

Decision Management Tools

Best Practices for Advancing Safety through Partnerships with Universities

Commercial Vehicle - Safety Technical Assistance Center

What Are Decision Management Tools?

Decision management tools are data query tools used to provide analytic services and decision support. The tools often include query and mapping capabilities, and may produce dynamic reports and scorecards to track crash reduction performance goals.

One of the most important characteristics of these tools is that they make data visual.

Decision management tools help to improve planning, program development, and program effectiveness by helping law enforcement to plan and prioritize enforcement strategies and activities, and to track and measure the effectiveness of those strategies and associated programs.

Examples of these tools are described below (including tools demonstrated during the Summit, and some that were not).

Why Create Decision Management Tools?

One challenge that states face is the enormous amount of data that transportation safety stakeholders



have at their fingertips. As we often say, having this data is a good problem. However, the task of storing and managing the information collected is monumental.

Furthermore, states need easy access to the data, along with the ability to query it in ways that are useful for crash prevention planning. This is not an area of expertise for law enforcement, but they need the information in order to do their jobs well. They need to have an understanding of the problems specific to their states, their region, each corridor, etc., in order to conduct data-driven policing, and to create commercial vehicle safety plans (CVSPs).

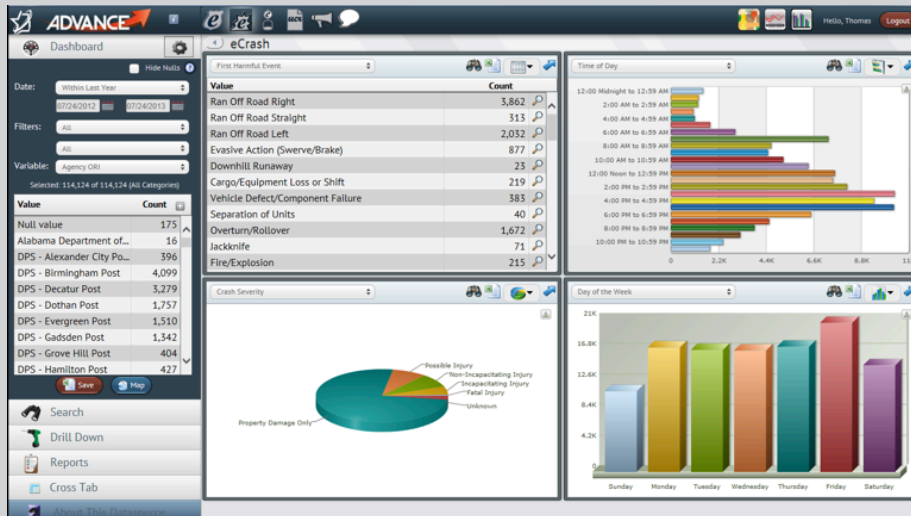
Decision management tools can assist with these challenges, as they are created to assist state Motor Carrier Safety Assistance Program (MCSAP)-lead agencies to:

- Identify problem areas; and
- Implement and monitor the effectiveness of safety activities.

Examples of Decision Management Tools in Action

If you are interested in creating decision management tools in your safety programming efforts, there are plenty of states that can provide real world examples of this work in action.

Alabama: Automated Discovery for Visual Analysis, Networking and Control (ADVANCE)



ADVANCE is a statistical dashboard and mapping tool developed by the Center for Advanced Public Safety (CAPS), at the University of Alabama, through sponsorship from the Alabama Criminal Justice Information Center and the Alabama Office of Highway Safety. ADVANCE is a framework that allows users to analyze and visualize data from several databases in a variety of ways, very quickly. Using an analytics tool called the Critical Analysis Reporting Environment (CARE), decision-makers can mine information without requiring the assistance of a sophisticated database or statistical experts.

Connecticut: The Connecticut Crash Data Repository (CTCDR)

The screenshot shows the UCONN Connecticut Crash Data Repository query interface. It features a search bar at the top and a 'Main Query Criteria' section with various filters:

- Dataset:** Radio buttons for CTDOT (1995-2014), MMUCC Format(2003-), and MMUCC(2015-).
- Date Range:** Fields for 'From' and 'To' dates, and a 'Last Number of Years' dropdown (All, 3 Years, 5 Years).
- Month Day & Time Settings:** Fields for 'Selected Months', 'Selected Days', 'Selected Days of the Week', and 'Selected Time'.
- Crash Severity:** Checkboxes for 'Injury of any type (Serious, Minor, Possible)', 'Fatal (Kill)', and 'Property Damage Only'.
- Case Status:** Checkboxes for 'Under Investigation' and 'Complete'.
- Trafficway Ownership:** Checkboxes for 'Public Road', 'Private Road', 'Not Applicable', and 'Unknown'.
- Trafficway Class:** Checkboxes for 'Trafficway, On Road', 'Trafficway, Not on Road', 'Non-trafficway', 'Parking Lot', and 'Unknown'.
- Police Agency Code:** A text input field.
- Private Property Crashes:** Checkboxes for 'Public Property' and 'Private Property'.
- Crash Location:** Dropdown menus for 'Town', 'County', 'COG', 'MPO', and 'District', along with a 'Route Class' dropdown.

