

GIS-BASED ACCIDENT LOCATION AND ANALYSIS SYSTEM (GIS-ALAS)

PROJECT REPORT: PHASE 1

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I. Introduction

This report summarizes progress made in Phase 1 of the GIS-based Accident Location and Analysis System (GIS-ALAS) project. The GIS-ALAS project builds on several longstanding efforts by the Iowa Department of Transportation (DOT), law enforcement agencies, Iowa State University, and several other entities to create a locationally-referenced highway accident database for Iowa. Most notable of these efforts is the Iowa DOT's development of a PC-based accident location and analysis system (PC-ALAS), a system that has been well received by users since it was introduced in 1989. With its pull-down menu structure, PC-ALAS is more portable and user-friendly than its mainframe predecessor. Users can obtain accident statistics for locations during specified time periods. Searches may be refined to identify accidents of specific types or involving drivers with certain characteristics. Output can be viewed on a computer screen, sent to a file, or printed using pre-defined formats.

Despite its many benefits, PC-ALAS can be rather difficult to use. Location "node numbers" -- corresponding to intersections, bridges, highway/rail crossings, etc. -- must be identified from cumbersome node tables or paper/CAD maps. Further, as a text-based system, PC-ALAS does not utilize recent developments in computer graphics and spatial analysis methods such as geographic information systems (GIS).

In Phase I of this project, the first version of the GIS-based Accident Location and Analysis System (GIS-ALAS) has been developed in response to these concerns. GIS-ALAS reproduces most of the query and reporting functions of PC-ALAS, but in a graphical environment which facilitates advanced spatial query and display capabilities. Customized data requests are available as before, but GIS-ALAS provides graphical data access, enabling the user to view and select desired locations on the network, eliminating the need for node tables and paper maps. Query results can be displayed in both map and tabular form, thereby creating more easily interpreted query results and promoting the analysis of accident patterns and causal relationships.

Specifically, two products have been developed, after having been chosen through an extensive steering committee process, to serve two types of users. The first product, Explorer ALAS, combines a free GIS viewing tool and an extensive database of accident locations and characteristics. This allows users, at little or no cost, to view accident data in a GIS environment. The second product is GIS-ALAS itself, perhaps more accurately called "ArcView ALAS." ArcView is a GIS software package that allows customization using a dedicated programming language, Avenue. The query functionality of PC-ALAS has been reproduced in a GIS environment using this language. Both products, Explorer ALAS and ArcView ALAS, access the same database, thus allowing one set of data to be maintained for both types of uses.

This report documents several aspects of Phase 1 of the GIS-ALAS effort. First, a literature review and a description of the state of the art and practice are provided. Second, the development and distribution of GIS-ALAS, in both its Explorer ALAS and ArcView ALAS forms, are outlined; this section, the bulk of this report, covers several topics, including the selection of the software platforms, the characteristics of Explorer ALAS, the characteristics of ArcView ALAS, distribution procedures, and database development. In addition, this section refers the reader to several appendices where more

detailed information is provided. Third, an update is provided on technology transfer activities, including beta testing and training. Finally, current and future project efforts are outlined.

II. Literature Review, State of the Art, and State of the Practice

Literature Review

Literature abounds on accident analysis, traffic records, and statistical methods used to perform accident analysis. Included within this literature are numerous articles submitted to Transportation Research Record (TRR) and numerous United States Department of Transportation (U.S. DOT)/Federal Highway Administration (FHWA)/National Highway Traffic Safety Administration (NHTSA) reports.

Statistical methods articles covered a variety of techniques to analyze accident records and road safety. One article described the use of the Classification and Regression Tree (CART) method of nonparametric regression-type statistical procedure applied as a classifier and a regression model to highway safety analyses [1]. Another evaluates the use of R^2 to evaluate goodness of fit of accident prediction models [2]. One article focuses on statistical hypotheses testing and its use to analyze whether the expected accident frequency is beyond what might be explained by changes in traffic and similar influences [3]. Another article used logistic regression analysis to determine whether age and gender were factors that influenced severity of injuries suffered in head-on automobile crashes on rural highways [4]. Yet another analyzed the reliability of statistical road accident injury severity models [5], while others focused on statistical methods to identify hazardous sites [6, 7, 8, 9]. The first of these utilized a statistical test of significance to test the difference in means between two Poisson random variables [6]. The second describes the development of the rate-quality control method and use of this method in hazardous roadway location identification [7]. The third uses regression models to estimate expected number of crashes [8] and the last covers the historical and conceptual development of procedures for identification of hazardous locations for safety improvement [9]. Additional articles focus on causal factors, one considering the relationship between volume-to-capacity ratios and accident rates [10] and the other examines the relationship between prior incidents and additional incidents on urban arterial roadways [11]. Other articles focused on roadside object effects on accident severity with one focusing on guardrail end-types, vehicle weights, and accident severities [12], a second on median treatments on urban arterial safety [13], a third on the effects of air bags on severity of roadside object crashes [14], a fourth studying the feasibility of utilizing accident data to derive unintentional roadside encroachment rates [15], and a fifth source, containing 7 articles, which concerns the finite element modeling of vehicle impact with a variety of safety structures [16].

Additionally, compilations of various state and federal accident statistics are available. The state of Iowa, much like other states, is required to publish a compilation of the motor vehicle crash statistics each year [17]. The federal government compiles the various state crash statistics obtained through the Fatal Accident Reporting System (FARS) and the General Estimates System (GES) in a book each year as well [18].

Also, national efforts have been made recently to improve data quality, data collection techniques, and data analysis techniques. The U.S. DOT/FHWA published a report a few years ago (1993) which summarizes a study which identified and examined technologies and current processes related to the collection and management of motor vehicle traffic accident data [19]. The report focused on identification of technologies that are most promising in terms of improving quality, accuracy, completeness, and timeliness of accident data and/or reducing the demands on police officers, accident investigators, data coders, and data entry personnel. Technologies examined included: form readers/optical scanners, laptop and notebook computers, pen-based portable computers, identification technologies including magnetic stripe, bar codes, “smart” cards, Automatic Vehicle Identification (AVI), the Global Positioning System (GPS), and location technologies. A more recent (1998) U.S. DOT/FHWA publication reports on the evaluation performed to determine the effect of emerging technologies on traffic accident reporting [20]. The technologies evaluated included standard laptop and pen-based portable computers, Global Positioning Systems (GPS), Geographic Information Systems (GIS), computer-based accident diagramming, and various forms of computer-based data entry. Technologies were evaluated for their effect on accuracy and completeness of data, speed of data entry, practicality (e.g., ease of learning, ease of use), and sturdiness of equipment. Costs of hardware and software used is also provided. One of four sites examined in this publication is Des Moines/West Des Moines, Iowa. Two U.S. DOT/NHTSA publications report on two current national data quality/data linkage efforts. The first reports on the current efforts of the Crash Outcome Data Evaluation System (CODES) [21]. Discussion includes data resources and case selection and issues related to “as reported” data and the linkage process. The second discusses the Minimum Uniform Crash Criteria (MUCC) development process and initial efforts to develop a uniform guideline for data element collection [22].

However, implementing these various technologies, systems, and criteria will require allocation of funds. A U.S. DOT/FHWA publication which summarizes a project conducted by Northwestern University Traffic Institute addresses this issue [23]. The project objectives were: determine the costs of collecting and managing safety data, determine the quality of safety data, and recommend strategies for reducing cost and/or improving quality. Two related reports that are available as of the end of 1997 are listed.

With the efforts made to analyze and collect accident data, it is vital that quality, complete data is collected. A U.S. DOT/NHTSA technical report reviews and lists some desired characteristics of data quality to be considered when building and maintaining statistical data systems [24]. Included are discussions of possible conflicts between different characteristics. Additionally, a U.S. DOT/FHWA publication summarizes existing and emerging sources of highway safety analysis exposure data [25]. Sources reviewed include: Highway Performance Monitoring System (HPMS), Highway Safety Information System (HSIS), Long-Term Pavement Performance (LTPP) Monitoring System, Nationwide Personal Transportation Survey (NPTS), National Truck Trip Information Survey (NTTIS), Operational Exposure Data Sources, Residential Transportation Energy Consumption Survey, Truck Inventory and Use Survey (TIUS), and Weigh-in-Motion (WIM) devices. Areas reviewed for possible emerging exposure data include: Intelligent Transportation Systems (ITS), transportation planning surveys,

and traffic volume data collected by the States. These data sources should allow for better causal factor determination and statistical analysis.

One other national effort to mention is the development of the Interactive Highway Safety Design Model (IHSDM). Two U.S. DOT/FHWA publications [26, 27] concerning the IHSDM are currently available. The IHSDM is a suite of CADD-compatible programs that highway designers can use to evaluate the safety effects of various design alternatives and will include the following modules: Policy Review, Design Consistency, Driver/Vehicle, Traffic Analysis, and Accident Analysis. Current plans for the Accident Analysis Module consist of models to estimate the number and severity of accidents on specified roadway segments, a benefit/cost analysis model to evaluate alternate roadside designs, and an expert system that can evaluate a design alternative and identify geometric deficiencies that may impact safety. The first report [26] presents the results of a workshop on the development of the IHSDM Accident Analysis Module. Results of the workshop included a recommendation that statistical models providing both point and interval estimates of safety measures be included. Statistical techniques that could be included are: linear regression; generalized linear models; Classification and Regression Tree (CART) analysis; Bayesian approximation; multivariate analysis; jackknifing, bootstrapping, and subsampling techniques; and nonparametric methods. A recommendation for combining formal statistical models with an expert systems approach for identifying potential safety problems associated with geometric design features also resulted. Another result was that a diagnostic approach to accident analysis module development be pursued. This diagnostic approach would combine accident reconstruction from hard-copy police accident reports and on-scene accident investigation. Identification of the sequence of events leading to particular accidents and the causal or contributing role of specific features in that sequence of events is key. The second report [27] presents the results of a feasibility study of alternative methods for developing the knowledge base for the Diagnostic Review Component (DRC) of the IHSDM.

Also, sources related to specific crash analysis programs/software were collected. The first of these is the user's guide for Iowa's PC-ALAS system [28], which was discussed in the introduction. The second is a CTRE report submitted to the Iowa DOT as part of the Collision Diagrams Software Evaluation project [29]. The third is the user's guide for Intersection Magic, one of the collision diagram softwares evaluated in the previously mentioned CTRE/Iowa DOT project [30]. The last is a user's manual for Alabama's Comprehensive Accident Rapid Evaluation (CARE) system [31]. Although both PC-ALAS and CARE are both excellent accident analysis and location systems, neither involves the use of a GIS for spatial referencing of the data.

Finally, only a few articles were found that utilized GIS for traffic accident analysis or modeling. One such article describes a prototype computer-based indexing model to store and retrieve the massive amounts of state transportation data, including accident data [32]. The article does not focus specifically on accident data. Another article describes a GIS-based accident risk model developed for the Ontario highway network [33]. The model described provides estimates of accident risk at four levels of spatial aggregation as specified by the user: networkwide, route-specific, route-section-specific, and site-specific. Neither of these articles reports on the development of a system, much less a system that can be utilized state- or nationwide. An additional article reported on

early efforts to develop a GIS-based ALAS for the state of Iowa [34]. The system described was an early pilot project of the Iowa DOT Geographic Information Systems Coordinating Committee (GISCC). This initial pilot project effort resulted in further investigation of a GIS-ALAS system for the state of Iowa.

With all the literature existing related to accident analysis, traffic records, statistical methods, and related fields, it is clear there is a strong interest in these topics. However, of all the literature collected, only a small fraction of the literature [32, 33, 34] mentioned the use of GIS. This reflects not only the relative infancy of GIS, especially for use by transportation researchers, but also the fact that GIS is not used frequently for accident location and analysis. However, clearly interest is growing, both in GIS for accident location and analysis and in other non-GIS methods of accounting for the importance of traffic safety throughout the transportation community.

State of the Practice

Currently in the state of Iowa, four different systems for accident location and analysis exist or are underway. The original mainframe system, ALAS, has existed since the inception of computerized accident records assessment in Iowa. The successor to ALAS, the personal computer-based ALAS (PC-ALAS) [28], began in 1989 as an effort to enable various transportation agencies around the state of Iowa to access statewide or countywide accident data and alleviate the burden on the Iowa DOT main office of having to process accident information requests for these various agencies. The agencies that currently use PC-ALAS include county engineering offices, law enforcement offices, the Iowa DOT Transportation Centers, the Governor's Traffic Safety Bureau (GTSB), and the Iowa Department of Public Safety (DPS). Two efforts that are currently underway include this project, Geographic Information System-based ALAS (GIS-ALAS), and the Microsoft Access-based ALAS (Access ALAS) project of the Iowa DOT Office of Data Services. In addition, other ongoing or recently completed projects in Iowa related to accident data include the Officer Information Manager/Mobile Accident Reporting System (OIM/MARS) project of the Iowa DOT Motor Vehicle Division, the Collision Diagram Software project for the Iowa DOT completed by CTRE, the Access Management project for the Iowa DOT completed by CTRE, and various other projects at CTRE that utilize accident data extensively.

Nationwide, only a handful of states seem to have a recent update to their mainframe systems. Of these, only Alabama's CARE (Comprehensive Accident Rapid Evaluation) [31] system seems to be widespread. Through an email listserv maintained by the University of Alabama, information concerning CARE is sent to transportation safety personnel nationwide. According to the list, CARE is already established in both Alabama and Tennessee, and Michigan, North Carolina, and the Federal Aviation Administration (FAA) have recently decided to use CARE as well.

State of the Art

Only a few GIS-related programs/software exist nationwide that perform functions similar to Iowa's PC-ALAS. Three such softwares include the Accident Information Management System: Geographic Information System (AIMS:GIS) (JMW Engineering, Inc.), Collision Database System (Crossroads Software), and AcciMap (CalGIS).

One source provides the following information on Accident Information Management System: Geographic Information System (AIMS:GIS):

AIMS:GIS is a GIS-based program originally developed for the City of San Francisco by JMW Engineering, Inc. The program runs on Windows 95, and uses MapInfo 4.1 to operate the GIS portion of the program. The program allows the user to select intersections or links by manual input or point and click selection from the map. Once an intersection or link is selected, a collision diagram can be generated. Other features of AIMS:GIS are the ability to plot worst accident locations, provide annual reports, and perform queries. AIMS:GIS prints collision diagrams to most printers or plotters. [29]

Another source provides additional information on AIMS:GIS. AIMS:GIS runs on all Windows operating systems, runs under MapInfo, costs \$4000 for the first copy of the software, 30 percent off that price for the second copy, 20 percent off that price for the third through fifth copies, and 10 percent off that price for the sixth through tenth copies. With the purchase one receives one-half year of free technical support (phone, faxes) and maintenance updates. After that, technical support and maintenance cost \$750 per year. None of this covers the cost of configuring the systems. AIMS:GIS needs to be configured to work for the accident database for each jurisdiction. In the case of the Iowa DOT, the system would need to be configured to work with the statewide accident database produced by the Office of Driver Services. For a city of 1 million, it could be configured for \$19,000. For state highways only, estimates range from \$40,000 - \$50,000 for the whole state. Additional functionality can be added by writing MapBasic code. This really is not an off-the-shelf product. It cannot just be bought, loaded, and expected to work. The location format that the software relies upon is strictly based on intersections (e.g., Main St. & 1st St.). Another component that needs to be purchased is an Address Geocoding database. The software cannot use Reference Points, Global Positioning Systems, or any other location format. To use data in other formats, a conversion program must be written as part of the configuration. It will convert the location of our data to an offset from an intersection. This includes rural areas. Handling of rural interstates and changes in the real world are vague. All of the software query and reporting functions are based on intersections. The software seems to be designed for use in urban areas. This is substantiated by the city population pricing structure. Along with the relative low costs (as compared with comparable software) comes low functionality. Most of the points made in the advertisement have to do with displaying data, not analyzing it. [35]

Also, a recent AIMS:GIS informational sheet lists the AIMS price as \$2,468, for up to 20,000 accidents. For additional accidents, the price rises by \$1,000 for each additional 20,000 accidents. The informational sheet mentions that AIMS:GIS doesn't require a GIS per se, it only requires a GIS map of your jurisdiction.

The source for the first AIMS:GIS information listed also provides some information on Collision Database System by Crossroads Software. This information follows:

Collision Database System (Crossroads Software) software runs under MS Windows and uses city street layout data to verify the location of every collision

in the database. The Collision Database System also uses a full relational database engine to store, query, and edit collision records and an operational GIS mapping module. The Collision Database System produces reports, collision diagrams, and maps of collision information. Presentation quality color collision diagrams can be created by specifying the location, date range, and any other collision parameters desired such as collision type, distances, conditions, and primary collision factors. This software also supports color printers and plotters. [29]

Collision Database System is priced similarly to AIMS:GIS.

