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Crash analyses: Identifying problem locations and funding mitigation strategies

Analyzing the frequency and causes of crashes in locations prone to crashes can help agencies decide where and how to make changes that can improve traffic safety.

Such a crash analysis typically consists of six steps:

1. Identifying locations that are candidates for safety improvements.
2. Quantifying each site's main crash trend(s).
3. Determining the source of the problem(s).
4. Evaluating possible improvements to address the crash problem(s).
5. Obtaining expert opinion about safety improvement(s).
6. Obtaining funding to implement improvements.

1. Identify locations that are candidates for safety improvements

Obtain the most recent city or county safety improvement candidate list (SICL) from Jeff Stratton, Iowa DOT Office of Traffic and Safety, jeff.stratton@dot. iowa.gov. The latest version of the SICL covers 1999–2003 crash data for intersections throughout Iowa, divided by city and county jurisdictions.

The list provides basic data for each problem location: total number of crashes, number of crashes by various levels of crash severity, and number of injuries in each level of severity. The initial rating of safety improvement potential has been calculated based on 60 percent weight given to the severity of crashes, and 20 percent weight given to frequency of crashes and to rate of crashes. For the severity rating, much more weight was placed on fatalities and major injuries than on less severe injuries.

2. Quantify each site's main crash trend(s)

In addition to numbers of crashes, it is useful to determine and compare various locations' crash *rates*—the number of crashes relative to the traffic volume for a given period of time—and crash rate *trends* over a period of three to five years.

Agencies can calculate the annual crash rate (crash frequency in a year per million entering vehicles for intersections) of a particular location, using the following equation:

$$Ri = \frac{C * 1{,}000{,}000}{(\sum (\mathrm{DEV}) * Y * 365}$$

where

Ri = crash rate per million entering vehicles,
C = number of crashes,
Y = number of years analyzed, and

DEV (daily entering vehicles) = annual average daily traffic$_{approach}$/2.

The Iowa DOT provides annual average daily traffic (AADT) for some legs of intersections; see www.mmsp.dot.state.ia.us/trans_data/traffic/aadtpdf.html.

To obtain AADT for a specific location, you may have to perform a traffic volume count study (see the article in the Nov–Dec 2004 issue of *Technology News*).

3. Determine the source of the problem(s)

Once a location has been determined to be a candidate for further review, examine the details surrounding each crash to look for patterns. Details to look for include the following:

- alcohol-related crashes
- run-off-road crashes
- cross-median crashes
- pedestrian crashes
- kinds of traffic
- weather conditions
- presence (or absence) of specific roadway features

You may need to combine the results of crash analysis software (see the sidebar at right) with crash analysis field observation reports, looking for trends in probable causes of crashes.

For example, analyzing crash data at a high-volume intersection using SAVER (Safety, Analysis, Visualization, and Exploration Resource) may indicate that the major cause of crashes at a specific intersection is the failure of eastbound traffic to yield right of way during left turns to westbound through lanes. Field observations may be necessary, however, to discover the underlying problem. It could be observed that high volumes of westbound truck traffic turning south at the intersection obstruct vision for eastbound to northbound left-turning vehicles (see figure at right).

4. Evaluate possible improvements to address the crash problem(s)

Once problems have been identified, consider possible solutions. Solutions can range in cost and complexity, from adding red flags to stop signs to adding turn lanes and traffic signals.

Example problems and solutions are listed in the table below. (This is not an exhaustive list.)

5. Obtain expert opinion about safety improvement(s)

Local agencies may have limited funding to hire consultants. Through the Iowa DOT's Traffic Engineering Assistance Program (TEAP), local agencies can apply for funding for professional advice in selecting appropriate crash mitigation strategies. (For information about TEAP, see the related article in the Jan–Feb 2005 issue of *Technology News*).

6. Obtain funding to implement improvement(s)

In addition to local funding, the Iowa DOT offers three funding programs to assist with traffic safety improvements:

- Traffic Safety Improvement Program (TSIP) provides funding in three categories (traffic control devices, site improvements, and safety studies) to help improve safety on public roads. (See application information on page 9.)
- Urban-State Traffic Engineering Program.
- U-STEP funds construction to solve traffic and safety problems, primarily on Iowa's city streets. The program provides up to $200,000 for spot improvements and up to $400,000 for linear improvements (those which span two or more

intersections). The city must engineer and administer the project, and costs are split 45 percent city and 55 percent state.

- County-State Traffic Engineering Program. C-STEP is the U-STEP counterpart for roads outside incorporated cities. It requires the county to engineer the project, and like U-STEP, mandates a 45 percent–55 percent split in funding.

Visit www.dot.state.ia.us/fundguid.htm for more information on state safety improvement funding.

Contracting for a crash analysis study

Instead of conducting your own crash analysis, you may hire an independent engineering consulting firm. Be prepared to provide the firm with data concerning traffic volume, crash history, roadway geometry and classification, and other pertinent information.

For more information

Contact Duane Smith, Iowa LTAP director, 515-294-8817, desmith@iastate.edu, or consult the handbook online.

For specific information about SAVER, contact Michael Pawlovich, Iowa DOT Office of Traffic and Safety, 515-239-1428, michael.pawlovich@iowa. dot.gov.

For information regarding CMaT (see the sidebar below), contact Bob Schultz, training consultant, 515-984-6589, rlspc@schultzgroup.org.

