042891					1		1			
35	050291				1			1			
36	050391				1			1			

ROW NUMBER	DATE	RAIN	SNOW	WIND	CLEA	CLOUDY	FOG	DRY	WET	ICE	SNOW
37	050691				1			1			
38	050791	1				1			1		
39	050791	1				1			1		
40	050891					1		1			
41	050891					1		1			
42	051391					1		1			
43	052291					1		1			
44	052391	1							1		
45	053091					1		1			
46	060391					1		1			
47	060691					1		1			
48	060791					1		1			
49	060991				1			1			
50	061391					1		1			
51	061591	1				1			1		
52	061591	1				1			1		
53	062091	1				1			1		
54	062191				1			1			
55	062491				1			1			
56	062491				1			1			
57	062691				1			1			
58	062791				1			1			
59	062891				1			1			
60	070191				1			1			
61	073091				1			1			
62	080191				1			1			
63	080391				1			1			
64	081791				1			1			
65	081791				1			1			
66	082791	1							1		
67	082891					1			1		
68	082991				1			1			
69	090591				1			1			
70	090891				1			1			
71	090891				1			1			
72	090891				1			1			

ROW NUMBER	DATE	RAIN	SNOW	WIND	CLEA	CLOUDY	FOG	DRY	WET	ICE	SNOW
73	090891				1			1			
74	091391				1			1			
75	091391				1			1			
76	091691				1			1			
77	092091				1			1			
78	092391				1			1			
79	092591				1			1			
80	100291				1			1			
81	100391				1			1			
82	101091				1			1			
83	101691	1		1					1		
84	102091				1			1			
85	102291					1		1			
86	102291					1		1			
87	103191	1				1			1		
88	103191	1				1		1			
89	110791					1		1			
90	111091					1		1			
91	111691	1				1			1		
92	112091					1		1			
93	112391					1	1	1			
94	112391					1		1			
95	120191	1				1			1		
96	120391					1		1			
97	120691	1				1			1		
98	120891			1		1		1			
99	120991					1		1			
100	120991					1		1			
101	121591						1			1	
102	121691						1			1	

ROW NUMBER	DOT ON SCENE	TIME ROAD CLOSED	LENGTH OF CLOSURE	SINGLE LANE CLOSED	SINGLE DIRECTION CLOSED
1	0724	0658	2		1
2	0230	0152	3		1
3	0230	0152	3		1
4	1836	1813	2		
5	1420	1344	2		1
6	0115		0.1		1
7	1356	1343	3		
8	1048	0947	2	1	
9	0316	0203	3	1	1
10	1031	1015	1	1	
11	1841	1814	2		1
12	2003	1918	2		
13	0500	0327	1	1	
14	2220	2130	2		
15	1705	1612		1	
16	2110	2138	0.5		
17	1142	1136	1		1
18	2306	2226	2	1	
19	1052	1032	1		1
20	1300	1300	1	1	1
21	1045	1036	2		1
22	1059	1056	0.5	1	1
23	0953	0949	2		
24	1330	1324	2		1
25	2110	2042	2		
26	2227	2157	4		
27	1134	1130	1	1	
28	0400	0257	3		
29	1633	1614	1		1
30	1852	1840	1		1
31	1610	1610	2		1
32	0800	0818	1		1
33	1433	1410	2	1	
34	1450	1430	2	1	
35	1053	1055	1	1	
36	1147	1122	2	1	

ROW NUMBER	DOT ON SCENE	TIME ROAD CLOSED	LENGTH OF CLOSURE	SINGLE LANE CLOSED	SINGLE DIRECTION CLOSED
37	1920	1900	1	1	
38	0610	0405	4	1	
39	1314	1257	1		1
40	0749	0740	0.5		1
41	1015	1013	2		1
42	1042	1118	1		1
43	0749	0719	4		1
44	2355	2327	2	1	
45	1223	1211	4	1	
46	1121	1106	0.5	1	
47	1057	1051	1	1	
48	0640	0634	1	1	
49	0210	0202	5		1
50	1105	1047	1		1
51	1730	1722	2		1
52	2325	2312	1		1
53	0047	0013	1		1
54	1545	1533	2		1
55	1144	1129	1		1
56	0943	0923	1		1
57	1103	1100	0.5		1
58	1033	1001	2	1	
59	2250	2215	2		1
60	1540	1535	3		1
61	0015	2350	4	1	1
62	1428	1414	3		
63	0850	0823	4	1	
64	0236	0207	2		
65	0339	0254	1		1
66	0825	0810	2		1
67	1239	1235	2		1
68	0433	0321	8	1	
69	1734		4		1
70	1723	1654	1		1
71	2143	2143	1		1
72	2030	2012	1		1