AcciMap (CalGIS) runs on WindowsNT 3.51 or higher, Windows95 and Win3.11, uses ArcView and Arc/Info, and costs from \$15,000 - \$20,000 for software (includes ArcView or Arc/Info license). The cost without the ArcView or Arc/Info license is uncertain. Additional license prices vary. This includes one year of technical phone support and maintenance. This does not cover configuration or customization costs. Since they customize the software based on individual situations, they won't estimate a total price. They did indicate that one place that had little configuration and customization paid \$100,000, and one that did a medium amount paid \$180,000. Maintenance costs are based on the number of computers the software is loaded on and are approximately 8 percent per year of initial costs. Any enhancements they make, they will support. They will train you to program enhancements, but will not support any enhancements you make. AcciMap seems to have a lot more functionality than AIMS:GIS, but with it comes a price. CalGIS, the creator of the software, seems to be very flexible in what they can do. That is partly why it is difficult for them to estimate a price. Part of it has to do with the quality of Iowa's data, where it resides, and how much functionality is desired. CalGIS is willing to visit and demonstrate their software. They also have a white paper with more information and a demo CD available. [35]

As a result of the Collision Diagram Software project, another collision diagram software, Intersection Magic by Pd' Programming Inc [30], was recommended to, and subsequently approved and implemented by, the Iowa DOT. Within the project evaluation report it is stated that part of the evaluation process would be considered in the GIS-ALAS development.

In conclusion, though many efforts have been made to analyze accident data through various statistical means and models, very few efforts have been made to utilize the power of a GIS environment to analyze the data utilizing its spatial nature. In addition, of the efforts that have utilized a GIS, few have developed a system to do so. The softwares that were developed utilizing a GIS environment either are not designed to analyze crash data or are prohibitively expensive. Some have both features. The recent efforts in Iowa are an initial step towards developing a low-cost, statewide system for distribution to transportation agencies for locating and analyzing hazardous roadway locations.

III. The Development of GIS-ALAS

This section outlines the development of GIS-ALAS. It covers several topics, including the selection of software platforms, the characteristics of two products developed in Phase 1 (Explorer ALAS and ArcView ALAS), and database development. Explorer ALAS is used to facilitate the simple, inexpensive viewing of accident data, and ArcView ALAS provides the query functionality of PC-ALAS in a GIS environment. In addition, this section refers the reader to several appendices where more detailed information is provided.

A. Selection of the Development Platform for GIS-ALAS

ArcView was selected to be the development platform for GIS-ALAS through the following process. First, the *GIS World Sourcebook* was consulted to identify the universe of potential software platforms. This publication, produced annually by GIS World, Inc., provides detailed lists and descriptions of hundreds of software products, services, and vendors. Searches on the Internet World Wide Web were also performed to identify additional candidates.

After examining the resulting list, the project team decided to narrow the list of candidates using several fundamental criteria. The chosen platform would be a desktop package suitable for distribution to a wide community of end users, with a development language to support necessary customization, and provided by a vendor with marketplace stability (to ensure that the selected platform would continue to be available in the future, preferably with enhanced functionality). The list of candidates was thus narrowed to three major desktop GIS packages: MapInfo (MapInfo), Maptitude (Caliper Corp), and ArcView (ESRI). Intergraph's GeoMedia, now resident at the Iowa DOT, was not considered as it was not in existence at the time of our software evaluation process. An advantage of GeoMedia is that it can utilize data from several GIS packages in their native format. GeoMedia will be reviewed during Phase II of the GIS-ALAS project.

The project team then prepared an outline of criteria which focused on the required functionality of the selected platform to support GIS-ALAS, both within its current scope ("minimum functionality" items), and for its future development ("enhanced functionality" items). Each category of functionality was further subdivided into several types, listed in Table 1 with typical criteria used in the evaluation.

The performance of all three options was similar in most respects. ESRI's ArcView was selected due to a combination of several factors. It has dynamic segmentation and network analysis capabilities that make it a particularly useful package for the management and analysis of transportation data. Technical support is available from ISU's GIS facility, which uses ESRI's suite of products extensively, from the high-end Arc/Info to the user-oriented ArcView. In addition, the selection of ArcView also provides an opportunity to more readily make use of software upgrades and other improvement in technology. For instance, the feasibility of providing the display and query functionality of GIS-ALAS via the World Wide Web using ArcView Internet Map Objects with Visual Basic is currently being investigated.

Table 1: Criteria and functionality considered in GIS-ALAS software evaluation

Criteria	Minimum and Enhanced Functionality
General functionality	Minimum: ability to reproduce PC-ALAS capabilities (existing and updated), cost of distribution, ease of training end users.
Data updates/ data integration	Minimum: functionality in updating data and cartography (regular and improved), import/export capabilities. Enhanced: ability to tie in to videolog/GPS, overlay "other" data (e.g., land use, road features, health care facilities, FRA data, aerial photos/DOQs/DEMs, weather, location of maintenance and emergency equipment, major infrastructure changes, intersections).
Queries	Minimum: ability to perform logical queries (e.g., high accident locations, alcohol related accidents, subset of accidents based on any field in the database at the state, county, and city levels), and spatial queries (e.g., beat/area request, graphical selection of a single node/link or a set of nodes/links, graphical selection of nodes within a user-defined area), and to support an appropriate interface for queries.
Analysis	Minimum: implications for analytical/statistical programming including capability for customizable analysis Enhanced: interdisciplinary applications, identify historical trends, analysis of relationships in accident causation, e.g., volumes, v/c (LOS), road conditions, weather, lighting.
Output	Minimum: ability to support reports (e.g., local area report, reports on frequency/location of any accident report form element, ability to select format of report, ability to create and save user-defined report formats), ability to support maps/diagrams (e.g., accident diagrams, maps of accidents in a given city or county, pie-diagram maps of accidents at nodes by cause, number of vehicles, etc.). Enhanced: intersection maps.
Maintenance	Minimum: ability to support system maintenance, and to easily adjust for changes in the format of the accident database.

The Iowa DOT's system of collecting, managing, and analyzing crash data is likely to change over time along with technologies and user needs. Although ArcView best suits the needs of the current system, it is possible that GIS-ALAS will make a transition to another platform at a later date. It is also possible that storage platforms and database management procedures will change. Currently, accident data are stored in DB2 and exported to text files for use by ArcView in GIS-ALAS. In the future, it is possible that data will be stored in DB2, as before, and transferred to Oracle as a central server for use by GIS-ALAS, including an Internet version, and Access ALAS.

The data are also available for use in a simple GIS viewer, ArcExplorer, currently available at no cost from ESRI's World Wide Web site, although this does not include the full query and reporting capabilities of ALAS. Improvements in software functionality, increased computer operating speeds, and the continued development of the Internet

likely will provide new opportunities to improve Iowa's crash data system. The next two sections describe the two products currently available through the GIS-ALAS project, Explorer ALAS and ArcView ALAS.

B. Explorer ALAS (See Appendix A for the Explorer ALAS User's Guide and Appendix H for the ArcExplorer User's Guide)

ArcExplorer is a GIS viewing tool provided by ESRI at no cost to users. This allows users to display accident data and perform limited data analyses (see Figure 1). Explorer ALAS is provided on a CD and includes data to display the primary roads, secondary roads, municipal roads, as well as accident records and locations. The CD currently has separate A, B, and C tables for the accident records, but future versions will combine these tables into a single "ABBBC" format. (A tables contain information about the accident, B tables contain information about the vehicles and drivers involved, and the C records contain information about any person injured.) Rail lines and hydrology are provided as reference layers but contain no attribute information.

Accident and roadway data can be queried to obtain results about specific information. These results will appear highlighted on the screen (Figure 2). Thematic mapping, which allows additional visual analysis of data, is also available using ArcExplorer.

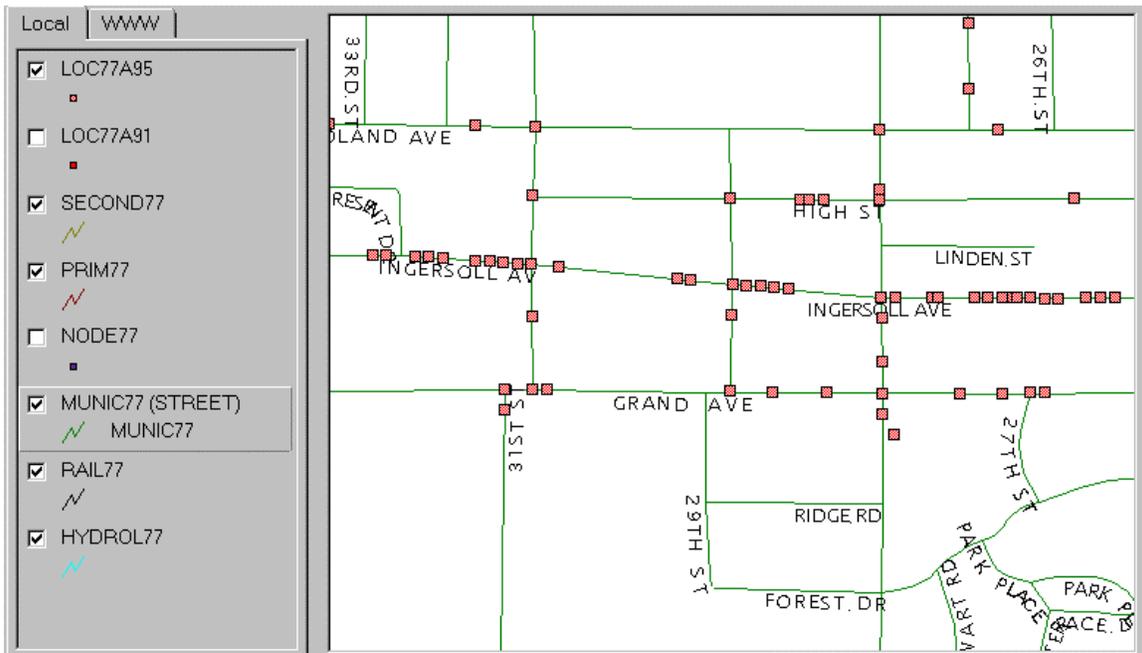


Figure 1: Accident data for a Des Moines neighborhood, 1995

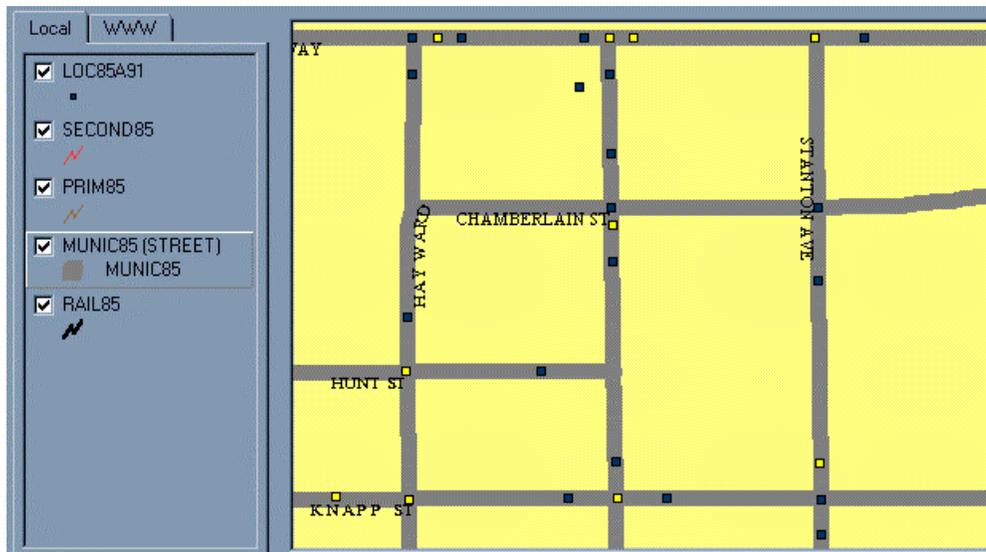


Figure 2: Injury accidents (white squares) and property-damage-only accidents (black squares) in the Campustown area of Ames, 1991

Advanced analysis tools are not provided with ArcExplorer. Query capabilities are limited compared to ArcView's query capabilities. Attempts to query two separate tables will not produce the desired result; for example, it is not possible to determine the number of people injured (A records) in crashes that had male drivers (B records) using Explorer-ALAS. Moreover, ArcExplorer has no programming language that can be used to customize its interface or functionality. ArcExplorer also cannot perform several types of spatial queries (e.g., selecting accidents within a user-defined box or within 0.25 miles of a given intersection). In addition, the results of queries cannot be exported from ArcExplorer to other formats for use in other software packages. To perform these more advanced analyses, the user must have a commercial GIS package.

C. ArcView ALAS (See Appendix B for the User's Guide and Appendix C for the Developer's Guide)

ArcView is a GIS product sold by ESRI. This software provides advanced analysis capabilities, along with customization tools using ArcView's programming language, Avenue. Spatial queries and analyses of multiple databases are possible using the advanced functionality of the software. This enables users to obtain results to more complex queries than are possible using ArcExplorer.

Through the customization of ArcView developed during Phase 1 of the GIS-ALAS project, ArcView ALAS has the general functionality of PC-ALAS within a visual interface designed to improve data query and analysis (see Figures 3 and 4). ArcView ALAS is also designed to have the "look and feel" of PC-ALAS, by creating identical menus and querying processes, in order to provide a shorter learning curve for users. Not every function that was present in PC-ALAS is available in the first release of GIS-ALAS. However, the major functions are present. Future enhancements will be considered and addressed as feedback is received from various beta testers of the current GIS-ALAS.

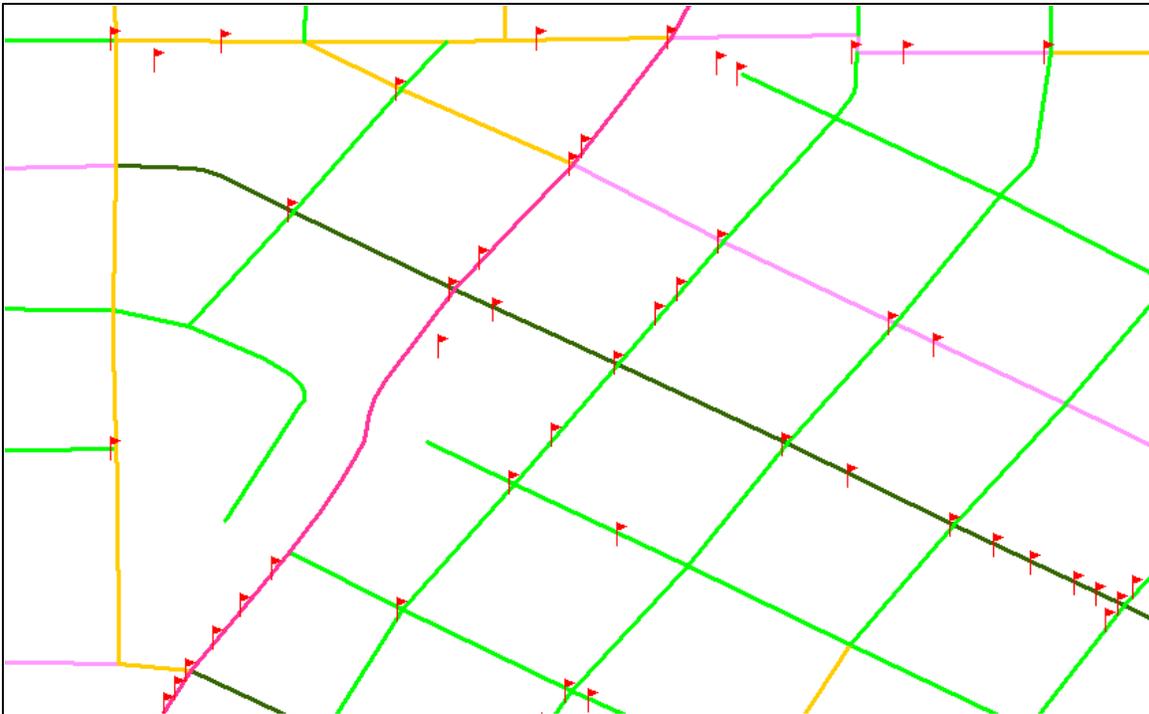


Figure 3: Thematic map of a neighborhood in Sioux City, Iowa. Traffic volumes are reflected in the shading of the roads. Accidents are displayed as flag symbols on the road network. This kind of graphical representation of data was not readily available before GIS-ALAS.