Major Cause of Crashes	Possible Countermeasures
Red-light running	· Remove signal sight obstructions · Post "Signal Ahead" warning signs · Install/replace signal visors and back plates · Add signal back plates · Install advance flasher signs · Install (additional) 12-inch signal lenses · Upgrade signalization · Review warrants/consider removing signal · Synchronize adjacent signals
Running stop sign	· Remove sign sight obstructions · Install larger signs · Install "Stop"/"Yield Ahead" signs · Construct rumble strips in pavement · Review warrants/consider removing sign · Replace "Stop" with "Yield" sign, if feasible · Place flashing beacons overhead or on "Stop" sign · Place red flags on "Stop" sign · Place "Stop" signs on both sides of road
Failing to yield right of way to pedestrians	· Add stop bars/crosswalks · Post "Ped Xing"/"Advance Xing" signs · Place advance pavement messages · Add/improve lighting · Post "School Xing"/"Advance Xing" signs · Use crossing guards near schools · Reroute pedestrians to safer crossing · Signalize pedestrian crossing · Install barrier curbing · Add pedestrian refuge islands · Post "No Right Turn on Red" sign, if at intersection

Exceeding speed limit	· Post/reduce speed limit · Increase traffic/speed enforcement · Install traffic-calming measures · Install larger signs · Install flashing beacons on signs
Turning improperly	· Prohibit turns · Signalize intersection · Reduce speed limit · Install raised median · Install left turn bays · Widen approaches to handle turn lanes · Improve signing and pavement markings
Obscured vision	· Eliminate parking · Remove obstructions from sight triangles · Close/relocate driveways near intersections · Signalize intersection · Install intersection warning signs

Editor's note

This article is the fourth of five summaries of traffic studies described in the Handbook of Simplified Practice for Traffic Studies: (1) spot speeds, (2) traffic volumes, (3) sight distances, (4) crash analyses, and (5) school zone programs. The handbook was developed by CTRE and funded by the Iowa Highway Research Board (TR-455).

The handbook describes straightforward traffic study procedures to help local agencies "get their arms" around specific traffic-related questions or potential problems. Data collected from these studies can be critical to decision making and can help agencies communicate more effectively with community members and local officials.

All procedures outlined in the handbook and described in the accompanying article follow national standards.

Many useful crash-analysis tools and resources mentioned in this article are available through the Iowa DOT's Crash Analysis Resources website, www.dot.state.ia.us/crashanalysis/.

The most recent crash data summaries on the site, however, are several years old—from 1995–1999—primarily due to a major change in the crash reporting form in 2001. The site should be fully updated by the end of 2005.

Crash analysis software

During steps 2 and 3 of a crash analysis (described in the accompanying article)—quantifying concerns and identifying underlying problems—it may be helpful to exploit the power of computer-based crash analysis tools.

Software

Through its Crash Analysis Resources website, the Iowa DOT provides many such tools and related training, free of charge.

By far the most sophisticated crash location and analysis tool is the Iowa DOT's geographic information system_based (GIS) Safety, Analysis, Visualization, and Exploration Resource (SAVER). SAVER enables detailed queries and has sophisticated mapping capabilities.

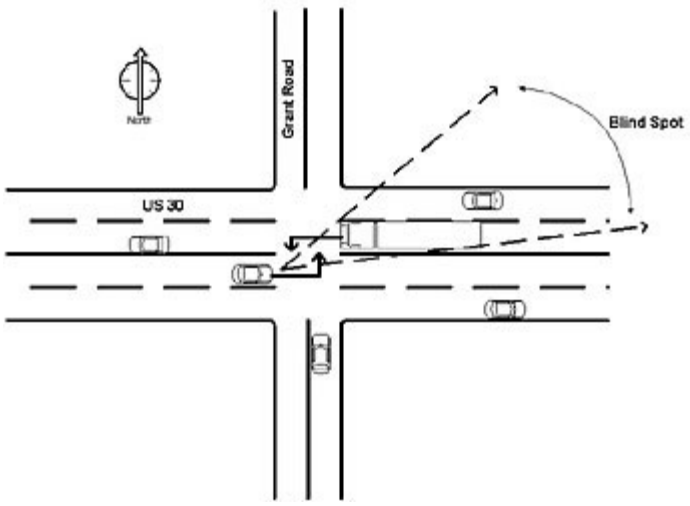
SAVER provides access not only to crash data (1995-2005) but related data vital to safety analyses. These data include roadway and traffic data (e.g., traffic volumes for roadway sections) and other background data (e.g., rail, river, corporate limits, etc.).

The Crash Mapping Tool (CMaT) is also available. This tool has less functionality and less data than SAVER but is also GIS-based and is suitable for most analyses of locations. Data for CMaT include crash data (2001-2004) and similar background data to SAVER.

Distribution and training for both programs are currently underway.

Free data analysis service

Another option for exploiting software for in-depth crash analyses is to consult CTRE's Iowa Traffic Safety Data Service (ITSDS). At no cost to local agencies, ITSDS staff use SAVER and other tools to conduct analyses on request, using up-to-date crash and related data. To request assistance, call the service, 515-294-8103, or use the online request form, www.ctre.iastate.edu/itsds/.



Obstructed vision at this intersection contributes to failure of eastbound traffic to yield right of way.