ROW NUMBER	DOT ON SCENE	TIME ROAD CLOSED	LENGTH OF CLOSURE	SINGLE LANE CLOSED	SINGLE DIRECTION CLOSED
73	2057	2049	2		
74	1726	1644	1	1	
75	1003	1003	4		1
76	1258	1219	2		
77	1617	1546	5		
78	0530	0315	2	1	1
79	1604	1609	2		1
80	1331		0.33		1
81	1550		0.6	1	
82		1406	2		1
83	0840	0819	2	1	
84	1930	1835	2	1	
85	1612	1546	1		
86	2154	2125	2		1
87	0927	0923	1		1
88	1409	1359	2		1
89	1513	1508	1	1	
90	0242	0213	3		1
91	0743	0717	1		1
92	0300	0306	3		1
93	0041	0035	3		
94	1214	1136	2		1
95	0154	0154	3	1	
96	1736	1736	2	1	
97	1803	1746	1	1	
98	1617	1551	4	1	
99	1341	1335	1	1	
100	2153	2138	1		
101	0930	0905	4		
102	0635	0559	2		1

ROW NUMBER	BOTH DIRECTIONS CLOSED	RAMP TOTAL CLOSURE	ACCIDENT SINGLE VEHICLE	ACCIDENT MULTIPLE VEHICLE
1				1
2				1
3				1
4	1			
5		1		1
6				
7	1			1
8		1		1
9				1
10			1	
11				1
12		1	1	
13			1	
14		1	1	
15				1
16			1	
17			1	
18			1	
19			1	
20			1	
21				1
22				1
23		1	1	
24			1	
25		1	1	
26	1	1		1
27			1	
28		1		
29				1
30			1	
31				1
32				1
33				1
34				1
35				1
36			1	

ROW NUMBER	BOTH DIRECTIONS CLOSED	RAMP TOTAL CLOSURE	ACCIDENT SINGLE VEHICLE	ACCIDENT MULTIPLE VEHICLE
37			1	
38				1
39			1	
40				1
41			1	
42			1	
43				1
44				1
45		1	1	
46				1
47				1
48			1	
49		1	1	
50				1
51				1
52			1	
53				1
54				1
55				1
56			1	
57			1	
58			1	
59				1
60				1
61			1	
62	1			1
63			1	
64		1		1
65				1
66		1		
67				1
68				1
69				1
70				1
71				1
72			1	

ROW NUMBER	BOTH DIRECTIONS CLOSED	RAMP TOTAL CLOSURE	ACCIDENT SINGLE VEHICLE	ACCIDENT MULTIPLE VEHICLE
73		1	1	
74				1
75				1
76		1	1	
77		1	1	
78			1	
79				1
80				
81				1
82				
83			1	
84				1
85				1
86				1
87		1		1
88		1		1
89			1	
90				1
91				1
92			1	
93		1	1	
94			1	
95				1
96				1
97				
98			1	
99			1	
100			1	
101	1			1
102				1

ROW NUMBER	FATAL ACCIDENT	HAZ MAT SPILL	NON-HAZ MAT SPILL	AUTO	MOTOR CYCLE	TRUCK
1				1		1
2	1			1		
3	1			1		
4						
5				1		
6						
7				1		
8	1			1		
9	1			1		
10						
11			1			
12	1			1		
13				1		
14	1				1	
15				1		
16						
17				1		
18	1			1		
19			1			
20				1		
21		1		1		
22				1		
23						
24		1				1
25				1		
26	1			1		
27			1			1
28						
29				1		
30		1				
31				1		
32				1		
33				1		
34				1		
35		1		1		
36						

ROW NUMBER	FATAL ACCIDENT	HAZ MAT SPILL	NON-HAZ MAT SPILL	AUTO	MOTOR CYCLE	TRUCK
37		1		1		
38	1			1		
39						
40				1		
41						
42			1			
43	1			1	1	1
44				1		
45		1				
46				1		
47				1		
48				1		
49						
50		1		1		1
51				1		1
52				1		
53				1		
54				1		
55				1		
56				1		
57				1		
58						
59	1			1		
60		1		1		
61	1					
62	1			1		
63	1			1		
64				1		
65				1		1
66						
67		1		1		
68						
69				1		
70				1		1
71				1		
72						