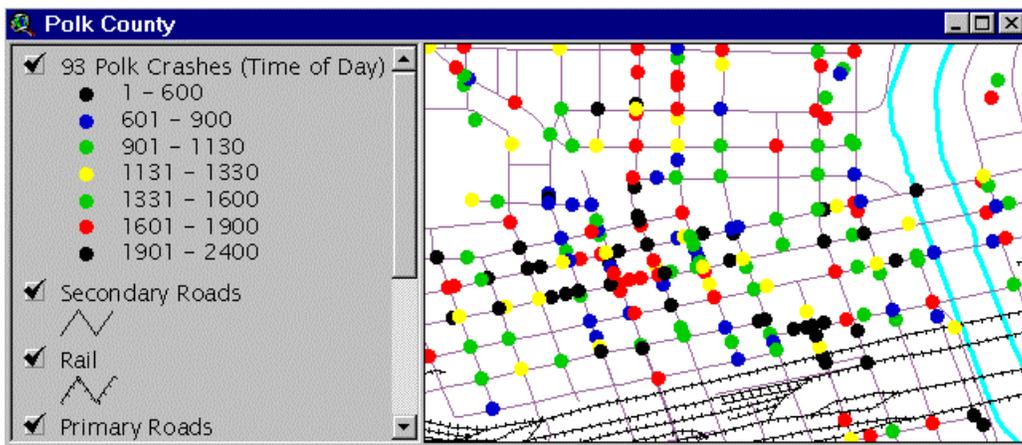


Figure 4: The spatial pattern of accidents by time of day can be easily displayed using the power of a GIS.

The GIS-ALAS team made a special effort to duplicate the Graphical User Interface (GUI) from PC-ALAS into the development of GIS-ALAS. This similarity provides an approach to data access familiar to users who have been exposed to PC-ALAS. The similarity between the two systems in performing a typical query (in this case, accident severity) is illustrated in the following three figures (Figures 5-7)

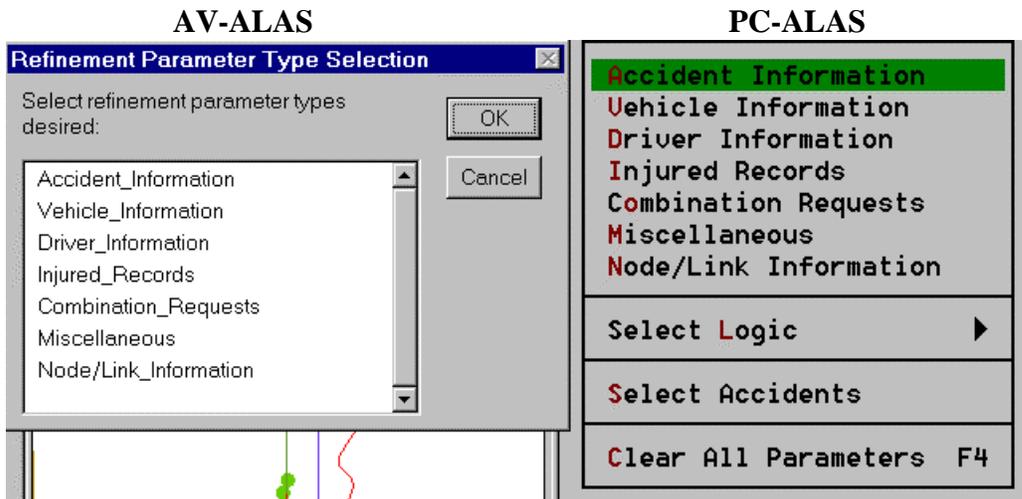


Figure 5: Selection of Refinement Parameters.

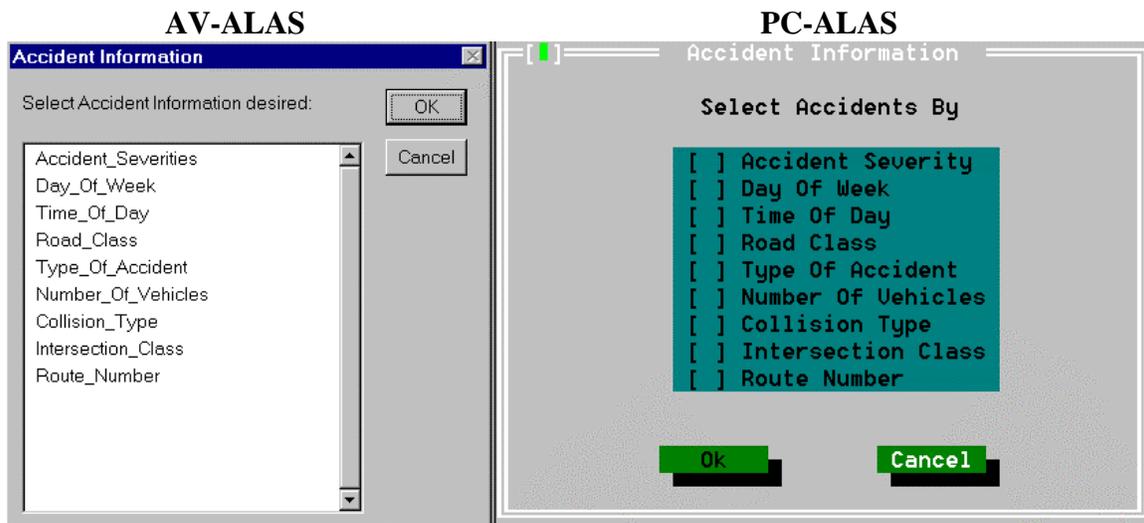


Figure 6: Selection of Accident Information Parameters.

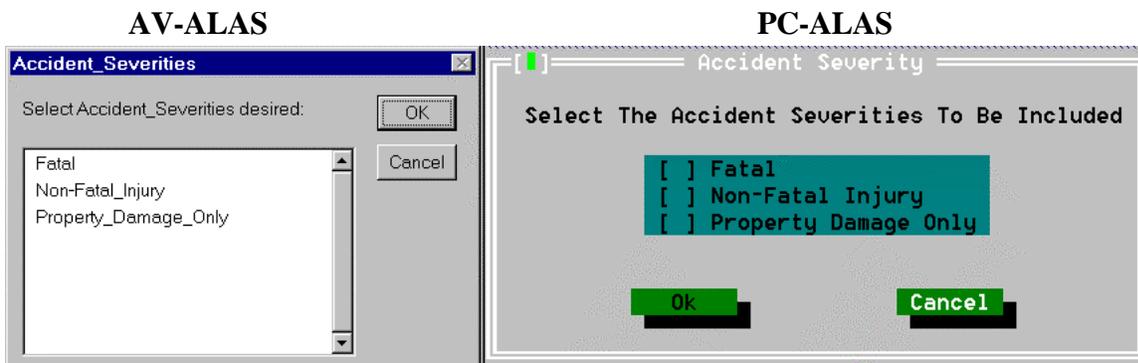


Figure 7: Selection of Accident Severities.

D. Database Development (See Appendices D, E, and F for information on variable names and value labels in the accident database)

Several data layers were needed to create a complete database that could be used with GIS-ALAS. These include road, rail, node, accident, and hydrology data layers. The rail data came via the National Transportation Atlas Database (NTAD) from the Bureau of Transportation Statistics (BTS). The remaining data layers were obtained from the Iowa DOT (see Table 2).

Table 2: Databases provided with GIS-ALAS

Coverage	Source	Current as of
Primary	Iowa DOT Office Of Transportation data	7/1/97
Secondary	Iowa DOT Office Of Transportation data	7/1/97
Municipal	Iowa DOT Office Of Transportation data	7/1/97
Rail	National Transportation Atlas Database	1997
Nodes	Iowa DOT Office of Cartography	7/1/97
Hydrology	Iowa DOT Office Of Cartography	1/1/96
A Accident Records	Iowa DOT Office of Transportation Safety	12/31/95
B Accident Records	Iowa DOT Office of Transportation Safety	12/31/95
C Accident Records	Iowa DOT Office of Transportation Safety	12/31/95

Estimates of the time required to create these databases in ArcView format are provided in Table 3. The time listed is the time required to generate the coverage from the design files obtained from the Iowa DOT Office of Transportation Data. The PC-ALAS data files, MPT files, were obtained from the Iowa DOT Office of Transportation Safety.

Table 3: Time estimates for creating GIS-ALAS coverages

Coverage	Time Required to Create
Attributed Primary, Secondary, and Municipal Roads	3 days
Accident Nodes	1 day
Accident Data	3 days
Hydrological Data	1 day
Total Time	8 days*

* Note: The amount of personnel time is approximately 3 days. Computer running time is 5 days.

The data obtained had to be converted for use within the GIS. The accident locations were derived from the node locations. Each accident location is determined from the distance from the reference node to the direction node. The current process determines the accident location based on the straight line distance between the nodes. Using this process may provide a location of an accident that is not on the roadway. The Iowa DOT Office of Cartography recently developed a solution to this problem. In the future, accident locations will be tied to the base records.

Roadway and hydrological data layers were provided from the Iowa DOT Office of Cartography. This information was converted to ArcView format by using another GIS, MapInfo. The MPT files were generated from PC-ALAS. This provided an ASCII file of all the information associated with the accident records. A MapBasic program was created to take the ASCII format data and create the tabular data for each accident within the state of Iowa. The accident locations are generated by using another MapBasic program. Once the accident locations are determined, a final MapBasic program was used to export the file into a MapInfo Interchange Format (MIF). ArcView can convert MIF files into ArcView format. A batch file was created to convert the data from MIF format to an ArcView format. Whenever possible, data from the Iowa DOT Office of Cartography was used. A similar process is involved in creating the other data layers in ArcView. This process was performed as illustrated in Figure 8.

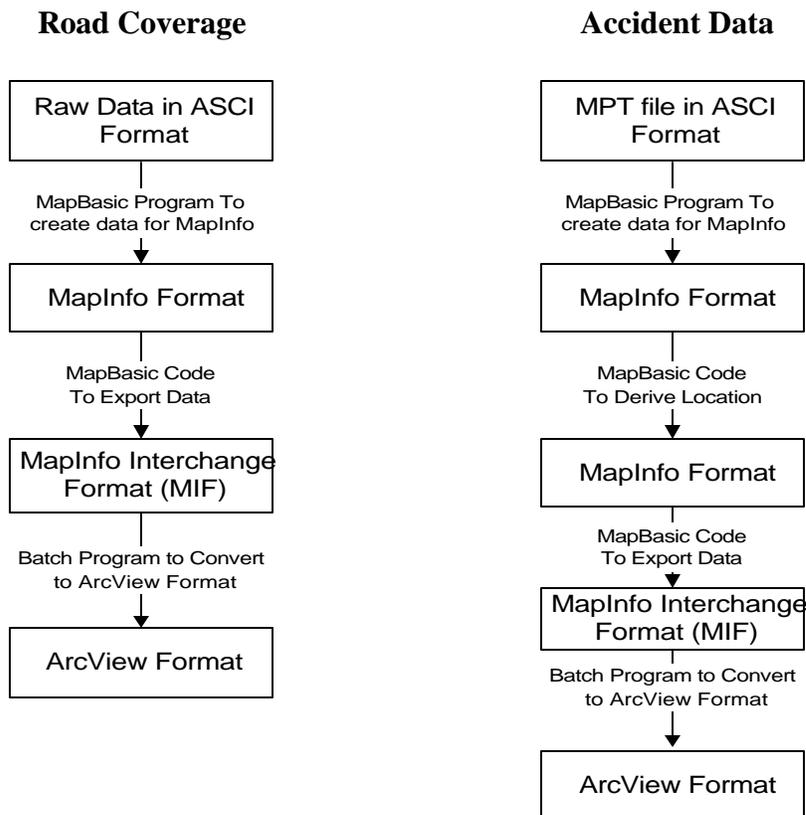


Figure 8: Database Development Process

IV. Technology Transfer

A. Distribution of GIS-ALAS Products and Data

GIS-ALAS products and data will be distributed on compact disc (CD). The CD for Explorer ALAS will include the file with which users can install a free version of ArcExplorer, as well as the accident data and related information outlined above. The CD for ArcView ALAS will include an ArcView project file, which contains the customization programs that provide its interface and analytical capabilities, as well as the databases outlined above. Currently, users who want to use ArcView ALAS will need to purchase ArcView. CTRE on has already begun distributing five years of accident data along with roadway graphics to the beta test users.

The use of the World Wide Web for distribution has been explored, but was not implemented in Phase 1. Concerns were expressed about confidentiality and other issues related to public access to accident data via the World Wide Web, especially for data on a single accident or a specific node number. Password protection of the World Wide Web application or some of its components can easily be accomplished. Other measures may also be taken to ensure the protection of the data, including: stripping off the last four digits of the node number and creating thematic maps (e.g., to show the number of accidents at particular location). An assessment needs to be made of potential uses and users of the product to determine specific functionality implementation requirements once the World Wide Web option becomes available.

Figure 9 summarizes the development and distribution of the GIS-ALAS database and its related products.

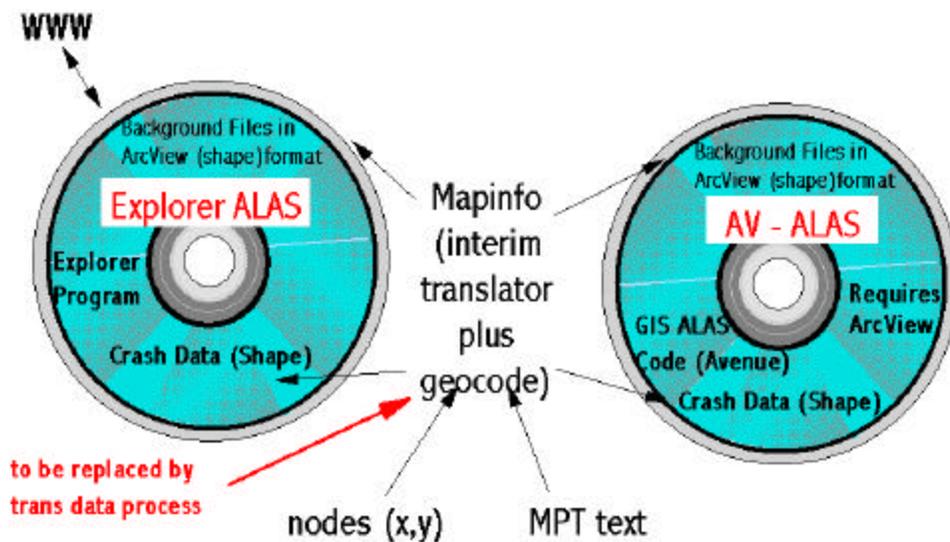


Figure 9: Summary of Database Development and Distribution

B. Training, Beta-Testing, and Feedback

On December 18, 1997, the GIS-ALAS project team provided a demonstration and training session for the GIS-ALAS Steering Committee and other interested individuals. Tutorials were provided for both Explorer ALAS and a prototype version of ArcView ALAS. Useful feedback was provided by the participants and this information was incorporated into the subsequent development of GIS-ALAS. Participants also generated a list of questions and issues for the project team to answer and address. The project team's responses to this list are provided in Appendix G.

Several individuals, many of whom attended the training session, are currently testing Explorer ALAS. These include Iowa DOT employees, city employees, Federal Highway Administration personnel, city and state law enforcement agencies, metropolitan planning associations, and county engineers. Feedback from the beta test group will be incorporated into future enhancements of the product. The following people are beta testers:

- Joyce Emery, Iowa DOT
- Jack Latterell, FHWA
- Becky Hiatt, FHWA
- Peggi Knight, Iowa DOT
- Bill Schuman, Iowa DOT
- Jaime Reyes, Iowa DOT
- John Nervig, Iowa DOT
- Jon Ranney, Iowa DOT
- Harold Jensen, Story County
- Alicia Caton, Des Moines MPO
- Sergeant R. L. Miller, Council Bluffs Police Dept
- Steve Mattke, City of Fort Dodge
- Major Larry Noble, State Patrol
- Robert Schultz, PC-ALAS Trainer
- Terry Dillinger, Iowa Department of Motor Vehicles
- Rich Rothart, Iowa Department of Motor Vehicles

Future beta testing activities and training sessions for ArcView ALAS are being planned.

In addition, the project team is working with a Ph.D. student at Iowa State University conducting dissertation research on usability testing and the implementation of information systems. The research is expected to identify possible usability problems of GIS-ALAS, explain their origin, and suggest ways to fix them. Specifically, this research will include an assessment of GIS-ALAS's purpose as seen by its designers and users, a period of observing and interviewing the users of GIS-ALAS in order to identify difficulties, and the preparation of design recommendations to improve the usability of the system. The products of this research will include:

- a summary of differences between users' and designers' perceptions of the system (often a source of problems);
- a report that categorizes and details difficulties that users have with the system;
- a prototype revision of the system that corrects some of the problems; and
- a report on an experiment to determine whether the revision was successful.

This research is currently being conducted and will be completed during the summer of 1998.

V. Next Steps

Phase 1 activities have been completed and the GIS-ALAS project is beginning its second phase. Phase 2 will build on this first version of GIS-ALAS by incorporating additional refinements and enhancements. The interface will be improved and specific functionality will be added in response to input from users. This input will be gathered both during the technology training sessions/workshops and after the users have had time to work with AV-ALAS or Explorer ALAS in their own offices. Typical improvements might include changes to the menus and/or toolbars, additional query and report options, clarifications in the on-line and/or hardcopy documentation, and the removal of bugs and other potential technical problems.

