

Collision Diagram Software Compatability with Iowa Accident Database

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The Iowa DOT was interested in automated collision diagram products. The Center for Transportation Research and Education (CTRE), an Iowa State University center, completed an evaluation. This paper presents the findings. An automated collision diagram program quickly and accurately generates a graphic of intersection accident history. Limited human resources can concentrate on the safety analysis and not on manually generating collision diagrams resulting in a more efficient safety analysis program. The Iowa DOT was interested in software packages that were currently available, used by other DOTs, and how packages compared to the requirements. Fourteen packages were initially identified by CTRE. After the first evaluation step, nine packages were considered for evaluation. A decision matrix was developed that provided a "go" "no go" to the individual programs. From this, four programs were obtained by CTRE for further analysis, and an investigation of each was conducted. From this analysis, a final selection was made. Comparing to the requirements, Intersection Magic, distributed by Pd' Programming, was the program that the Iowa DOT selected for their collision diagram package. The software displays accident history in graphical formats and use filters to segregate graphics for specific inquiries. This allows the evaluator the opportunity to look at different types of accidents and see if there are trends that warrant further evaluation. The Iowa DOT is in the process of comparing the results from Intersection Magic with previously generated diagrams and developing a program for implementation in field offices. Key words: collision, diagram, Intersection Magic.

INTRODUCTION

The Iowa DOT was interested in implementing an automated collision diagram product because of the wide usage of this evaluation tool at all levels of government. The Center for Transportation Research and Education (CTRE), a center of Iowa State University, completed an evaluation of the potential software packages for the Iowa DOT and this paper presents the findings.

State, county, and city engineers and planners are responsible for analyzing traffic crash data as a part of their duties. They analyze crash data for the purposes of developing a list of locations where crashes have occurred, ranking locations according to crash numbers and rates, and developing reports for each location selected for analysis. They create a collision diagram that graphically displays crash trends, and for the purpose of preparing re-

ports for public information meetings, budget preparation, or funding requests. Generating a collision diagram generally concludes the data collection and analysis process and allows planners and engineers the opportunity to focus on specific initiatives that are directed toward specific crash trends. It is desirable to automate the collision diagram development process and integrate the software application with the existing accident database at the Iowa Department of Transportation.

The underlying purpose of an automated collision diagram program is to have the ability to quickly and accurately generate a visual description of the accident history for a specific location. This also means that limited human resources can concentrate on safety analysis where it is most needed. Resources that were previously spent on the generation of collision diagrams by manual applications can now be channeled into more in-depth analysis, resulting in a more efficient and better safety analysis program.

Currently, the Iowa DOT's Traffic Safety staff produce collision diagrams that are hand drawn. Technicians must first research accident records by accessing the Iowa PC-ALAS (Personal Computer-Accident Location and Analysis System) database and then generate a collision diagram manually which visually displays the accident history. A summary of data, collected from PC-ALAS, is attached to the collision diagram and groups the accident reports by type of accident (corresponding to the visual display). Because of reduced staffing at the Iowa DOT, collision diagrams are currently drawn only for Hazardous Elimination System (HES) projects and major problem intersections.

The Iowa electronic accident record database has existed since 1977. Although the format has changed from a mainframe system to a personal computer system, the database has managed the same basic accident record information over the years. The current version, called PC-ALAS, utilizes flat files that are in ASCII text format arranged into "A," "B," and "C" records. The "A" record contains the general information about the accident, the "B" record contains driver and vehicle specific information, and the "C" record contains injury information. Every accident record will contain an "A" record and at least one "B" record, but the presence of additional "B" or "C" records varies with each accident. Upon request for accident information, the Iowa DOT can query PC-ALAS for a 3-5 year period (urban locations) or up to a 10 year period (rural locations) for accident data. The accident location system is a link-node system utilizing eight-digit node numbers assigned to intersections and other roadway features on a quasi-coordinate system.

The Iowa accident system contains 70,000-75,000 accidents for each year. The magnitude of this system mandates that a collision diagram software package be sophisticated enough to handle all accident records, including an expanded database for future years. The Iowa DOT is in the process of converting the PC-ALAS data-

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base to Microsoft Access. They are also planning to interface the ALAS database with a Geographical Information System (GIS) platform and create a GIS-ALAS application. All of these issues including GIS-ALAS development were considered during the collision diagram software evaluation.

Evaluation Requirements

The Iowa DOT identified specific data fields they required be included in a collision diagram software package. The data fields were prioritized by level of importance into primary, secondary, and tertiary data fields. These data fields are shown in Table 1. The primary data fields were required to be a part of any collision diagram software package the Iowa DOT would consider. The secondary and tertiary data fields were not as important to the Iowa DOT but would be weighed in the evaluation. These fields are derived from the officer’s accident report and are used in the PC-ALAS database. These data fields are used to conduct filters or queries that help engineers and technicians conduct traffic accident analysis.