ROW NUMBER	FATAL ACCIDENT	HAZ MAT SPILL	NON-HAZ MAT SPILL	AUTO	MOTOR CYCLE	TRUCK
73	1			1		
74						
75	1			1		1
76						
77						
78				1		
79				1		
80						
81				1		
82				1		
83						
84	1			1		
85				1		
86				1		
87				1		
88				1		
89				1		
90				1		
91				1		
92	1			1		
93	1			1		
94		1				
95				1		
96				1		
97			1			
98						
99			1			
100		1				
101	1			1		
102				1		

ROW NUMBER	VAN	TANKER	SEMI	PICK UP	PED	BIKE	# VEHS
1							3
2							1
3							2
4					1		
5			1				4
6			1				
7			1				4
8			1				2
9							2
10	1						1
11			1	1			2
12							1
13					1		1
14							1
15							4
16			1				1
17							1
18							1
19				1			
20							1
21				1			2
22			1				4
23			1				1
24							1
25							1
26							2
27							1
28					1		
29							1
30							1
31			1	1			4
32			1	1			6
33	1						3
34				1			2
35			1				2
36			1				1

ROW NUMBER	VAN	TANKER	SEMI	PICK UP	PED	BIKE	# VEHS
37							1
38							2
39			1				1
40	1			1			3
41			1				1
42			1				1
43	1						6
44			1				4
45			1				1
46			1				3
47				1			2
48							1
49			1				1
50	1						6
51							6
52							1
53							3
54				1			4
55			1				3
56							1
57							1
58			1				1
59							3
60			1				4
61				1			1
62			1				5
63							1
64	1						2
65							5
66			1				2
67			1				2
68			1	1			2
69							2
70							3
71				1			5
72			1				1

ROW NUMBER	VAN	TANKER	SEMI	PICK UP	PED	BIKE	# VEHS
73							1
74			1				2
75	1		1				6
76			1				1
77			1				1
78							1
79	1						3
80			1				1
81							2
82					1		1
83			1				1
84				1			2
85							2
86				1			5
87			1	1			5
88			1				3
89							1
90							4
91							7
92					1		1
93							1
94			1				1
95							3
96			1				2
97			1				1
98				1			1
99			1				1
100			1				1
101			1				4
102	1						18

ROW NUMBER	CLEAN UP REQD	TRAFFIC CONTROL	DETOUR REQD	WSP	FIRE	ECOLOGY
1						
2		1		1	1	
3		1		1	1	
4		1	1	1		
5		1	1	1		
6		1		1		
7		1	1	1	1	
8		1		1	1	
9		1		1	1	
10		1		1		
11	1	1		1		
12		1	1	1	1	
13						
14		1	1	1	1	
15		1		1		
16		1		1		
17	1	1		1	1	
18		1		1	1	
19	1	1		1		
20	1	1		1	1	
21	1	1		1	1	1
22		1		1		
23	1	1		1		
24		1		1		
25	1	1		1	1	
26	1	1	1	1	1	
27	1	1		1		
28		1		1		
29		1		1	1	
30	1	1		1		
31	1	1	1	1	1	
32		1		1		
33		1		1	1	
34		1		1	1	
35	1	1		1	1	1
36	1	1		1		

ROW NUMBER	CLEAN UP REQD	TRAFFIC CONTROL	DETOUR REQD	WSP	FIRE	ECOLOGY
37	1	1		1		
38		1		1	1	
39		1		1		
40		1		1	1	
41	1	1		1		
42	1	1		1		
43	1	1		1	1	
44	1	1		1	1	1
45	1	1	1	1	1	1
46		1		1	1	
47		1		1	1	
48	1	1		1	1	
49	1	1	1	1	1	1
50	1	1		1	1	
51		1		1	1	
52	1	1		1		
53		1		1	1	
54	1	1		1	1	
55		1		1	1	
56	1	1	1	1	1	
57	1	1		1	1	
58	1	1		1	1	1
59		1		1	1	
60	1	1		1	1	
61		1		1	1	
62	1	1		1	1	
63		1		1	1	
64		1		1	1	
65		1		1		
66		1		1	1	
67	1	1		1	1	1
68	1	1		1	1	
69	1	1		1		
70		1		1		
71		1		1	1	
72		1		1		