Additional data incorporation will be investigated in cooperation with the Black Hawk County pilot project team. This investigation will consider incorporating several different kinds of data, such as road features, health care facilities, geographic borders (e.g., counties, census tracts), emergency response service districts, highway/rail grade crossings, aerial photos/digital ortho quads (DOQs)/digital elevation models (DEMs), and maintenance and emergency facilities. In addition, this task will assess a tie-in to GPS and links to weather and other real-time information.

Phase 2 also includes exploring the following tasks:

- 1) Assess methods to identify accident rates for highway sections or intersections based on specific accident locations and traffic counts.
- 2) Develop enhanced procedures for link-node/latitude-longitude conversions.
- 3) Investigating the changes in emergency response patterns due to the construction of the "Avenue of the Saints."
- 4) Conduct technology transfer and training.

For more information on past, current, or future efforts on the GIS-ALAS project, please contact Reg Souleyrette at 515-294-5453 (reg@ctre.iastate.edu).

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APPENDIX A

User's Guide (Explorer-ALAS)

Please Note:

- 1) This is a summary User's Guide designed to provide basic information on Explorer ALAS, its database structure and naming conventions, and installing and running ArcExplorer. More details on ArcExplorer are provided in the ArcExplorer User Manual that is created when the software is installed from the CD (it is located in the file C:\Program Files\ESRI\ArcExplorer\ArcExplorer.pdf or see Appendix I).
- 2) For more information on the variable names and value labels in the accident database, please consult Appendices D, E, and F.

The data: an overview

Data files are stored in several folders under the directory /gisalas. They are in ArcView's shapefile format.

Several types of data files are stored

- Accident reference nodes are from Iowa's Accident Location and Analysis System. They correspond to key points in Iowa's road system (intersections, grade crossings, bridges, etc.) and are used to provide a location reference for highway crashes.
- Road information is provided in three separate files: *primary roads*, *secondary roads*, and *municipal roads*.
- Two types of background files are provided to assist the user in viewing the data: *hydrology* (rivers and lakes), and *rail lines*.

The accident nodes, primary roads, secondary roads, municipal roads, and hydrology were converted from the Iowa DOT's Microstation files into ArcView. The rail lines are from the U.S. DOT Bureau of Transportation Statistics.

Field definitions

Road files

The attributes for the road files (primary roads, secondary roads, and municipal roads) come from the Iowa DOT's base records. Several of the available fields have been converted to ArcView to be included in the current data distribution. A summary description of these fields is listed below. A more complete description, from the base records documentation, is attached.

<u>Field name</u>	<u>Description</u>
Co	Two digit county number
St_rte	Route information (varies by level: primary, secondary, and municipal)
Number	Road segment identifier
Street	Street name (generally only on municipal roads)
Grade_signal	Number of automatic traffic signals at grade intersections
Grade_stop	Number of stop signs at grade intersections
Truck_rte	Truck route status (primary only)
Yr_cnt	Year of traffic count
Aadt	Traffic volume
Surf_wid	Surface width (in meters)
Surface_type	Surface type
Out_shd_wid	Outside shoulder width
In_shd_wid	Inside shoulder width
Index	Internal identification number assigned by GIS software

Accident reference nodes

Most of fields in the layer of accident reference nodes are identification numbers or coordinates generated during the conversion process. The more meaningful items for users of the data are:

County_num	County number (the first 2 digits of the 8-digit node number)
Township_N	Township number (the 3 rd and 4 th digits of the 8-digit node number)
Node_numbe	Last 4 digits of node number (identifying the node within a township)
ID	The full 8-digit node ID

Rail and hydrology

The layers for rail lines and hydrology currently have no meaningful attribute data attached.

File organization and file-naming conventions.

County-level data

County-level data are stored under the directory /gisalas/_county. Under this directory, there is one subdirectory for each county in Iowa. For example, the files for Story County are stored in /_gisalas/_county/_story. Within each county's subdirectory, the following files are stored.

File	File-naming convention (see note below)	Example
Accident nodes	"node" + county number + .extension	Node85.shp
Primary roads	"prim" + county number + .extension	Prim85.shp
Secondary roads	"second" + county number + .extension	Second85.shp
Municipal roads	"muni" + county number + .extension	Muni85.shp
Rail lines	"rail" + county number + .extension	Rail85.shp
Hydrology	"hydrol" + county number + .extension	Hydrol85.shp
A records	"Loc" + county number + "a" + year.extension	Loc85a94.shp
B records	"Loc" + county number + "b" + year.extension	Loc85b94.shp
C records	"Loc" + county number + "c" + year.extension	Loc85c94.shp
Hydrology	"hydrol" + county number + .extension	Hydrol85.shp

The county numbers are based on those in the Iowa DOT's base records. They always have two-digits, e.g., Adair County is "01" rather than "1".

Note: Each "layer" of information actually has three files, each with a different extension. Files with the extension ".shp" (e.g., prim85.shp) contain the actual geometry, or shapes, of the roads, accident nodes, etc. These are usually the files that the user selects to view. Files with the extension with ".shx" (e.g., prim85.shx) are used internally by ArcView (as an index of the feature geometry). The user can ignore these files but must not delete them (otherwise the corresponding .shp files will be unavailable). Files with the extension ".dbf" are database files. They store the attribute data (e.g., street names, traffic volumes) connected to the maps. This information can be access, when the appropriate map is displayed, using ArcExplorer's query tools. (These files can also be opened on their own, in a non-GIS environment, with any software package capable of working with .dbf files.)

How to use the data

A copy of ArcExplorer is provided to view the data. This program is available for free download from ESRI (the provider of ArcView, Arc/Info, and other product, at their web site, www.esri.com). The data can also be viewed with ArcView.

A copy of the User Manual is created when the software is installed from the CD. (It is simply a printout of the file C:\Program Files\ESRI\ArcExplorer\ArcExplorer.pdf, which will be available once the program is installed.) It contains instructions for installing and using ArcExplorer. Most of the necessary information is in the User Manual, but the following points highlight the key items to get you started:

- To install ArcExplorer, copy the setup file, asetup.exe, to any place on your hard drive. Double click on the file's icon to start the installation. The default options provided by the installation program are appropriate and do not need to be changed.
- To start ArcExplorer, once it is installed, it can be started by double clicking on the appropriate icon (it should be the ArcExplorer.exe icon in the C:\Program Files\ESRI\ArcExplorer directory).

- Putting the cursor over any of the buttons in the toolbar/buttonbar will bring up a small text box that tells what the button does.
- To add a layer of a map, click on the Add Theme button (the one with the plus sign). The program may take a few moments to search your networks. (You can also use Control-A, or select Add Theme from the Theme menu item.) Once this is finished, click through appropriate directories to reach the files you want, then select the files. Warning: Large files, especially statewide files, may take a long time to draw. If you want to stop the drawing process and move on to something else (perhaps bringing up county-level maps instead), use the escape (“ESC”) key to cancel the procedure. To remove a layer, use the
- The “Table of Contents” appears at the left. Here you control whether or not a given layer is drawn on the map (click on a layer’s white box to turn it on and off). This is also where you control the order in which the layers are drawn. The layers on the bottom of the Table of Contents are drawn first, and the layers at the top are drawn on top of them. Clicking on a layer in the Table of Contents makes it “active” (the active theme appears to have a raised box around it) enabling you to do certain things with it. To move a given theme from the bottom to the top of the Table of Contents, make it active and drag it to the top.
- To zoom in and out, use the magnifying glass buttons. The one with the plus sign zooms in, while the one with the minus sign zooms out. You can zoom in on a point, or select a box to determine the extent of the new view. To move the map up, down, right, or left, use the pan buttons (the hand and the arrows).
- To do a query on a theme’s database, make the theme active, then click on the query button (the hammer/question mark). To get data for a particular part of a theme (e.g., a road segment on the primary road layer), make the theme active, click on the info/identify button (the letter “i”), then click on the appropriate feature in the map (e.g., on the road segment).
- To change the colors, line widths, etc. or to create maps of a layer’s data (e.g., a map of traffic volumes for primary roads), make the theme active and open the Theme Properties window by selecting Theme Properties from the Theme menu item. (Or you can double click on the theme in the Table of Contents.) The Theme Properties window is also where you can label items on the map (e.g., labeling all the accident nodes with their ID number).
- You can save your work in a “project.” which is a collection of map layers and how you decided to display them. This way, the next time you use ArcExplorer, you don’t have to repeat the process of opening layers, changing colors, etc. You can simply open up the project you’ve previously saved. To save a project, select Save from the File menu item. To open it up next time you use ArcExplorer, select Open from the File menu item.

More details on these procedures are outlined in the ArcExplorer User Manual.

APPENDIX B

User's Guide (ArcView-ALAS)

GIS-ALAS Project Phase I, ArcView ALAS Version 1.0 User's Guide

Starting ArcView ALAS (AV-ALAS)

To start ArcView ALAS (AV-ALAS), first open ArcView on your computer. When ArcView has finished opening, point to the File menu with the mouse pointer and click the left mouse button. Then move the mouse pointer down to the Open Project option and click the left mouse button again. A dialog box will then open, listing a default directory structure and any ArcView project files listed under that directory structure.

If the root drive (the letter prior to the colon, i.e. the "c" in "c:\") shown under the word "Directories:" is not the proper drive, move the mouse pointer to the downward pointing arrow on the right of the box below the word "Drives:" and click the left mouse button. Select the correct drive by moving the mouse pointer over it (the drive should be highlighted) and click the left mouse button again. Then, when the correct drive has been selected, the directory structure below the word "Directories" should contain just that drive.

If the root drive shown is the proper one, but something other than "_gisalas" trails the "\", then move the mouse pointer to the root drive portion of the directory structure in the box below the word "Directories:" and click the left mouse button twice in quick succession.

The box below the word "Directories:" should now list a more detailed listing of the directories below the root drive, one of which should be "_gisalas". Move the mouse pointer down to "_gisalas" and click the left mouse button twice in quick succession. The directory structure below the word "Directories:" should now include the "_gisalas" subdirectory and the box two below the words "File Name:" should contain a list of filenames ending in ".apr". Move the mouse pointer down to "av_alas.apr" and click the mouse button. The box directly below the words "File Name:" should now contain the word "av_alas.apr". Now move the mouse pointer to the OK button in the upper right portion of the dialog box and click the left mouse button. AV-ALAS should now open, with 10 menus across the top (File, Project, Window, Help, ALAS File, Request, Search, Report, Defaults, and Help) and another dialog box titled "av_alas.apr" with a series of icons down the left side (Views, Scripts, Tables, Charts, and Layouts).

Using ArcView ALAS (AV-ALAS)

I. Region Selection

To begin using AV-ALAS, once it is opened, the user must first open a map and pick a region of interest. To do this, place the mouse pointer on the "ALAS File" menu and click the left mouse button. Then move the mouse pointer to the words "View Map" and click the left mouse button.

A dialog box titled "Set Main Default Directory" should open. If the root directory shown in the box below the words "Enter new default root directory:" list the root directory of the project's location (and most times it will), then move the mouse pointer to the OK button and click the left mouse button. If another root directory is shown, delete the currently listed directory by depressing the "delete" key on the keyboard and typing in the correct root directory in the form "x:", where "x" is the proper root directory. Then move the mouse pointer to the OK button and click the left mouse button. Another dialog box, titled "Set Main Default Directory" should open. If the directory structure shown in the box below the words "Enter new default directory name:" contains the root directory plus the directory "_gisalas" in the form "x:_gisalas\", where "x" is the root directory, then move the mouse pointer to the OK button and click the left mouse button. Most times this should be the case.

Now, a dialog box titled "Region Selection" should appear. In the box below the words "Select Region:", four options should appear: County, Regional_Planning_Association, Transportation_Center, and Statewide. To select one of these, move the mouse pointer over the desired option and click the left mouse button. It should then be highlighted. Then move the mouse pointer over the OK button and click the left mouse button. **NOTE:** Currently only the COUNTY option will progress the user to a functional end. Choose only the COUNTY option.

Following that, a dialog box title "Region Selection" should appear, this time listing the options from previously. For the County option, a listing of the counties in Iowa should appear in a box below the words "Select County:". To select the county desired, place the mouse pointer on one of the arrows (depending on whether one wishes to scroll up or scroll down through the county list) on the right side of the box and depress the left mouse button. The list of counties will scroll by on the screen. Release the left mouse button when the county desired is shown. Move the mouse pointer over the county desired and click the left mouse button. The county should now be highlighted. Move the mouse pointer to the OK button and click the left mouse button.

The next dialog box that should open is titled "Beginning Date". If the date below the words "Enter default beginning date." is acceptable, move the mouse pointer over the OK button and click the left mouse button. If not, delete the currently listed date by depressing the delete key on the keyboard and then type the desired date in the form "Month/Day/Year" with the year portion being four digits. Then move the mouse pointer over the OK button and click the left mouse button.

The next dialog box that should open is titled "Ending Date". If the date below the words "Enter default ending date." is acceptable, move the mouse pointer over the OK button and click the left mouse button. If not, delete the currently listed date by depressing the delete key on the keyboard and then type the desired date in the form "Month/Day/Year" with the year portion being four digits. Then move the mouse pointer over the OK button and click the left mouse button. **NOTE:** The ending date must be after the beginning date.

Now, a dialog box titled "Selection Method" should open. The box below the words "Choose which selection method you wish to employ:" should contain the word "Nodes" and have an downward pointing arrow at the right end of the box. Move the mouse pointer over the arrow and click the left mouse button. Now the words "Actual_Accident_Locations" should appear under the word "Nodes". To select either option (Nodes is the default), move the mouse pointer over that option and click the left mouse button. Then move the mouse pointer over the OK button and click the left mouse button. **NOTE:** The Nodes option allows selection of nodes and running of requests and queries using these nodes (the Node-based option). The Actual Accident Locations options allows selection of the actual accident locations and running of requests and queries using these locations. Currently, only the Nodes option is functional.

Finally, a window titled after whichever county you selected should open, displaying the map for that county. If the window needs to be resized, move the mouse pointer to the side or corner of the window that is to be expanded. When the mouse pointer is at these locations, the mouse pointer will become a double-pointed arrow. When the mouse pointer is a double-pointed arrow, click and hold down the left mouse button, then move the mouse pointer in the direction of the desired expansion/contraction of the window. When sized to the desired level, release the left mouse button.

II. Location Specification

A. Node-Based

To begin a node-based search, first determine the area of interest. To zoom in or display the area of interest in more detail, first move the mouse pointer to the button (buttons are located below the menus) containing the magnifying glass with a plus sign  in it and click the left mouse button. Now move the mouse pointer to the map (the mouse pointer should turn into a magnifying glass with a plus sign in it once it is over the map) near where the area of interest is and click and hold down the left mouse button. Then drag the mouse pointer to form a rectangle around the area of interest. Then release the left mouse button. The map should now zoom in to the area of interest. This can be repeated for further detail of the area.

NOTE: To zoom out, select the button containing the magnifying glass with the minus sign  in it and click the left mouse button. Then move the mouse pointer to the map and click the left mouse button. The map will zoom out an arbitrary amount.

To ensure that you are in the correct region, move the mouse pointer to the button containing the black dot with a white "i"  in it (this is called the information tool) and click the left mouse button. Then move the mouse pointer to the map (the mouse pointer should turn into a crosshair with a black dot containing a white "i" next to it). Then position the crosshair over the element of interest (commonly a road) and click the left mouse button. A dialog box titled "Identify Results" should open. This dialog box contains the information about the feature selected. For a road, one of the bits of information will be the road name, for municipal roads this is listed in the STREET field and for primary roads this is listed in the St_rte field. Secondary roads have no listing at this time.

Once the area has been sufficiently detailed and verified, the next step is to select the node(s) of interest. To do this, an area selection tool is utilized. To select the area selection tool, move the mouse pointer up to the buttons and then move the pointer over the button containing the empty rectangle  (commonly this button is immediately to the left of the zoom in button) and click the left mouse button. Then move the mouse pointer to the map and draw a rectangle around the desired node(s). To draw the rectangle, place the mouse pointer to the appropriate location, click and hold down the left mouse button, draw the rectangle, and release the left mouse button. The nodes within the region, in addition to the linework (the roads, rivers, rail, etc.) should change color to red if they are not already red. Additionally, multiple rectangles may be drawn by holding down the "shift" key on the keyboard. Once the nodes are selected, a node-based request may be done.

To request information about node-based accidents, move the mouse pointer over the Request Menu and click the left mouse button. Then move the mouse pointer over the Run Location menu option and click the left mouse button. A dialog box titled "Run Location" should open. A box below the phrase "Choose a type of location:" should contain the phrase "Node_Request_(Crashes_at_Nodes)" and the box should have a downward pointing arrow on the right side. For a node-related accident request, moving the mouse pointer to the OK button and clicking the left mouse button is sufficient. For other types of node-based requests, move the mouse pointer over the arrow on the right side of the box below the phrase "Choose a type of location:" and click the left mouse button. Then place the mouse pointer over the choice desired and click the left mouse button. The desired option should now appear in the box. Then move the mouse pointer to the OK button and click the left mouse button. The Node Request, the Intersection Node Request, and the Link Between Nodes options will work on the search immediately; the String of Nodes option is not currently functional; and the Mile Pointed Request and Mile Posted Request options will request additional information. Explanations of the various options follow:

- Node-related Accidents Request

A Node-related accidents request searches for and reports on only those accidents that happened at the node selected. Nodes can be intersections, bridges, points where a road curves, railroad crossings, overpasses, grade separations, etc. Basically, all nodes shown on the map have node-related accidents that occur at them, but they might also contain intersection-related accidents.