In addition, other evaluation requirements were established:

- Utilizes a PC with a 386 processor or higher, MS Windows 3.1 or later, 4 MB of RAM, VGA or higher resolution monitor, 6 MB of hard disk space, and any compatible printer
- PC-ALAS data format compatibility
- Color plotting
- Adaptable to a GIS platform
- Calculate accident rates
- Accident record edit functions
- Quality presentation graphics
- Apply filters and complete queries
- Statistical reports of analysis
- Retrieve accident record by clicking on accident icon
- Alter intersection alignment and move accidents around within intersection
- Level of support from software developer.

FIRST STEP EVALUATION

The Iowa DOT was interested in reviewing collision diagram software packages that were currently available, if any other Department of Transportation was using a collision diagram software package, and how the packages compared to the Iowa DOT requirements.

The following list of fourteen includes all of the software packages that CTRE explored for compatibility with the Iowa DOT requirements. Some of these packages are commercially available and others are developed in house by a transportation agency.

- Intersection Magic (Pd’ Programming)
- Accident Information Management System: Geographic Information System (AIMS:GIS)
- Collision Database System (Crossroads Software)
- Accident Surveillance & Analysis Program (ASAP) (Hank Mohle & Associates)
- Collision Plot Program (Illinois DOT)
- Collision Diagram for Windows 2.1, COLLDIAG (Ohio Department of Public Safety)
- TRACPLOT (Ohio DOT)
- Collision Diagrams (Wyoming Highway Department)

Table 1 PC-ALAS Data Fields

PC-ALAS Data Fields		
Primary Fields	Secondary Fields	Tertiary Fields
Case: year, prefix, and number	Accident severity code: Fatal, injury, property damage	Report type
Date of accident	Total killed	City
County number	Total injured by severity level (major, minor, unknown)	Intersection class
Intersection identifier (node-based system)	Total vehicles	Locality
Reference node	Total property damage	Special use: police, fire, taxi, etc.
Distance indicator	Day of week	Number of occupants
Direction node	Time of day	Vehicle defects
Collision type	Route number	Type of surface
Initial direction of travel	Road class: interstate, US or state highway, county road, city street	Location of fixed object
Vehicle action (prior to accident)	Type of accident	Drivers sex
	Character of roadway	Position of injured pedestrian
	Roadway geometrics	Protective devices
	Light conditions	Sobriety of pedestrian
	Weather conditions	
	Location: on roadway, shoulder, median, etc.	
	Vehicle type	
	Point of initial contact	
	Contributing circumstances	
	Traffic controls	
	Type of roadway: # of lanes, ramp, etc.	
	Traffic flow: 1 way, 2 way	
	Fixed object struck	
	Surface conditions	
	Driver age	
	Driver charged	
	Sobriety test given and results	
	Driver condition	
	Driver/vehicle contributing factors	
	Vision obscured	
	Injury severity (pedestrian)	
	Protective device	
	Pedestrian action	

- Intersection Collision Plot Diagram (Texas Safety and Traffic Operations)
- Traffic Operations System Software TOSS (University of Kansas)
- AutoCAD
- Small Computer Accident Records System SCARS (University of Florida)

Table 2 State Department of Transportation Inquiry

State	Software
New York	No current collision software
Ohio	COLLDIAG for Windows
Missouri	No current collision software
Kansas	TOSS and Intersection Magic
Wyoming	FORTAN PROGRAM
Pennsylvania	No current collision software
Connecticut	No current collision software
Texas	Mainframe program
California	No current collision software

- Small Computer Collision Diagram SCCOLD (University of Florida)
- Accident Records, Summary and Diagrams (ACCISUM) (University of Kansas)

Several states were using or were considering the use of collision diagram software packages and each of them was contacted to evaluate their particular application, if any, and the correlation to the Iowa DOT requirements. This information is located in Table 1 and was current at the end of 1996.

Five of the software programs were out of date and were typically based on a main frame system. Others obviously were not compatible with PC-ALAS format and could not be made compatible without extensive reprogramming. Some programs were simply not sent to CTRE for evaluation.

SECOND STEP EVALUATION

Nine software packages were considered for further evaluation and the are listed below.