ROW NUMBER	CLEAN UP REQD	TRAFFIC CONTROL	DETOUR REQD	WSP	FIRE	ECOLOGY
73		1		1	1	
74	1	1		1		
75	1	1	1	1	1	
76		1	1	1		
77	1	1	1	1	1	
78		1		1		
79		1		1	1	
80	1	1		1		
81		1		1		
82		1		1		
83		1		1		
84		1		1	1	
85		1		1		
86	1	1		1		
87	1	1		1	1	
88	1	1		1	1	
89	1	1		1	1	
90	1	1		1	1	
91	1	1	1	1	1	
92		1		1		
93	1	1		1	1	
94	1	1		1		1
95		1		1		
96	1	1		1		
97	1	1		1		
98		1		1		
99	1	1		1		
100	1	1		1		1
101	1	1	1	1	1	
102	1	1	1	1	1	

ROW NUMBER	COUNTY EMERGENCY	COUNTY POLICE	CITY POLICE	TIME ROAD OPENED	TRAFFIC CONTROL
1				0908	1
2				0531	1
3				0531	1
4		1	1	1943	1
5				1610	1
6					1
7			1	1626	1
8				1205	1
9				0711	1
10				1132	1
11				2025	1
12				2244	1
13				0515	1
14				0014	1
15					1
16				2207	1
17				1229	1
18					1
19				1108	1
20				1359	1
21				1225	1
22				1130	1
23				1144	1
24				1500	1
25				2225	1
26			1	0102	1
27				1220	1
28			1	0530	1
29				1647	1
30				1927	1
31				1822	1
32				0846	1
33				1705	1
34				1723	1
35				1140	1
36				1243	1

ROW NUMBER	COUNTY EMERGENCY	COUNTY POLICE	CITY POLICE	TIME ROAD OPENED	TRAFFIC CONTROL
37				2024	1
38				1038	1
39				1329	1
40				0813	1
41				1224	1
42				1118	1
43		1		1153	1
44				0203	1
45				1631	1
46				1132	1
47		1	1	1152	1
48				0710	1
49	1		1	0650	1
50			1	1151	1
51				1834	1
52			1	2341	1
53				0054	1
54			1	1731	1
55				1211	1
56			1	1040	1
57					
58				1223	1
59				0022	1
60				1832	1
61				0354	1
62			1	1652	1
63				1202	1
64			1	0345	1
65				0505	1
66				1007	1
67				1425	1
68				0332	1
69				2127	1
70				1759	1
71				2254	1
72				2118	1

ROW NUMBER	COUNTY EMERGENCY	COUNTY POLICE	CITY POLICE	TIME ROAD OPENED	TRAFFIC CONTROL
73					1
74					1
75				1418	1
76				1531	1
77				2109	1
78				0608	1
79			1	1856	1
80					1
81				1625	1
82				1616	1
83				0926	1
84			1	2156	1
85				1650	1
86				2241	1
87				1029	1
88				1601	1
89			1	1602	1
90			1	0548	1
91				0830	1
92				0536	1
93				0356	1
94				1329	1
95		1	1	0444	1
96				2001	1
97				1925	1
98				1901	1
99				1448	1
100				2223	1
101				1256	1
102				0825	1

ROW NUMBER	TIME STARTED	TIME END	DIAPERS	BOOM	FLARES
1	0724	0908			1
2	0230	0531			1
3	0230	0531			1
4	1836	1943			1
5	1420	1610			1
6	0125	0135			
7	1356	1626			1
8	1048	1205			1
9	0316	0711			1
10	1015	1132			1
11	1841	2025	1	1	1
12	2003	2244			1
13	0500	0515			1
14	2218	0014			1
15	1705	1818			1
16	2110	2207			
17	1142	1229			
18	2306	0154			1
19	1035	1108			
20	1300	1359			1
21	1035	1226			
22	1059	1130			1
23	0951	1144			1
24	1335	1500			
25	2110	2225			1
26	2227	0102			1
27	1134	1220			1
28	0400	0530			1
29	1633	1647			1
30	1852	1927			1
31	1610	1822			1
32	0800	0846			1
33	1433	1630			1
34	1450	1723			
35	1053	1140	1		
36	1147	1243			1

ROW NUMBER	TIME STARTED	TIME END	DIAPERS	BOOM	FLARES
37	1920	2024			1
38	0610	1038			1
39	1314	1329			1
40	0749	0813			
41	1013	1224			
42	1042	1118			1
43	0749	1153			1
44	2342	0203			
45	1223	1631	1	1	1
46	1121	1132			1
47	1057	1152			1
48	0635	0710			
49	0222	0650	1		1
50	1102	1151			1
51	1730	1834			1
52	2325	2341			1
53	0047	0054			1
54	1545	1731			1
55	1144	1211			1
56	0943	1040			1
57					
58	1033	1223	1		1
59	2250	0020			1
60	1540	1832			
61	0015	0354			1
62	1414	1652			1
63	0850	1202			1
64	0236	0345			1
65	0339	0505			1
66	0825	1007	1		1
67	1239	1425	1		1
68	0433	0332			1
69	1734	2127			1
70	1723	1759			1
71	2154	2254			1
72	2030	2118			1