- Intersection-related Accidents Request

An Intersection-related accidents request searches for and reports on those accidents that happened at the node selected as well as the accidents that were marked as intersection-related even if they occurred on a link. Intersections are only road-to-road intersections.

- Link-related Accidents Request

A Link-related accidents request searches for and reports on those accidents that happened at the end nodes of the link as well as those that happened on the link. To perform a link-related accidents request, two (only two) end nodes must be specified.

- String of Nodes Accidents Request

The String of Nodes accidents request currently does not function.

- Mile Pointed Accidents Request

The Mile Pointed accidents request searches for and reports on those accidents that happened between a set of mile points on a specific roadway in a specific direction. Mile points are only on the primary system and indicate the distance along a roadway from the southern and western borders of a county.

When performing a mile pointed request, the first dialog box that should appear is titled "Direction of Travel". To select one of the options, move the mouse pointer over the desired selection and click the left mouse button. Then move the mouse pointer over the OK button and click the left mouse button. The next dialog box that should appear is titled "Route Number". To enter the route number, simply enter the number of the route desired, preceded by a zero if the route number is only two digits long. Then move the mouse pointer to the OK button and click the left mouse button. The next dialog box that should appear is titled "Beginning MilePoint". Enter the beginning mile point desired, with implied two decimal points (i.e., mile point 10.50 is entered as 1050). Then move the mouse pointer to the OK button and click the left mouse button. The next dialog box that should appear is titled "Ending MilePoint". Enter the ending mile point desired in a fashion similar to that of the beginning mile point.

- Mile Posted Accidents Request

The Mile Posted accidents request searches for and reports on those accidents that happened between a set of mile posts on a specific roadway in a specific direction. Mile posts are only on the primary system and indicate the distance along a roadway from the southern and western borders of the state.

When performing a mile pointed request, the first dialog box that should appear is titled "Direction of Travel". To select one of the options, move the mouse pointer over the desired selection and click the left mouse button. Then move the mouse pointer over the OK button and click the left mouse button. The next dialog box that should appear is titled "Route Number". To enter the route number, simply enter the number of the route desired, preceded by a zero if the route number is only two digits long. Then move the mouse pointer to the OK button and click the left mouse button. The next dialog box that should appear is titled "Beginning MilePost". Enter the beginning mile post desired, with implied two decimal points (i.e., mile post 10.50 is entered as 1050). Then move the mouse pointer to the OK button and click the left mouse button. The next dialog box that should appear is titled "Ending MilePost". Enter the ending mile post desired in a fashion similar to that of the beginning mile post.

B. Actual Accident Locations-Based

Currently the Actual Accident Locations-Based location specification is not fully functional. However, some activities may still be performed.

To activate the Actual Accident Locations-Based location specification, such that it is, choose Actual Accident Locations instead of Nodes during that phase of the map viewing sequence. When the map

finishes drawing, the actual accident locations will be visible and the nodes will not be visible. These actual accident locations will be marked on the map as dots.

To retrieve information about specific accidents, the information tool (the button containing the black dot with the white "i" inside it) may again be used. Also, the zoom in tool (the button containing the magnifying glass with the plus sign) may be used to view the region of interest in more detail.

With the information tool selected, placing the mouse pointer on an accident location and clicking the left mouse button should result in a dialog box titled "Identify Results" to appear. Information about any accident that occurred at that location and information about the roadways and other features that are also at that location should be listed along the left side of the dialog box. The item in the list that is highlighted should have its detailed information displayed along the right side of the box. The dialog box may be resized in the same fashion that the view window may be resized. Also, other features may be selected to have their detailed information displayed by moving the mouse pointer over their location and clicking the left mouse button.

Currently only the "A Record" (the general information about the accident) information will be displayed by using the information tool. To obtain the "B Record" (the driver and vehicle information related to an accident) and the "C Record" (the injured person information related to an accident) information involves setting those layers "active". To do this, note the list along the left side of the view window. The items in the list are what are known as layers. Note that some of those items (layers) in the list have a check box with a check in them. These layers are visible. Also, note that some of those items (layers) in the list are highlighted. These layers are active. The information tool only provides information for those layers that are active. To set a layer active, without setting any other layers inactive (thereby making it so no information will come from those layers when using the information tool), depress and hold down the "shift" key on the keyboard, move the mouse pointer over to the layer to be set active, and click on the left mouse button. The layer should now be outlined as well. Information about that layer will be displayed in the "Identify Results" dialog box when appropriate. Once again looking at the list of layers, note that some of the layers are identified as "C Rec."s, "B Rec."s, and "A Rec."s at the end of their titles. These are the "C Records", "B Records", and "A Records", respectively. Prior to the record specifying portion of their name comes first the county number and then the year (shown in two digits).

III. Parameter Refinement/Specification

Once the location desired has been selected and preliminary results have been obtained, more detailed parameter specifications may be made. These parameter specifications can be refined using the Refine Search option under the Search menu. To select the Refine Search option, first move the mouse pointer to the Search menu and click the left mouse button. Then move the mouse pointer to the Refine Search option and click the left mouse button. A dialog box titled "Refinement Parameter Type Selection" should appear. This dialog box should contain a list of options, including: Accident Information, Vehicle Information, Driver Information, Injured Records, Combination Requests, Miscellaneous, and Node/Link Information. Of these, only the first four currently function and they will be detailed below. To select one of these types, move the mouse pointer over the parameter type in the list that is desired and click the left mouse button. Multiple types of parameters may be selected (e.g., both Accident Information and Vehicle Information). To unselect a parameter type, move the mouse pointer over that parameter type and click the left mouse button. The parameter types are selected when highlighted and unselected when not highlighted. Once all parameter types desired have been selected, move the mouse pointer to the OK button and click the left mouse button. Following this the particular parameter type windows should open, in succession if multiple parameter types were selected (i.e., The Accident Information parameters dialog box should open if it were selected. If both the Accident Information and the Vehicle Information parameter types were selected, first the Accident Information dialog box would open then, when the OK button is clicked, the Vehicle Information dialog box would open.) Within each parameter types dialog box, selections can be made in a fashion similar to the way selections were made in the "Refinement Parameter Type Selection" dialog box. Once again note that the options can be scrolled through using the arrows at the right of the list box.

Also, with each of these dialog boxes, note that if no options are selected when the OK button is clicked, the program will request that either an option is selected or the cancel button is clicked instead. And, if you cancel one of the parameter type dialog boxes, the others will still appear.

If the query logic has not yet been specified, a dialog box will appear requesting the logic with which the queries should be done. The choices are "and" or "or". "And" logic will provide only those accidents that meet all the parameters specified. "Or" logic will provide those accidents meeting any of the parameters specified.

Once all of the parameter types have been selected and run through, the program will select the data fitting the parameters selected for the specified time period, create new layers which contain the data for the parameters specified, and provide a total number of crashes fitting those parameters. This step may take a few minutes, depending on the number of accidents found at the location(s) specified. Once the parameter search is completed, reports may be generated for the selected information.

NOTE: When beginning another parameter search, it is important to distinguish between two types of further parameter searches: refinement of the current parameter search and beginning a new parameter search. If further refinement of the current parameter search is desired, only the additional parameters (i.e., those beyond the original parameters specified) need be specified. If a new set of parameters is to be selected, first go back to the Request option and redo the location specification operation. This will provide the original set of accidents at the location(s) specified.

Following is a list of the parameters specifications under each parameter type (detailed information about the values for these for performing unstructured queries is in the appendix):

- A. Accident Information
 - Accident Severities
 - Fatal
 - Non-Fatal Injury
 - Property Damage Only
 - Day of Week
 - Sunday
 - Monday
 - Tuesday
 - Wednesday
 - Thursday
 - Friday
 - Saturday
 - Time of Day
 - Beginning time of day
 - Ending time of day
 - Road Class
 - Interstate
 - US or State Highway
 - County Road
 - City Street
 - Other
 - Unknown
 - Type of Accident
 - Non-collision accidents
 - Overturned in Roadway
 - Jackknifed
 - Carbon Monoxide
 - Fire/Explosion
 - Immersion

- Other
- Collision accidents
 - Pedestrian
 - Vehicle in Traffic
 - Motorcycle in Traffic
 - Vehicle in Other Roadway
 - Parked Vehicle
 - Train
 - Pedacycle
 - Animal
 - Fixed Object
 - Other Object
- Number of Vehicles
 - Single Vehicle
 - Double Vehicle
 - More than Two
- Collision Type
 - Head-On
 - Broadside/Left Turn
 - Rear End
 - Rear End/Right Turn
 - Rear End/Left Turn
 - Sideswipe/Opposite Direction
 - Sideswipe/Same Direction
 - Sideswipe/Right Turn
 - Sideswipe/Left Turn
 - Sideswipe/Dual Left Turn
 - Sideswipe/Dual Right Turn
 - Broadside/Right Angle
 - Broadside/Right Entering
 - Broadside/Left Entering
 - Head-On/Left Entering
 - Sideswipe/Both Left Turning
 - Other
 - Single
 - Pedestrian
 - Bicycle
- Intersection Class
 - Non-Intersection
 - Interstate/Interstate
 - Interstate/US or State Highway
 - Interstate/City or County Road
 - US or State Highway/US or State Highway
 - US or State Highway/City or County Road
 - US or State Highway/Other
 - City of County Road/City or County Road
 - City of County Road/Other
 - Other/Unknown
- Route Number

- Enter route number (three digits). If route number is less than three digits, enter preceding zeroes (e.g., 35 would be entered as 035)
- B. Vehicle Information
- Type of Vehicle
 - Passenger Car
 - Car/Trailer
 - Panel Truck
 - Pickup Truck
 - Pickup/Trailer
 - Pickup/Camper
 - Straight Truck
 - Truck Tractor
 - Truck Tractor/Semi
 - Double Bottom Truck
 - Tow Truck/Wrecker
 - Motor Home
 - Bus
 - School Bus
 - Farm Vehicle/Equipment
 - Motorcycle
 - Bicycle, Etc.
 - Recreation Vehicle
 - Maintenance/Construction Vehicle
 - Train
 - Other (Describe)
 - Moped
 - Multipurpose Vehicle
 - Unknown
 - Roadway/Environment
 - None Apparent
 - Weather Conditions
 - Surface Conditions
 - Roadway Defect
 - Pedestrian Action
 - Pedestrian Drinking
 - Previous Accident
 - Animal in Roadway
 - Frost Covered Bridge
 - Traffic Control
 - Non-Contact Vehicle
 - Road Under Construction
 - Other
 - Unknown
 - Traffic Controls
 - No Controls Present
 - Traffic Signals
 - Stop Signs
 - Yield Signs
 - Warning Signs
 - School Signs

- No Passing Zone (Marked)
- School Stop Sign
- Stop Arm on School Bus
- Railroad Warning Sign
- Railroad Automatic Signal
- Railroad Crossing Gate
- Peace Officer
- Other Traffic Director
- Other Control
- Control Not Functional/Not In Place
- Fixed Object Struck
 - None
 - Bridge/Overpass
 - Underpass or Bridge Support
 - Building
 - Culvert
 - Curb
 - Ditch
 - Island/Raised Median
 - Embankment/Retaining Wall
 - Fence
 - Guardrail
 - Light Pole
 - Sign Post
 - Tree/Shrub
 - Utility Pole
 - Other Pole/Support
 - Mailbox
 - Impact Attenuator
 - Other
 - Unknown
- Special Use Vehicles
 - None
 - Police
 - Fire
 - Taxi
 - Government
 - Ambulance
 - Towing
 - Driver Training
 - Other
 - Unknown
- Vehicle Attachment
 - None
 - Single Trailer
 - Double Trailer
 - Semi
 - Farm
 - Utility
 - Camping

- Boat Trailer
- Mobile Home
- Mobile Home (Oversized)
- Oversized Load
- Towed Vehicle
- Other
- Unknown
- Speed Limit
 - Unknown
 - 5 mph
 - 10 mph
 - 15 mph
 - 20 mph
 - 25 mph
 - 30 mph
 - 35 mph
 - 40 mph
 - 45 mph
 - 50 mph
 - 55 mph
 - 60 mph
 - 65 mph
- Vehicle Action
 - Going Straight
 - Turning Left
 - Turning Right
 - Making U-turn
 - Passing
 - Changing Lanes
 - Merging
 - Parking
 - Slowing/Stopping
 - Backing
 - Stopped for Sign/Signal
 - Stopped in Traffic Lane
 - Stalled in Traffic Lane
 - Properly Parked
 - Improperly Parked
 - Other
 - Unattended Moving Vehicle
 - Unknown
- C. Driver Information (**options in bold incomplete**)
 - Age of Driver
 - Youngest age
 - Oldest age
 - Sex of Driver
 - Male
 - Female
 - Not Stated
 - **License Restrictions (incomplete)**

- None
- Corrective Lenses
- Left Outside Mirror
- Not When Headlights are Required
- Chauffeur - No Semitrailer Combination
- Automatic Transmission
- Chauffeur - Not Exceeding 5 Tons GW
- Operator & Chauffeur School Bus Only
- Valid for Motorcycle
- See Restrictions Supplement
- S.R. Only
- I.D. Only
- Restrictions Complied With
 - Yes
 - No
 - Unknown
- Driver Charged
 - Yes
 - No
 - Not Stated
- Sobriety Test Results
 - Low end BAC
 - High end BAC
- Condition of Driver
 - Apparently Normal
 - Physical Defect
 - Fatigued
 - Apparently asleep
 - Ill
 - Under Medication
 - Infirmities of Age
 - Drinking (Not Impaired)
 - Drinking (Impaired)
 - Drugs
 - Other
 - Unknown
- **Driver/Vehicle Contributing Circumstances (incomplete)**
 - None Apparent
 - Ran Traffic Signal
 - Ran Stop Sign
 - Passed Stopped School Bus
 - Passing Where Prohibited
 - Passing Interfered With Other Vehicle
 - Left of Centerline (Not Passing)
 - FTYROW At Uncontrolled Intersection
 - FTYROW From Stop Sign
 - FTYROW From Yield Sign
 - FTYROW Making Left Turn
 - FTYROW From Driveway
 - FTYROW From Parked Position

- FTYROW To Pedestrian
- FTYROW Other
- Wrong Way On One Way Road
- Speed Too Fast For Conditions
- Exceeding Speed Limit
- Drag Racing
- Improper Turn
- Improper Lane Change
- Following Too Close
- No Signal/Improper Signal
- Disregarded Railroad Signal
- Disregarded Warning Sign
- Reckless Driving
- Improper Backing
- Illegal/Improper Parking
- Failure To Have Control
- Headlights Not On
- Inattentive/Distracted
- Driver Confused
- Vision Obscured
- Oversized Vehicle
- Overloaded With Passengers/Cargo
- Inexperienced Driver
- Other
- Unknown

D. Injury Information

- Age Range
 - Low age
 - High age
- Protective Device
 - None
 - Lap Belt Use
 - Lap and Shoulder
 - Airbag Deployed
 - Child Restraint
 - Motorcycle Helmet
 - Passive Belt
 - Other
 - Unknown
- Pedestrian Sobriety
 - Had Been Drinking
 - Drinking (Not Impaired)
 - Drinking (Impaired)
 - Drugs
 - Unknown
- Injured Severity
 - Fatal
 - Major (Incapacitating)
 - Minor (Bruises and Abrasions)
 - Possible (Complaint of Pain)

- Unknown
- Pedestrian Action
 - Crossing Against Signal
 - Crossing, Not At Crosswalk
 - Walking, Improper Position On Roadway
 - Soliciting Rides On Roadway
 - Walking With Traffic
 - Walking Against Traffic
 - Crossing With Signal
 - Crossing in Crosswalk
 - Onto Road Between Parked Cars
 - Ran Onto Roadway
 - Directing Traffic
 - Playing
 - Lying or Sitting on Roadway
 - Pushing or Working on Vehicle
 - Getting On or Off Vehicle
 - Maintenance/Construction Project
 - Walking Off Roadway
 - Unknown
- Position Of Injured
 - Front Seat Driver Side - (1)
 - Front Seat Middle - (2)
 - Front Seat Passenger Side - (3)
 - Back Seat Driver Side - (4)
 - Back Seat Middle - (5)
 - Back Seat Passenger Side - (6)
 - Third Seat Driver Side - (7)
 - Third Seat Middle - (8)
 - Third Seat Passenger Side - (9)
 - Motorcycle/Moped Driver
 - Motorcycle/Moped Passenger
 - Bus Passenger
 - Bicyclist
 - Pedestrian
 - Riding on Exterior
 - Other
 - Unknown

IV. Reports

Once the accidents have been selected, whether or not refinements have been made, reports may be generated. By moving the mouse pointer to the Reports menu and clicking the left mouse button and then moving the mouse pointer to either the Engineering or Enforcement option and clicking, a report should be generated. The report should appear in the form of tables which are listed in the window titled "av_alas.apr". To view each portion of the report generated, move the mouse pointer over the portion desired and click the left mouse button twice in quick succession. A table should appear containing the information pertinent to that portion of the report. To remove the table from view, move the mouse pointer to the upper right portion of the window over the box with an X in it and click the left mouse button. The window should disappear.