- Intersection Magic (Pd' Programming)
- Accident Information Management System: GIS, AIMS:GIS (JMW Engineering, Inc.)
- Collision Database System (Crossroads Software)
- ASAP Accident Surveillance & Analysis Program (Hank Mohle and Assoc.)
- Collision Plot Program (Illinois DOT)
- COLLDIAG for Windows (Ohio DOT)
- Traffic Operations System Software, TOSS (University of Kansas)
- Small Computer Collision Diagram, SCCOLD (University of Florida)
- Accident Records, Summary and Diagrams, ACCISUM (University of Kansas)

A decision matrix was developed that gave a "go" "no go" to the individual software programs that were evaluated at this second level. Table 2 indicates the various software package's individual capabilities along with a notation as to whether the packages were obtained for further testing. The software was evaluated against the functional criteria. The packages that fit the most criteria and offered the most interest by the developer were studied further. Many of the programs were not windows based and were dismissed.

Table 3 Decision Matrix for Continued Evaluation

Software	PC-ALAS compatible	System Requirements	Graphics quality	Obtained for further analysis
Intersection Magic	x	x	x	x
AIMS:GIS	x	x	x	x
Collision Database	x	x	x	x
ASAP	x		x	
Collision Plot Program		x	x	
COLLDIAG	x	x	x	x
TOSS	x		x	
SCCOLD		x	x	
ACCISUM	x	x		

Table 4 Final Evaluation Matrix

Software	Editing capability	GIS compatible	Graphics quality	Query capabilities
Intersection Magic	x	x	x	x
AIMS:GIS	x	x		x
Collision Database	x	x		x
COLLDIAG	x	x		x

THIRD STEP EVALUATION

The characteristics of the collision diagram software programs that received the most consideration were compatibility with the existing PC-ALAS structure, system requirements such as associated software and hardware, and quality of the collision diagram graphics.

Based on these characteristics, the following software packages were obtained for further investigation.

Four software packages were obtained for further analysis. The research team at CTRE acquired the collision diagram programs from individual suppliers or from government agencies. They tried to integrate them with the ALAS data base and evaluated them against the requirements established for the project. The four that were acquired include Intersection Magic (Pd' Programming), AIMS:GIS Accident Software (JMW Engineering), Collision Database System (Crossroads Software), and COLLDIAG for Windows (Ohio DOT).

Demonstration software packages were obtained and investigations of each software package were conducted. Introductory meetings with the Iowa DOT narrowed the focus to two software packages through the use of initial demonstrations. The software packages chosen for in-depth investigation were Intersection Magic and AIMS:GIS. The other two programs were dismissed because they were not compatible with a GIS platform. CTRE obtained 1993 Jasper County accident records taken from PC-ALAS data files and sent them to Pd' Programming and JMW Engineering. CTRE wanted to test the compatibility of the data files with these



FIGURE 1 Intersection menu.

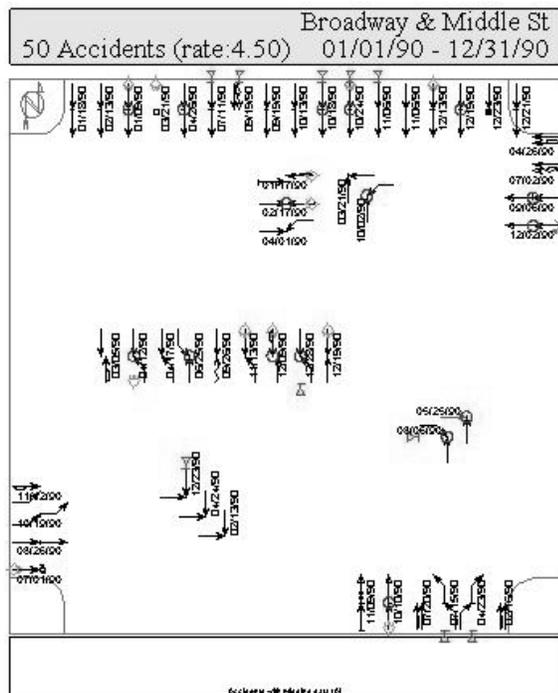


FIGURE 2 Total accidents.

two programs. It was a good test of the service the Iowa DOT could anticipate from the software distributor in the future. After some minor problems with formatting, both Pd' Programming and JMW Engineering sent us working copies of their respective software packages. Testing and evaluations were completed within several weeks and a working session with Iowa DOT safety analysis technicians was conducted. A meeting with the Iowa DOT safety engineering staff engineers took place soon after the working session.