ROW NUMBER	TIME STARTED	TIME END	DIAPERS	BOOM	FLARES
73					
74	1726	1804			1
75	1003	1418			1
76	1258	1531			1
77	1617	2109	1		1
78	0530	0608			
79	1604	1856			1
80	1331	1357			1
81	1550				1
82	1406	1616			1
83	0840	0926			1
84	1930	2156			1
85	1612	1650			1
86	2154	2241			1
87	0927	1029			1
88	1409	1601			1
89	1513	1602			1
90	0242	0548			1
91	0749	0920			1
92	0300	0535			1
93	0041	0356			1
94	1214	1329	1		
95	0154	0444			1
96	1736	2001			1
97	1743	1925			1
98	1617	1901			1
99	1335	1441			
100	2153	2223	1	1	
101	0930	1256			1
102	0635	0843			1

ROW NUMBER	PORTABLE LIGHTS	ABSOR BENTS	ROLLUP SIGNS	MOBILE PHONE	PUSH BUMPER
1	1			1	
2	1	1	1	1	
3	1	1	1	1	
4	1			1	
5			1	1	
6					
7			1	1	1
8			1		
9	1	1	1	1	
10				1	
11	1	1	1	1	
12	1		1	1	
13	1			1	
14			1	1	
15					
16					
17		1		1	
18	1		1		
19				1	
20		1		1	
21		1		1	
22				1	
23		1	1		
24				1	
25	1	1		1	
26	1		1	1	
27				1	
28					
29		1		1	
30				1	
31			1	1	
32				1	
33			1	1	
34					
35				1	
36					

ROW NUMBER	PORTABLE LIGHTS	ABSOR BENTS	ROLLUP SIGNS	MOBILE PHONE	PUSH BUMPER
37		1	1		
38			1	1	
39					
40		1		1	1
41				1	
42				1	
43				1	
44					
45		1	1	1	
46		1			
47				1	
48				1	
49	1		1	1	
50		1		1	
51			1	1	
52	1				
53				1	
54				1	1
55				1	
56				1	
57					
58				1	
59	1	1		1	1
60		1		1	
61	1		1	1	
62			1	1	
63			1	1	
64	1	1		1	
65		1		1	
66		1			
67		1	1	1	
68	1		1	1	
69	1		1	1	
70				1	
71		1		1	
72			1	1	

ROW NUMBER	PORTABLE LIGHTS	ABSOR BENTS	ROLLUP SIGNS	MOBILE PHONE	PUSH BUMPER
73					
74		1		1	
75		1		1	
76			1	1	
77	1		1	1	
78		1	1		
79			1	1	
80		1		1	
81					
82			1	1	
83				1	
84	1			1	
85			1	1	
86					
87				1	
88		1		1	
89		1			
90	1		1	1	
91			1	1	
92	1		1		
93	1		1	1	
94		1	1	1	
95	1		1		
96			1	1	
97					
98	1		1		
99				1	
100				1	
101			1	1	
102		1		1	

ROW NUMBER	VARIABLE MESSAGE SIGNS	HAR
1	1	
2		1
3		1
4		
5		
6		
7	1	1
8	1	
9	1	1
10		
11	1	
12		
13		
14	1	
15		
16		
17	1	
18		
19		
20	1	
21	1	
22	1	
23	1	
24		
25		
26	1	
27		
28		
29		
30	1	
31	1	
32	1	
33		1
34		
35	1	1
36		

ROW NUMBER	VARIABLE MESSAGE SIGNS	HAR
37		
38		
39		
40		
41	1	
42	1	
43	1	
44		
45	1	1
46		
47		
48		
49	1	1
50		
51		
52		
53		1
54		
55	1	
56		
57		
58		
59		
60		
61		
62	1	
63	1	
64		
65		
66		
67		
68	1	1
69	1	1
70		
71		
72		

ROW NUMBER	VARIABLE MESSAGE SIGNS	HAR
73		
74		
75	1	1
76	1	1
77	1	
78		
79	1	1
80	1	
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82	1	1
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86	1	
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90	1	
91	1	
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96	1	
97	1	
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99	1	
100		
101	1	
102	1	