Currently, the Engineering and Enforcement options produce the same reports. In the future, they will differ as per the differences in PC-ALAS. The portions of the report that currently function are the Parameter Sheet and the Summary Sheet. The other portions of the report will be completed as well.

V. Defaults

The defaults allow the user to set options during the current working session. To set a default, move the mouse pointer to the Defaults menu and click the left mouse button. After that, move the mouse pointer to the desired default item and click the left mouse button. Specifics about each option follow:

A. Report

The report option currently does not function.

B. Location

The location option allows the user to select or change the region of interest.

C. Directory

The directory option allows the user to select or change the default root and default directories.

D. Date

The date option allows the user to select or change the date(s) of interest.

VI. Help

The help option currently does not function.

APPENDIX C

Developer's Guide (ArcView-ALAS)

The developer's guide to ArcView-ALAS provides information about the customization of ArcView to produce the ArcView-ALAS product. Avenue, ArcView's customization language, was used to duplicate the functionality of PC-ALAS.

information about the menu or option selected. Menu information includes: Disabled, Help, Help Topic, Invisible, Label, Tag, Update. Option information includes: Click, Disabled, Help, Help Topic, Invisible, Label, Shortcut, Tag, Update. To change any one of these, move the mouse pointer over it and double click the left mouse button. The only options that have been set within AV_ALAS are the Label and Click options. More information about changing menu options is contained within the ArcView documentation.

Directory Structure

The directory structure of AV_ALAS contains a number of directories and files that are required for operation and some that, currently, are not required. Those directories that are required are the main directory, “_gisalas/”, the subdirectory “_gisalas/_maps/”, the subdirectory “_gisalas/_maps/_county/” and all of the county directories below that, the subdirectory “_gisalas/_query/”, the subdirectory “_gisalas/_reports”, the subdirectory “_gisalas/_reports/_template/”. The other directories can be deleted if desired, though future versions may require them.

In the future, not all the county directories under “_gisalas/_maps/_county” will be required, however they are currently required since if someone chooses a county that doesn’t have a directory, the program may cause an error. In addition, currently the county directories need to be spelled exactly as shown (i.e., Black Hawk county’s directory must be “_black_hawk”, with the underscores.). In fact, this is true of all of the directories in the directory structure. The most obvious problem this causes is that machines that don’t have Windows or NT operating systems can not have long directory or file names. However, it is anticipated that anyone using this system will have one of these two operating systems. In addition, the code can be readily changed to accommodate operating systems that do not support long file names.

In addition, certain files are required. The most important of these files is the ArcView project file containing the scripts and menus for the program, “_gisalas/av_alas.apr”. If this file is deleted, the program has been deleted and another copy must be obtained or copied into its place. Also, the data files for all counties must be contained within their respective “_gisalas/_maps/_county/” county subdirectory. If not, the program will not be able to locate the data files and bring them open. In addition, the files under the “_gisalas/_reports/_template/” directory must be there. Other files will be created by the program as it is run, but are not required and may be deleted without harming the program.

The directory structure is listed below:

```
_gisalas/  
  av_alas.apr  
  _exelib/  
  _maps/  
    _county/  
      _adair/  
      _adams/  
      _allamakee/  
      _appanoose/  
      _audobon/  
      _benton/  
      _black_hawk/  
      _boone/  
      _bremer/  
      _buchanan/  
      _buena_vista/  
      _butler/  
      _calhoun/  
      _carroll/  
      _cass/  
      _cedar/  
      _cerro_gordo/
```

_cherokee/
_chickasaw/
_clarke/
_clay/
_clayton/
_clinton/
_crawford/
_dallas/
_davis/
_decatur/
_delaware/
_des_moines/
_dickinson/
_dubuque/
_emmet/
_fayette/
_floyd/
_franklin/
_fremont/
_greene/
_grundy/
_guthrie/
_hamilton/
_hancock/
_hardin/
_harrison/
_henry/
_howard/
_humboldt/
_ida/
_iowa/
_jackson/
_jasper/
_jefferson/
_johnson/
_jones/
_keokuk/
_kossuth/
_lee/
_linn/
_louisa/
_lucas/
_lyon/
_madison/
_mahaska/
_marion/
_marshall/
_mills/
_mitchell/
_monona/
_monroe/
_montgomery/
_muscatine/
_o'brien/

- _osceola/
 - _page/
 - _palo_alto/
 - _plymouth/
 - _pocahontas/
 - _polk/
 - _pottawattamie/
 - _poweshiek/
 - _ringgold/
 - _sac/
 - _scott/
 - _shelby/
 - _sioux/
 - _story/
 - _tama/
 - _taylor/
 - _union/
 - _van_buren/
 - _wapello/
 - _warren/
 - _washington/
 - _wayne/
 - _webster/
 - _winnebago/
 - _winneshiek/
 - _woodbury/
 - _worth/
 - _wright/
- _itc/
- _rpa/
- _statewide/
- _query/
- _reports/
 - _templat/
 - _safety/
 - fixobj1.dbf
 - param.dbf
 - summary1.dbf
 - summary2.dbf
 - summary3.dbf
 - summary4.dbf
- _sourcelib/
- _userlib/
 - _beats/
 - _city/
 - _datasets/
 - _defaults/
 - _reports/

Script Names with Script Ties

A listing of the scripts within the AV-ALAS project follows. Within this listing an explanation of the function of each script is detailed. Additionally, each script listed will have the scripts that “call” it identified, as well as the scripts that are “called” by it. Following this,

the scripts in their entirety, with documentation, are listed. It should be noted that the scripts need to retain these names, unless every script calling the script has its call line changed as well. Also, the script code is listed in another document. **NOTE:** Those scripts in bold are currently not functional.

- **_gisalas.Default.DatePeriod**
Function: Sets the default date period. Requests a beginning date and an ending date in the form “MM/DD/YYYY”.
Called by: **_gisalas.Default.Region**
Calls: **_gisalas.Default.Region**

- **_gisalas.Default.Directories**
Function: Sets the default root directory and the default program directory. Requests entry of the default directory and the default program directory.
Called by: **_gisalas.Default.Region**
Calls: none

- **_gisalas.Default.Region**
Function: Sets the default region. Requests selection of the default region from a series of lists.
Called by: **_gisalas.Map.View, _gisalas.Default.DatePeriod**
Calls: **_gisalas.Default.DatePeriod**

- **_gisalas.Map.View**
Function: Opens a view for the default region containing the map layers for the default region. These map layers include: Secondary Roads, Rail, Primary Roads, Municipal Roads, Hydrology, ALAS Nodes, and the A, B, and C Record files for the years specified by the default date period.
Called by: Menu option **A**LAS File/View **M**ap
Calls: **_gisalas.Default.Region**

- **_gisalas.Parameters.AccidentInformation**
Function: Opens a dialog box for the user to specify which Accident Information parameters they are interested in.
Called by: **_gisalas.Parameters.Refinement.Main**
Calls: none

- **_gisalas.Parameters.AccidentInformation.AccidentSeverity**
Function: Searches the “Severity_c” field of the A Records for the accident severities chosen in the **_gisalas.Parameters.AccidentInformation** script.
Called by: **_gisalas.Parameters.Search**
Calls: none

- **_gisalas.Parameters.AccidentInformation.CollisionType**
Function: Searches the “Collision_” field of the A Records for the collision types chosen in the **_gisalas.Parameters.AccidentInformation** script.
Called by: **_gisalas.Parameters.Search**
Calls: none

- `_gisalas.Parameters.AccidentInformation.DayOfWeek`
 Function: Searches the “Day_of_wei” field of the A Records for the days of the week chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.AccidentInformation.IntersectionClass`
 Function: Searches the “Int_class” field of the A Records for the intersection classes chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.AccidentInformation.NumberOfVehicles`
 Function: Searches the “Total_veh” field of the A Records for the number of vehicles chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.AccidentInformation.RoadClass`
 Function: Searches the “Road_class” field of the A Records for the road classes chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.AccidentInformation.RouteNumber`
 Function: Searches the “Route” field of the A Records for the route chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.AccidentInformation.TimeOfDay`
 Function: Searches the “Military_t” field of the A Records for the times chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.AccidentInformation.TypeOfAccident`
 Function: Searches the “Accident_t” field of the A Records for the accident types chosen in the `_gisalas.Parameters.AccidentInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.DriverInformation`
 Function: Opens a dialog box for the user to specify which Driver Information parameters they are interested in.
 Called by: `_gisalas.Parameters.Refinement.Main`
 Calls: none
- `_gisalas.Parameters.DriverInformation.AgeOfDriver`
 Function: Searches the “Driver_age” field of the B Records for the driver ages

chosen in the `_gisalas.Parameters.DriverInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.DriverInformation.ConditionOfDriver`

Function: Searches the “Drive_cond” field of the B Records for the driver conditions chosen in the `_gisalas.Parameters.DriverInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- **`_gisalas.Parameters.DriverInformation.Dri/VehContributingCirc`**

Function: Currently non-functional.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.DriverInformation.DriverCharged`

Function: Searches the “Driver_cha” field of the B Records for the driver charged conditions chosen in the `_gisalas.Parameters.DriverInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- **`_gisalas.Parameters.DriverInformation.LicenseRestrictions`**

Function: Currently non-functional.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.DriverInformation.RestrictionsCompliedWith`

Function: Searches the “Restrictio” field of the B Records for the restrictions complied with conditions chosen in the `_gisalas.Parameters.DriverInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.DriverInformation.SexOfDriver`

Function: Searches the “Driver_sex” field of the B Records for the driver genders chosen in the `_gisalas.Parameters.DriverInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.DriverInformation.SobrietyTestResults`

Function: Searches the “Sobriety_r” field of the B Records for the sobriety test results chosen in the `_gisalas.Parameters.DriverInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.InjuredRecord`

Function: Opens a dialog box for the user to specify which Injured Record parameters they are interested in.

Called by: `_gisalas.Parameters.Refinement.Main`

Calls: none

- `_gisalas.Parameters.InjuredRecord.AgeRange`

Function: Searches the “Age1”, “Age2”, and “Age3” fields of the C Records for

the ages chosen in the `_gisalas.Parameters.InjuredRecord` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.InjuredRecord.InjurySeverity`

Function: Searches the “Inj_sev1”, “Inj_sev2”, and “Inj_sev3” fields of the C Records for the injury severities chosen in the `_gisalas.Parameters.InjuredRecord` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.InjuredRecord.PedestrianAction`

Function: Searches the “Ped_act1”, “Ped_act2”, and “Ped_act3” fields of the C Records for the pedestrian actions chosen in the `_gisalas.Parameters.InjuredRecord` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.InjuredRecord.PedestrianSobriety`

Function: Searches the “Sobriety1”, “Sobriety2”, and “Sobriety3” fields of the C Records for the pedestrian sobrieties chosen in the `_gisalas.Parameters.InjuredRecord` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.InjuredRecord.PositionOfInjured`

Function: Searches the “Inj_pos1”, “Inj_pos2”, and “Inj_pos3” fields of the C Records for the positions of injured persons chosen in the `_gisalas.Parameters.InjuredRecord` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.InjuredRecord.ProtectiveDevice`

Function: Searches the “Prot_dev1”, “Prot_dev2”, and “Prot_dev3” fields of the C Records for the positions of injured persons chosen in the `_gisalas.Parameters.InjuredRecord` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.Refinement.Main`

Function: Opens a dialog box for the user to specify which parameter types they are interested in. Once the parameter types of interest have been chosen, the individual parameter specification scripts are run. Once all parameters have been specified, the `_gisalas.Parameters.Search` script is run.

Called by: Menu option Search/Refine Search

Calls: `_gisalas.Parameters.AccidentInformation`

`_gisalas.Parameters.CombinationRequests`

`_gisalas.Parameters.DriverInformation`

`_gisalas.Parameters.InjuredRecord`

`_gisalas.Parameters.Miscellaneous`

`_gisalas.Parameters.VehicleInformation`

`_gisalas.Parameters.Search`

- `_gisalas.Parameters.Search`

Function: Calls all of the search scripts that have been selected through the `_gisalas.Parameters.Refinement.Main` script. Compiles the results of the various searches, prepares tables and adds them to the view, and displays the total number of accidents fitting the parameters selected. Also, while preparing the tables, the script captures all records in the A, B, and C Records related to the selected records by the “Crash_key” field in each record type.

Called by: `_gisalas.Parameters.Refinement.Main`

Calls:

- `_gisalas.Parameters.AccidentInformation.AccidentSeverity`
- `_gisalas.Parameters.AccidentInformation.CollisionType`
- `_gisalas.Parameters.AccidentInformation.DayOfWeek`
- `_gisalas.Parameters.AccidentInformation.IntersectionClass`
- `_gisalas.Parameters.AccidentInformation.NumberOfVehicles`
- `_gisalas.Parameters.AccidentInformation.RoadClass`
- `_gisalas.Parameters.AccidentInformation.RouteNumber`
- `_gisalas.Parameters.AccidentInformation.TimeOfDay`
- `_gisalas.Parameters.AccidentInformation.TypeOfAccident`
- `_gisalas.Parameters.CombinationRequest.AlcoholRelated`**
- `_gisalas.Parameters.CombinationRequest.FixedObjectRelated`**
- `_gisalas.Parameters.CombinationRequest.MotorcycleRelated`**
- `_gisalas.Parameters.CombinationRequest.PedacycleRelated`**
- `_gisalas.Parameters.CombinationRequest.TrainRelated`**
- `_gisalas.Parameters.DriverInformation.AgeOfDriver`
- `_gisalas.Parameters.DriverInformation.ConditionOfDriver`
- `_gisalas.Parameters.DriverInformation.Dri/VehContributingCirc`
- `_gisalas.Parameters.DriverInformation.DriverCharged`
- `_gisalas.Parameters.DriverInformation.LicenseRestrictions`
- `_gisalas.Parameters.DriverInformation.RestrictionsCompliedWith`
- `_gisalas.Parameters.DriverInformation.SexOfDriver`
- `_gisalas.Parameters.DriverInformation.SobrietyTestResults`
- `_gisalas.Parameters.InjuredRecord.AgeRange`
- `_gisalas.Parameters.InjuredRecord.InjurySeverity`
- `_gisalas.Parameters.InjuredRecord.PedestrianAction`
- `_gisalas.Parameters.InjuredRecord.PedestrianSobriety`
- `_gisalas.Parameters.InjuredRecord.PositionOfInjured`
- `_gisalas.Parameters.InjuredRecord.ProtectiveDevice`
- `_gisalas.Parameters.MiscellaneousInformation.CharacterOfRoadway`**
- `_gisalas.Parameters.MiscellaneousInformation.LightConditions`**
- `_gisalas.Parameters.MiscellaneousInformation.Locality`**
- `_gisalas.Parameters.MiscellaneousInformation.LocationOfAccidents`**
- `_gisalas.Parameters.MiscellaneousInformation.SpecialPeriods`**
- `_gisalas.Parameters.MiscellaneousInformation.SurfaceConditions`**
- `_gisalas.Parameters.MiscellaneousInformation.Weather`**
- `_gisalas.Parameters.VehicleInformation.FixedObjectStruck`
- `_gisalas.Parameters.VehicleInformation.Roadway/Environment`
- `_gisalas.Parameters.VehicleInformation.SpecialUseVehicle`
- `_gisalas.Parameters.VehicleInformation.SpeedLimit`
- `_gisalas.Parameters.VehicleInformation.TrafficControls`
- `_gisalas.Parameters.VehicleInformation.TypeOfVehicle`
- `_gisalas.Parameters.VehicleInformation.VehicleAction`
- `_gisalas.Parameters.VehicleInformation.VehicleAttachment`

- `_gisalas.Parameters.SelectLogic`
 Function: Prompts user to select which search logic is preferred. The choices are “and” or “or”. “And” logic chooses only those records that meet all parameter specifications. “Or” logic choose all records that meet any of the parameter specifications.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation`
 Function: Opens a dialog box for the user to specify which Vehicle Information parameters they are interested in.
 Called by: `_gisalas.Parameters.Refinement.Main`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.FixedObjectStruck`
 Function: Searches the “Fix_obj_st” field of the B Records for the fixed objects chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.Roadway/Environment`
 Function: Searches the “Road_contr” field of the B Records for the roadway and environment contributing factors chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.SpecialUseVehicle`
 Function: Searches the “Special_us” field of the B Records for the special use vehicles chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.SpeedLimit`
 Function: Searches the “Speed_limi” field of the B Records for the speed limits chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.TrafficControls`
 Function: Searches the “Traffic_co” field of the B Records for the traffic controls chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.TypeOfVehicle`
 Function: Searches the “Vehicle_ty” field of the B Records for the vehicle types chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`
 Calls: none
- `_gisalas.Parameters.VehicleInformation.VehicleAction`
 Function: Searches the “Vehicle_ac” field of the B Records for the vehicle actions chosen in the `_gisalas.Parameters.VehicleInformation` script.
 Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Parameters.VehicleInformation.VehicleAttachment`

Function: Searches the “Attachment” field of the B Records for the attachments chosen in the `_gisalas.Parameters.VehicleInformation` script.