To further verify the conclusion reached by CTRE, state department of transportation representatives from other states were interviewed to see if the Intersection Magic program they were using gave the same results that CTRE experienced in the test and evaluation process. All of the responses were positive and supported the

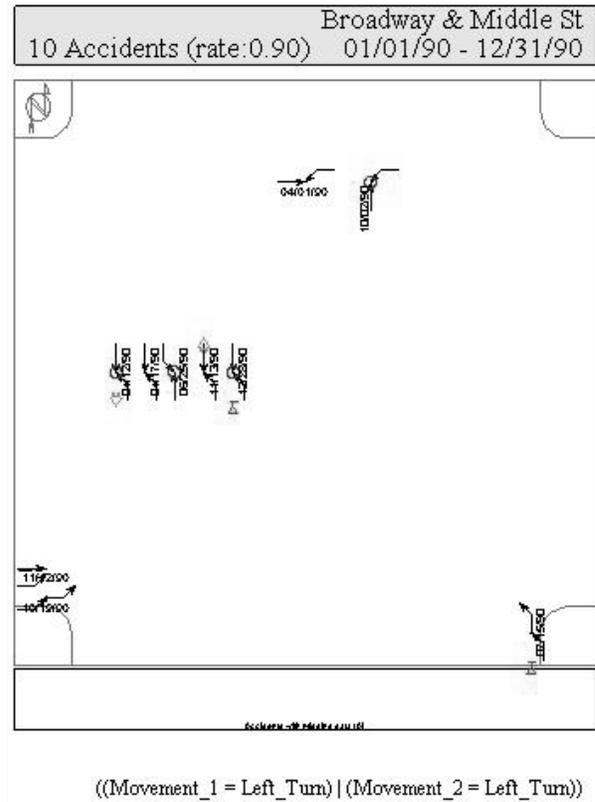


FIGURE 3 Left turn accidents.

conclusion that CTRE derived. The list of states and contacts are shown in Table 4.

RESULTS

There were many good collision diagram software programs that CTRE evaluated. Compared to the requirements established by the Iowa DOT, Intersection Magic, distributed by Pd' Programming, would be the program that the Iowa DOT would use for their collision diagram requirements. The Iowa DOT made this decision because Intersection Magic met all of the requirements that had been established along with the following:

- GIS compatible
- Editable database and intersection geometry
- Variety of symbols for accident types
- Color plots
- Query and filter capabilities
- Statistical reports are generated
- Graphics were superior
- Superior software support
- Superior data displays and graphics
- Ability to print a variety of reports
- Internal scripting language for repetitive tasks was very sophisticated.

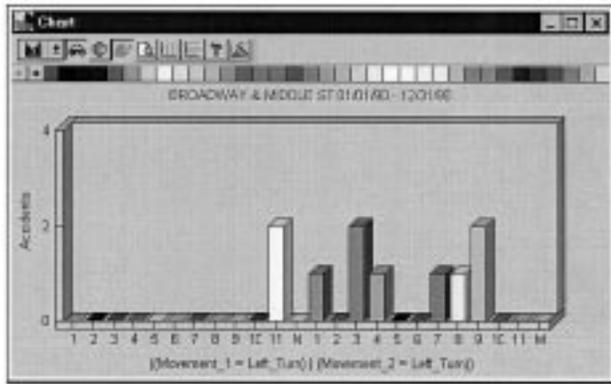


FIGURE 4 Time of day left turn accidents occurred.

An example of the capabilities of this software program, four figures are presented that illustrate how it may be used in an analysis. Figure 1 illustrates the intersection menu and allows the user to select the type of identifier, the date range desired, the primary and cross streets, and add any filters that may be desired.

Figure 2 is a graphical plot of all of the accidents that occurred at the intersection identified in figure one. The accidents are for the date range specified and are located on the leg of the intersection where they occurred. If there is a wrong data element that located a given accident in the wrong location, the user can click and drag the specific accident to the proper location. Each type of accident has a separate symbol.

A filter has been applied to the accident history show in Figure 2. All of the left turn accidents for the date range specified in figure one are shown. The location within the intersection is representative of the direction the vehicles were traveling at the time of the accident.

A question that is likely to be asked would be "What time of the day do these left turn accident occur?" Figure 4 shows a graphical representation of the time they occurred. The transportation official that is evaluating this intersection can now start to concentrate on the time period from 11:00 AM until 4:00 PM to see if there are reasons for the pattern shown.

Table 5 DOT Contacts Using Intersection Magic Collision Diagram Software

State	Name	Telephone Number
Kentucky	Boyd Sigler	(502) 564-3020
Idaho	Gary Sanderson	(208) 334-8487
South Dakota	Larry Dean	(605) 773-3869
Alaska	Ron Martindale	(907) 266-1593
Utah	Eric Chang	(801) 965-4284
Minnesota	Mike Schadegg	(612) 797-3126
Connecticut	John Vivari	(860) 594-2712

IOWA DOT RECENT ACTIVITIES

The Iowa DOT has been in the process of implementing the Intersection Magic software program into their analysis process. DOT staff has used the program to generate collision diagrams and comparing to hand drawn diagrams for the same locations. The staff has found that the accuracy is about 95% when comparing Intersection Magic to the hand drawn diagrams. The next step for the Iowa DOT is to provide this product to field offices for evaluation and for implementation. The final step will be for local governments to use the software for the evaluations required when an application for safety funds is generated.

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