Called by: `_gisalas.Parameters.Search`

Calls: none

- `_gisalas.Report.Enforcement`

Function: Generates the enforcement reports and adds them to the project under the tables heading.

Called by: Menu option Report/Enforcement Report

Calls: none

- `_gisalas.Report.Engineering`

Function: Generates the engineering reports and adds them to the project under the tables heading.

Called by: Menu option Report/Engineering Report

Calls: none

- `_gisalas.Request.RunLocation`

Function: Allows the user to select the selection type they are interested in.

Called by: Menu option Request/Run Location

Calls: `_gisalas.Request.RunLocation.IntersectionNode`

`_gisalas.Request.RunLocation.Link`

`_gisalas.Request.RunLocation.MilePointed`

`_gisalas.Request.RunLocation.MilePosted`

`_gisalas.Request.RunLocation.NodeString`

`_gisalas.Request.RunLocation.Node`

- `_gisalas.Request.RunLocation.IntersectionNode`

Function: In the case of a node-based location specification, searches the node file for those nodes that have been selected and uses the nodes selected to choose the A, B, and C records related to those nodes for the years specified, using the “Int_ID” field in the A Records and the “Crash_key” field in the A, B, and C Records to catch the B and C records associated with the A Records selected.

Called by: `_gisalas.Request.RunLocation`

Calls: none

- `_gisalas.Request.RunLocation.Link`

Function: In the case of a node-based location specification, searches the node file for those nodes that have been selected and uses the nodes selected to choose the A, B, and C records related to those nodes for the years specified, using the “Ref_Node” field and the “Dir_Node” field in the A Records and the “Crash_key” field in the A, B, and C Records to catch the B and C records associated with the A Records selected.

Called by: `_gisalas.Request.RunLocation`

Calls: none

- `_gisalas.Request.RunLocation.MilePointed`

Function: In the case of a node-based location specification, searches the the “Milepoint” field in the A Records and the “Crash_key” field in the A, B, and C Records to catch the B and C records associated with the A Records selected.

Called by: `_gisalas.Request.RunLocation`

Calls: none

- `_gisalas.Request.RunLocation.MilePosted`

Function: In the case of a node-based location specification, searches the the “Milepost” field in the A Records and the “Crash_key” field in the A, B, and C Records to catch the B and C records associated with the A Records selected.

Called by: `_gisalas.Request.RunLocation`

Calls: none

- `_gisalas.Request.RunLocation.Node`

Function: In the case of a node-based location specification, searches the node file for those nodes that have been selected and uses the nodes selected to choose the A, B, and C records related to those nodes for the years specified, using the “Ref_Node” field in the A Records and the “Crash_key” field in the A, B, and C Records to catch the B and C records associated with the A Records selected.

Called by: `_gisalas.Request.RunLocation`

Calls: none

APPENDIX D

A Record (Accident Information) Database Documentation

These data are derived from the ALAS database file. Three types of files are used: accident information files, vehicle information files, and injury information files. This section contains documentation on the accident information.

This documentation provides definitions of the numbers that appear in the columns of the database. The Iowa Department of Transportation Data Processing Department provided the information to compile this listing.

Data Name	Actual Name	Values	What it means
Record_num	Record Number		1 No Significant Meaning
Severity_c	Severity Code		1 Fatal 2 Non-Fatal 3 Property Damage Only
Report_typ	Report Type		1 1977 Officer 2 1977 Driver 3 Pre-1977 Driver 4 1979 Officer 5 1979 Driver
Total_kill	Total Killed	Number Killed	
Total_inju	Total Injured	Number Injured	
Total_vehi	Total Vehicle	Number of Vehicles	
Property_d	Total Property damage	Dollar Amount	
Accident_d	Date of Accident	six digit number	mm-dd-yr
Day_of_wee	Day of Week		1 Sunday 2 Monday 3 Tuesday 4 Wednesday 5 Thursday 6 Friday 7 Saturday
Military_t	Time of Day	military hours	
Rural_urba	Rural/Urban Code		R Rural U Urban
County	County		1 Adair 2 Adams 3 Allamakee 4 Appanoose 5 Audubon 6 Benton 7 Black Hawk 8 Boone 9 Bremer 10 Buchanan 11 Buena Vista 12 Butler 13 Calhoun 14 Carroll 15 Cass 16 Cedar 17 Cerro Gordo 18 Cherokee 19 Chickasaw 20 Clarke 21 Clay 22 Clayton 23 Clinton 24 Crawford 25 Dallas 26 Davis 27 Decatur 28 Deleware

Data Name	Actual Name	Values	What it means
		29	Des Moines
		30	Dickinson
		31	Dubuque
		32	Emmet
		33	Fayette
		34	Floyd
		35	Franklin
		36	Fremont
		37	Greene
		38	Grundy
		39	Guthrie
		40	Hamilton
		41	Hancock
		42	Hardin
		43	Harrison
		44	Henry
		45	Howard
		46	Humboldt
		47	Ida
		48	Iowa
		49	Jackson
		50	Jasper
		51	Jefferson
		52	Johnson
		53	Jones
		54	Keokuk
		55	Kossuth
		56	Lee
		57	Linn
		58	Louisa
		59	Lucas
		60	Lyon
		61	Madison
		62	Mahaska
		63	Marion
		64	Marshall
		65	Mills
		66	Mitchell
		67	Monona
		68	Monroe
		69	Montgomery
		70	Muscatine
		71	O'Brien
		72	Osceola
		73	Page
		74	Palo Alto
		75	Plymouth
		76	Pocahontas
		77	Polk
		78	Pottawattamie
		79	Poweshiek
		80	Ringgold

Data Name	Actual Name	Values	What it means
		81 Sac 82 Scott 83 Shelby 84 Sioux 85 Story 86 Tama 87 Taylor 88 Union 89 Van Buren 90 Wapello 91 Warren 92 Washington 93 Wayne 94 Webster 95 Winnebago 96 Winneshiek 97 Woodbury 98 Worth 99 Wright	
City	City	0 or 10-99	
Route	Route	Route # (e.g., 0030 = highway 30) 0990 County Road 0991 County Park 0995 City Street 0996 City Park, Frontage, Alley	
Road_class	Road Class	1 Interstate 2 US or State Highway 3 County Road 4 City Street 5 Other 0 Unknown	
Int_class	Intersection Class	0 Not an Intersection (Unknown) 1 Interstate/Interstate 2 Interstare/US or State Highway 3 Interstate/City or County Road 4 US-State Highway/US-State Highway 5 US-State Highway/County Road or City Street 6 US-State Highway/Other 7 County Road or City Street/County Road or City Street 8 County Road or City Street with other	
Int_id	Intersection Identifier	six digit number	
Ref_node	Refernce Node	six digit number	
Distance_l	Distance Indicator		
Dir_node	Direction Node	six digit number	
Accident_t	Type of Accident	Non-Collision 1 Overturned in Roadway 2 Jackknifed 3 Carbon Monoxide 4 Fire/Explosion 5 Immersion 6 Other	

Data Name	Actual Name	Values	What it means
		Collision with	<ul style="list-style-type: none"> 10 Pedestrian 11 Vehicle in Traffic 12 Motorcycle in Traffic 13 Vehicle in Other Roadway 14 Parked Vehicle 15 Train 16 Pedacycle 17 Animal 18 Fixed Object 19 Other Object
Road_chara	Character of Roadway	Non-Intersection Intersection Interchange	<ul style="list-style-type: none"> 1 No Special Features 2 Bridge/Overpass/Underpass 3 Railroad Crossing 4 Business Drive 5 Farm/Residential Drive 6 Other, Non-intersection 11 Within Intersection 12 Not Within Intersection but Intersection Related 13 Alley Intersection 14 Other (Intersection) 21 Intersection of Ramp and Minor Road 22 Ramp 23 On Major Road, between Ramps 24 On Minor Road, between Ramps 25 Entrance Ramp at Major Road 26 Major Road at Exit Ramp 27 Bridge/Overpass/Underpass 28 Not Within Interchange but Interchange Related 29 Other (Interchange) 0 Unknown
Road_geome	Roadway Geometrics		<ul style="list-style-type: none"> 1 Straight, Level 2 Straight, Up/Downgrade 3 Straight, Hillcrest 4 Curve, Level 5 Curve, Up/Downgrade 6 Curve, Hillcrest 7 Intersection, Level 8 Intersection, Up/Downgrade 9 Intersection, Hillcrest 0 Unknown
Light_cond	Light Conditions		<ul style="list-style-type: none"> 1 Day 2 Dusk 3 Dawn 4 Dark-Lighted Roadway 5 Dark-Roadway not Lighted 0 Unknown
Weather_co	Weather Condtion (up to two numbers)		<ul style="list-style-type: none"> 1 Clear 2 Cloudy

Data Name	Actual Name	Values	What it means
			<ul style="list-style-type: none"> 3 Fog 4 Mist 5 Rain 6 Sleet/Hail 7 Snow 8 Strong Wind 9 Other 0 Unknown
Locality	Locality		<ul style="list-style-type: none"> 1 Business District (Central) 2 Manufacturing District 3 Residential District 4 Business District (Outlying) 5 School/Playground Zone 6 Recreational Area 7 Open Country (Rural) 8 Other 9 Parking Lot/Private Property 0 Unknown
Location	Location		<ul style="list-style-type: none"> 1 On Roadway 2 Shoulder 3 Median 4 Roadside/Ditch 5 Outside Right of Way 0 Unknown
Collision_	Collision Type		<ul style="list-style-type: none"> 1 Head-on 2 Broadside/Left Turn 3 Rear End 4 Rear End/Right Turn 5 Rear End/Left Turn 6 Sideswipe/Opposite Direction 7 Sideswipe/Same Direction 8 Sideswipe/Right Turn 9 Sideswipe/Left Turn 10 Sideswipe/Dual Left Turn 11 Sideswipe/Dual Right Turn 12 Broadside/Right Angle 13 Broadside/Right Entering 14 Broadside/Left Entering 15 Headon/Left Entering 16 Sideswipe/Both Left Turning 17 Other 18 Single 19 Pedestrian 20 Bicycle
Milepoint	Milepoint		<ul style="list-style-type: none"> 0-7999 Milepoint Location 8000-8999 Off Direction route milepoints adjusted by 8000 9999 Primary route with an unknown milepoint NOTE: If accident was coded between two nodes with an unknown distance (000), the milepoint is assigned halfway between the nodes.
Milepost	Milepost		
Case_total	Unique Identifier		

Data Name	Actual Name	Values	What it means
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Crash_key	Unique Identifier	
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APPENDIX E

B Record (Vehicle Information) Database Documentation

These data are derived from the ALAS database file. Three types of files are used: accident information files, vehicle information files, and injury information files. This section contains documentation on the vehicle information.

This documentation provides definitions of the numbers that appear in the columns of the database. The Iowa Department of Transportation Data Processing Department provided the information to compile this listing.

Data Name	Actual Name	Values	What it means
Record_num	Record Number	1 to 20	No Significant Meaning
Vehicle_nu	Vehicle Number	1 to 20	No Significant Meaning
Vehicle_ty	Vehicle Type	1 to 23 0	1 Passenger Car 2 Car/Trailer 3 Panel Truck, Utility, No Rider 4 Pickup truck 5 Pickup/Trailer 6 Pickup/Camper 7 Straight Truck 8 Truck Tractor 9 Truck Tractor/Semi 10 Double Bottom Truck 11 Tow Truck/Wrecker 12 Motor Home 13 Bus 14 School Bus 15 Farm Vehicle/Equipment 16 Motorcycle 17 Bicycle/Pedacycle 18 Rec. Vehicle: ATV, non-hwy w/motor and no hwy registration 19 Maintenance/Construction Vehicle 20 Train 21 Other : mower, golf cart, dunebuggy, snowmobile, etc 22 Moped 23 Multipurpose, on/offroad, Blazer, Caravan, Minivan, Jeep (pre '91 were type 18 & 21) 0 Unknown
Vehicle_ye	Vehicle Year	2 digits	2 digit year (e.g., 93=1993)
Special_us	Special Use	1 to 9 0	1 None 2 Police 3 Fire 4 Taxi 5 Government 6 Ambulance 7 Towing 8 Driver Training 9 Other (Describe with Report) 0 Unknown
Number_occ	Number of Occupants		Number of people in vehicle
Attachment	Attachment	1 to 13	1 None 2 Single Trailer 3 Double 4 Semi 5 Farm 6 Utility 7 Camping 8 Boat Trailer 9 Mobile Home 10 Mobile Home (Oversized) 11 Oversize Load 12 Towed Vehicle 13 Other

Data Name	Actual Name	Values	What it means
		0 Unknown	
Fire_explo	Fire/Explosion	1 None 2 Yes 0 Unknown	
Hit_and_ru	Hit and Run	1 None 2 With Motor Vehicle 3 With Non-Occupant 4 Driver Left Scene 0 Unknown	
Point_init	Point of Initial Impact	1 Front 2 Right Front 3 Right Side 4 Right Rear 5 Rear 6 Left Rear 7 Left Side 8 Left Front 9 Top 10 Undercarriage 0 Unknown	
Damage_are	Damaged Areas (up to 4)	1 Front 2 Right Front 3 Right Side 4 Right Rear 5 Rear 6 Left Rear 7 Left Side 8 Left Front 9 Top 10 Undercarriage 0 Unknown	
Damage_sev	Damaged Severity	1 None 2 Light 3 Moderate 4 Severe 0 Unknown	
Vehicle_de	Vehicle Defects	1 None 2 Brakes 3 Steering 4 Blowout 5 Smooth Tires 6 Other Tire Defect 7 Wipers 8 Trailer Hitch 9 Exhaust 10 Headlights 11 Taillights 12 Turn Signal 13 Suspension 14 Other 15 Glass 0 Unknown	

Data Name	Actual Name	Values	What it means
Init_dirac	Initial Direction of Travel	1 North 2 Northeast 3 East 4 Southeast 5 South 6 Southwest 7 West 8 Northwest 0 Unknown	
Speed_limi	Speed Limit	0 to 65	Only in multiples of 5
Road_contr	Roadway/Environmental Contributing Circumstances	1 None 2 Weather Conditions 3 Surface Conditions 4 Roadway Defect 5 Pedestrian Action 6 Pedestrian Drinking 7 Previous Accident 8 Animal in Roadway 9 Frost Covered Bridge Floor (only) 10 Traffic Control Not In Place or Not Functioning 11 Non-Contact Vehicle 12 Road Under Construction 13 Other 0 Unknown	
Traffic_co	Traffic Controls	1 No Controls Present 2 Traffic Signals 3 Stop Signs 4 Yield Signs 5 Warning Signs 6 School Signs 7 No Passing Zone (Marked) 8 School Stop Sign 9 Stop Arm on School Bus 10 RR Warning Sign 11 RR Automatic Signal 12 RR Crossing Gate 13 Peace Officer 14 Other Traffic Director 15 Other Control 16 Control Not Functioning/Not In Place	
Type_traff	Type of Trafficway	1 One Lane or Ramp 2 Two Lanes 3 Three Lanes 4 Four or More, Undivided 5 Four or More, Divided 6 Alley 7 Driveway 8 Other 0 Unknown	
Traffic_fl	Traffic Flow	1 One-Way Traffic 2 Two-Way Traffic 0 Unknown	

Data Name	Actual Name	Values	What it means
Surface_ty	Type of Surface	<ul style="list-style-type: none"> 1 Cement/Concrete 2 Asphalt 3 Gravel/Rock 4 Dirt 5 Brick 6 Steel (Bridge Floor) 7 Wood (Bridge Floor) 8 Other 0 Unknown 	
Vehicle_ac	Vehicle Action	<ul style="list-style-type: none"> 1 Going Straight 2 Turning Left 3 Turning Right 4 Making U-Turn 5 Passing 6 Changing Lanes 7 Merging 8 Parking 9 Slowing-Stopping 10 Backing 11 Stopped for Stop Sign/Signal 12 Stopped in Traffic Lane 13 Stalled in Traffic Lane 14 Properly Parked, No Driver 15 Improperly Parked, with and without driver 16 Other (with and without driver) 17 Unattended Moving Vehicle 0 Unknown 	
Fix_obj_st	Fixed Object Struck	<ul style="list-style-type: none"> 1 None 2 Bridge/Overpass 3 Underpass/Bridge Supports 4 Building 5 Culvert 6 Curb 7 Ditch 8 Island/Raised Median 9 Embankment/Retaining Wall 10 Fence 11 Guardrail 12 Light Pole 13 Sign Post 14 Tree/Shrubbery 15 Utility Pole 16 Other Pole/Support 17 Mailbox 18 Impact Attenuator 19 Other 0 Unknown 	
Fix_obj_lo	Location of Fixed Object	<ul style="list-style-type: none"> 1 On Roadway 2 Shoulder 3 Median 4 Roadside/Ditch 5 Outside Right of Way 	

Data Name	Actual Name	Values	What it means
		0 Unknown	
Surface_co	Surface Conditions (up to 2 numbers)	1 Dry 2 Wet 3 Ice 4 Snow 5 Loose Gravel 6 Mud 7 Debris 8 Other 0 Unknown	
Driver_age	Driver's Age	0 Less than 1 Year Old 1 to 97 Actual Age 98 98 years old and older 99 Unknown	
Driver_sex	Driver's Sex	M Male F Female	
License_re	License Restrictions	0 None 1 Corrective Lenses 2 Left Outside Mirror 3 Not When Headlights Required 4 Chauffeur-No Semitrailer Combination 5 Automatic Transmission 6 Chauffeur-Not Exceeding 5 Tons Gross Vehicle Weight 7 Operator & Chauffeur - School Bus Only 8 Valid for Motorcycle 9 See Restriction Supplement A S.R. Required X I.D. Only	
Restictio	Restrictions Complied With	1 Yes 2 No 0 Unknown	
Driver_cha	Driver Charged	N No Y Yes	
Sobriety_t	Sobriety Test Given	1 None 2 Breath 3 Blood 4 Urine 5 Refused 0 Unknown	
Sobriety_r	Sobriety Test Results	take # multiplied by 0.01 to get actual blood alcohol level	
Driver_cond	Driver Condition	1 Apparently Normal 2 Physical Defect 3 Fatigued 4 Apparently Asleep 5 Ill 6 Under Medication 7 Infirmities of Age 8 Drinking (Not Impaired) 9 Drinking (Impaired) 10 Drugs 11 Other 0 Unknown	

Data Name	Actual Name	Values	What it means
Driver_cont	Driver/Vehicle Contributing Circumstances (up to 2)	1 None Apparent 2 Ran Traffic Signal 3 Ran Stop Sign 4 Passed Stopped School Bus 5 Passing Where Prohibited 6 Passing, Interfered With Other Vehicle 7 Left of Center, Not Passing 8 Failed to Yield ROW at Uncontrolled Intersection 9 FTYROW from Stop Sign 10 FTYROW from Yield Sign 11 FTYROW Making Left Turn 12 FTYROW from Driveway 13 FTYROW from Parked Position 14 FTYROW to Pedestrian 15 FTYROW Other 16 Wrong Way on One way Road. 17 Speed to Fast for Conditions 18 Exceeding Speed Limit 19 Drag Racing 20 Improper Turn 21 Improper Lane Change 22 Following to Close 23 No Signal/Improper Signal 24 Disregarded RR Signal 25 Disregarded Warning Signal 26 Reckless Driving 27 Improper Backing 28 Illegal/Improper Parking 29 Failure to Have Control 30 Headlights Not On 31 Inattentive/Distracted 32 Driver Confused 33 Vision Obscured 34 Oversized Vehicle 35 Overloaded With Passengers/Cargo 36 Inexperienced Driver 38 Other 0 Unknown	
Vision_obs	Vision Obscured	1 Not Obstructed 2 Trees/Crops 3 Buildings 4 Embankments 5 Sign/Billboards 6 Hillcrest 7 Parked Vehicles 8 Moving Vehicles 9 Person/Object In or On Vehicle 10 Blinded by Sun/Headlights 11 Frosted Windows/Windshield 12 Blowing Snow 13 Fog/Smoke/Dust	

Data Name	Actual Name	Values	What it means
		14 Other 0 Unknown	
DI-classty	DL Class Type	A Vehicle 26001 GCWR+, Towed GVWR 10001+ B Vehicle 26001 GCWR+, Towed LT 10001 C Vehicle 26000 or Less GVWR & either 16 Pass Design of Hazmat C Non-Commercial Vehicle D Chauffeur M Motorcycle RS Y Invalid with 0 Supplement	
DI_endorse	DL Endorsements (up to 5)	H Hazmat P Pass N Tank X Hazmat and Tank T Double or Triple Trailer 1 Truck Tractor Semi-Trailer Combo 2 16001 GVWR+ (Not Valid for Truck Trailer Semitrailer Combo 3 Pass Vehicle < 16 Pass Design	
Case_total	Unique Identifier		
Crash_key	Unique Identifier		

APPENDIX F

C Record (Injury Information) Database Documentation

These data are derived from the ALAS database file. Three types of files are used: accident information files, vehicle information files, and injury information files. This section contains documentation on the injury information.

This documentation provides definitions of the numbers that appear in the columns of the database. The Iowa Department of Transportation Data Processing Department provided the information to compile this listing.

Data Name	Actual Name	Values	What it means
Record_num	Record Number	1	No Significant Meaning
Unit_num1	Unit 1 Number	Varies	No Significant Meaning
Age1	Age of Person 1	Varies	Age of Driver
Sex1	Sex of Person 1	M F	Male Female
Inj_Sev1	Injury Severity of Person 1	1 2 3 4 0	Fatal Major (Incapacitating) Minor (Bruises, Abrasions) Possible (Complaint of Pain) Unknown
Inj_area1	Injured Area of Person 1	1 2 3 4 5 6 7 0	Upper Torso Lower Torso Internal Head Arms Legs Multiple Unknown
Inj_pos1	Injured Position of Person 1	1 to 9 M S U B P E T O	Diagram On Report Motorcycle/Moped Driver Motorcycle/Moped Passenger Bus Passenger Bicyclist Pedestrian Riding on Exterior Other Unknown
Prot_dev1	Protective Device of Person 1	1 '' 2 3 4 5 6 7 8 0	None On Old IASP Only None or Pedestrian Lap Belt Used Lap and Shoulder Belt Air Bag Deployed Child Restraint Motorcycle Helmet Passive Belt Other Unknown
Ejection1	Person 1 Ejected	1 2 3 4 0	Not Ejected or Pedestrian Partially Ejected Totally Ejected Extricated Unknown
Ped_act1	Pedestrian Action of Person 1	1 2 3 4 5 6 7 8 9 10	Crossing, Against Signal Crossing, Not at Crosswalk Walking, Improper Position on Roadway Soliciting Rides on Road Walking With Traffic Walking Against Traffic Crossing, With Signal Crossing, In Crosswalk Onto Road Between Parked Cars Ran Onto Roadway

Data Name	Actual Name	Values	What it means
		11 Directing Traffic 12 Playing 13 Lying or Sitting On Roadway 14 Pushing, Working on Vehicle 15 Getting On or Off Vehicle 16 Maintenance/Construction Project 17 Walking, Off Roadway 0 Unknown	
Cloth_col1	Color of Clothing Person 1	1 Generally Light 2 Generally Dark 0 Unknown	
Ped_drive1	Pedestrian also Driver	N No Y Yes Not Stated	
Sobriety1	Person 1 Sobriety	1 Had Not Been Drinking 2 Drinking (Not Impaired) 3 Drinking (Impaired) 4 Drugs 0 Unknown	
Sobr_res1	Sobriety Results Person 1	number times 0.01 = % alcohol in Blood	
Unit_num2	Unit 2 Number	Varies No Significant Meaning	
Age2	Age of Person 2	Varies Age of Driver	
Sex2	Sex of Person 2	M Male F Female	
Inj_Sev2	Injury Severity of Person 2	1 Fatal 2 Major (Incapacitating) 3 Minor (Bruises, Abrasions) 4 Possible (Complaint of Pain) 0 Unknown	
Inj_area2	Injured Area of Person 2	1 Upper Torso 2 Lower Torso 3 Internal 4 Head 5 Arms 6 Legs 7 Multiple 0 Unknown	
Inj_pos2	Injured Position of Person 2	1 to 9 Diagram On Report M Motorcycle/Moped Driver S Motorcycle/Moped Passenger U Bus Passenger B Bicyclist P Pedestrian E Riding on Exterior T Other O Unknown	
Prot_dev2	Protective Device of Person 2	1 None On Old IASP Only ' ' None or Pedestrian 2 Lap Belt Used 3 Lap and Shoulder Belt 4 Air Bag Deployed 5 Child Restraint	

Data Name	Actual Name	Values	What it means
		6 Motorcycle Helmet 7 Passive Belt 8 Other 0 Unknown	
Ejection2	Person 2 Ejected	1 Not Ejected or Pedestrian 2 Partially Ejected 3 Totally Ejected 4 Extricated 0 Unknown	
Ped_act2	Pedestrian Action of Person 2	1 Crossing, Against Signal 2 Crossing, Not at Crosswalk 3 Walking, Improper Position on Roadway 4 Soliciting Rides on Road 5 Walking With Traffic 6 Walking Against Traffic 7 Crossing, With Signal 8 Crossing, In Crosswalk 9 Onto Road Between Parked Cars 10 Ran Onto Roadway 11 Directing Traffic 12 Playing 13 Lying or Sitting On Roadway 14 Pushing, Working on Vehicle 15 Getting On or Off Vehicle 16 Maintenance/Construction Project 17 Walking, Off Roadway 0 Unknown	
Cloth_col2	Color of Clothing Person 2	1 Generally Light 2 Generally Dark 0 Unknown	
Ped_drive2	Pedestrian also Driver	N No Y Yes Not Stated	
Sobriety2	Person 2 Sobriety	1 Had Not Been Drinking 2 Drinking (Not Impaired) 3 Drinking (Impaired) 4 Drugs 0 Unknown	
Sobr_res2	Sobriety Results Person 2	number times 0.01 = % alcohol in Blood	
Unit_num3	Unit 3 Number	Varies No Significant Meaning	
Age3	Age of Person 3	Varies Age of Driver	
Sex3	Sex of Person 3	M Male F Female	
Inj_Sev3	Injury Severity of Person 3	1 Fatal 2 Major (Incapacitating) 3 Minor (Bruises, Abrasions) 4 Possible (Complaint of Pain) 0 Unknown	
Inj_area3	Injured Area of Person 3	1 Upper Torso 2 Lower Torso 3 Internal 4 Head	

Data Name	Actual Name	Values	What it means
		5 Arms 6 Legs 7 Multiple 0 Unknown	
Inj_pos3	Injured Position of Person 3	1 to 9 Diagram On Report M Motorcycle/Moped Driver S Motorcycle/Moped Passenger U Bus Passenger B Bicyclist P Pedestrian E Riding on Exterior T Other O Unknown	
Prot_dev3	Protective Device of Person 3	1 None On Old IASP Only ' ' None or Pedestrian 2 Lap Belt Used 3 Lap and Shoulder Belt 4 Air Bag Deployed 5 Child Restraint 6 Motorcycle Helmet 7 Passive Belt 8 Other 0 Unknown	
Ejection3	Person 3 Ejected	1 Not Ejected or Pedestrian 2 Partially Ejected 3 Totally Ejected 4 Extricated 0 Unknown	
Ped_act3	Pedestrian Action of Person 3	1 Crossing, Against Signal 2 Crossing, Not at Crosswalk 3 Walking, Improper Position on Roadway 4 Soliciting Rides on Road 5 Walking With Traffic 6 Walking Against Traffic 7 Crossing, With Signal 8 Crossing, In Crosswalk 9 Onto Road Between Parked Cars 10 Ran Onto Roadway 11 Directing Traffic 12 Playing 13 Lying or Sitting On Roadway 14 Pushing, Working on Vehicle 15 Getting On or Off Vehicle 16 Maintenance/Construction Project 17 Walking, Off Roadway 0 Unknown	
Cloth_col3	Color of Clothing Person 3	1 Generally Light 2 Generally Dark 0 Unknown	
Ped_drive3	Pedestrian also Driver	N No Y Yes Not Stated	

Data Name	Actual Name	Values	What it means
Sobriety3	Person 3 Sobriety	1 Had Not Been Drinking 2 Drinking (Not Impaired) 3 Drinking (Impaired) 4 Drugs 0 Unknown	
Sobr_res3	Sobriety Results Person 3	number times 0.01 = % alcohol in Blood	
Case_total	Unique Identifier		
Crash_key	Unique Identifier		

APPENDIX G

Answers to Questions at Explorer-ALAS Introduction on 12/18/97

December 18th several beta test members were introduced to Explorer-ALAS at the Center for Transportation Research and Education (CTRE). The ALAS team members were present to assist and aide the participants. This appendix presents questions that were presented from the participants; the answers to these questions were provided by the ALAS team.

Responses to the AV-ALAS software were not addressed due to several bugs that existed in the customization process. These bugs have been removed and future training sessions with AV-ALAS are being scheduled. Participants will be asked to record any questions and the ALAS team will provide responses to the questions.

Questions/Comments for Explorer ALAS (12/18/97)

How do you change the color of the results of a query?

View, Map Display properties, click on the box that has selection color and change to the appropriate color, when color is selected click on the x in the upper right corner.

How come the “hammer” doesn’t highlight?

The only time that the hammer will not highlight is when there is no active theme. If you want to query a theme you need to make it active (put the highlighted box around it) once this is done the “hammer” (query tool) will become enabled.

How do you save a view?

To save a view click on the file and select save. Save the file to your directory and click Save. This saves the current view that is present on the screen. When this file is opened all of the themes that were present on the view are automatically opened and the last view that was saved is the view that will be present on the screen when this file is opened

How do you label routes?

The street names are only available for the municipal routes. There are two different ways to label a route. The first way to label the route is to double click on the theme that you want to label. Under the Classification Options select labels. The screen should change and there should be a pull down menu for text field. This will list all of the fields in the database that can be labeled. Select the appropriate label, one can also select various fonts and colors of text on this screen as well. The second way is to select theme from the top of the screen and then select theme properties. Once this is done follow the directions from the Classification Options.

Can you label just the major street roads (Lincoln Way and Duff)?

Individual lines can not be labeled, the entire layer must be labeled or nothing from that layer can be labeled.

How do you find a known node location?

To find a known value for any element that exists in the database one would use the query tool (hammer). To find a particular node the process is as follows: 1) make the node layer active, 2) click on the query builder (hammer), 3) select a field (node number is the id), 4) select the equal sign, 5) enter the value that is desired, 6) click on the execute button; a value shall occur below that lists the results from the query if more than one value occurs then there are multiple locations of that particular field, 7) click on the value in the query results fields, 8) click on the pan button and highlight button, this will take you to the area that this particular field is located, if you want to zoom in you can do this manually or select the zoom button.

How do we shortcut to a pre-set view? Is this possible?

To create a shortcut to a preset view is only possible if you create the view and save it as an ArcExplorer Project (.aep). When you open an ArcExplorer Project it will automatically open to the view that it was saved as.

How can you change the symbol for the accident location so it is not a square?

To change the symbol double click on the theme that contains the symbol to be changed. From there one can select the color and style of the marker. Click OK when finished to have changes applied to the view.

Why are some of the existing roads not continuous?

The road files are obtained from the Iowa Department of Transportation Office of Transportation Data. This coverage does not include institutional roads and some

new roadways may not be included in the coverage.

Can themes be listed alphabetically?

The themes can be arranged in various ways. The way to arrange themes is to click and hold down on the theme that is to be moved and drag and drop it to its new location. This is the only way to list the themes in any particular order. The themes are originally listed in the order that they are opened.

Could dot indicators be made different shapes as well as colors?

One can change the dot size and color by clicking on the theme that the dots represent. The size, color, and style can be changed from the screen that appears. One can also create a thematic map according to Unique Values or Class Breaks

Can we search for street names?

To find a known value for any element that exists in the database one would use the query tool (hammer). To find a particular street the process is as follows: 1) make the Municipal layer active, 2) click on the query builder (hammer), 3) select a field (street contains the street name), 4) select the equal sign, 5) enter the value that is desired, 6) click on the execute button; a value shall occur below that lists the results from the query if more than one value occurs then there are multiple locations of that particular field, 7) click on the value in the query results fields, 8) click on the pan button and highlight button, this will take you to the area that this particular field is located, if you want to zoom in you can do this manually or select the zoom button.

Is there any thematic mapping capability?

Thematic mapping is available this is done by creating class breaks and unique values for a particular theme. Double click on the theme and one can create a thematic map by changing how the data is presented

Why did system crash when "min" was selected from summary statistics?

When this process was attempted on our computers the same problem occurred. ESRI has been contacted about this problem and are working on a solution.

APPENDIX H

Using ArcExplorer

This appendix contains the user's guide for ArcExplorer. This document was produced by ESRI and is available when ArcExplorer is installed a computer. The location of this document (assuming default installation locations) is C:\Program Files\ESRI\ArcExplorer\ArcExplorer.pdf.