CTCDR is an online, web-based, data collection, reporting, and analysis tool developed by the Connecticut Transportation Safety and Research Center at the University of Connecticut, in partnership with the Connecticut Department of Transportation (CTDOT). The tool was designed to make crash reporting easier for officers, and to provide access to crash information collected by state and local police to members of the traffic safety community. The crash data in this tool is updated every night and made available to the public as well as CTDOT staff and law enforcement agencies. This tool allows users to collect, query, store, analyze, and print/export the data for research and informational purposes.

Ready To Get Started With Your Own Decision Management Data Visualization Tool?

It is useful to think of analytics and visualization solutions as belonging to one of these categories:

- **Descriptive analytics** use statistics that directly reflect the data. These tools are the most common, and have the lowest technical barrier to usage, but do not directly prescribe a course of action or attempt to estimate what might happen in the future. The UMassSafe Crash Data Explorer is one example of a descriptive analytics tool, as it presents summary statistics across multiple dimensions of a data set. The COVERLAB site, which presents progress against traffic safety goals, is another example of a descriptive analysis tool.
- **Predictive analytics** use statistical techniques to use current data to make inferences about the future. These techniques can be fairly simple, using simple trend analysis techniques such as moving averages or linear regression. More sophisticated machine learning techniques can be applied to uncover patterns in text, spatial relationships, or temporal trends. Unlike descriptive analytics, predictive techniques are not error-free--- prediction quality is dependent on the quality of the input data and the applicability of the statistical techniques to the problem at hand. The Indiana crash risk map is an example of a predictive analytics tool. Using characteristics including

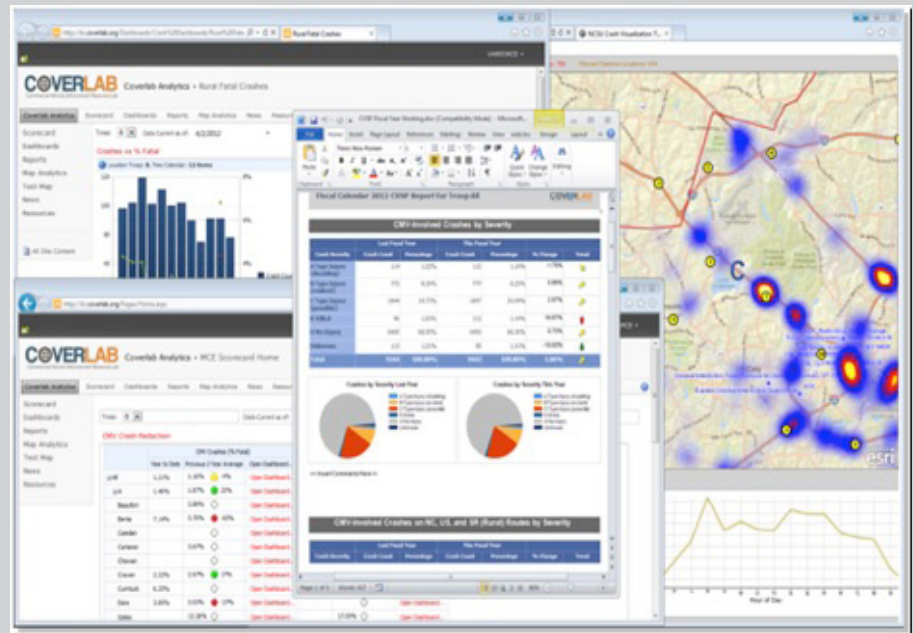
weather and time-of-day, this tool estimates the probability that a crash will occur within a geographic region.

- **Prescriptive analytics** solutions are very powerful, but require significant statistical expertise and high-quality data to be successful. These solutions leverage techniques from the theory of causal inference to both predict an outcome and indicate how to change an outcome. For instance, a prescriptive analytics tool could be used to determine what type of traffic control device might be most effective at reducing crash rates in a problematic intersection. To arrive at judgments such as these, it is necessary to control for numerous confounding factors, which are those that affect both the treatment (in this case the type of traffic control device) and the outcome (crash rate). Sometimes, these confounding factors are not measurable, so it is important to catalog available data before attempting the development of this kind of solution.

When beginning the development of an analytics solution, it is important to:

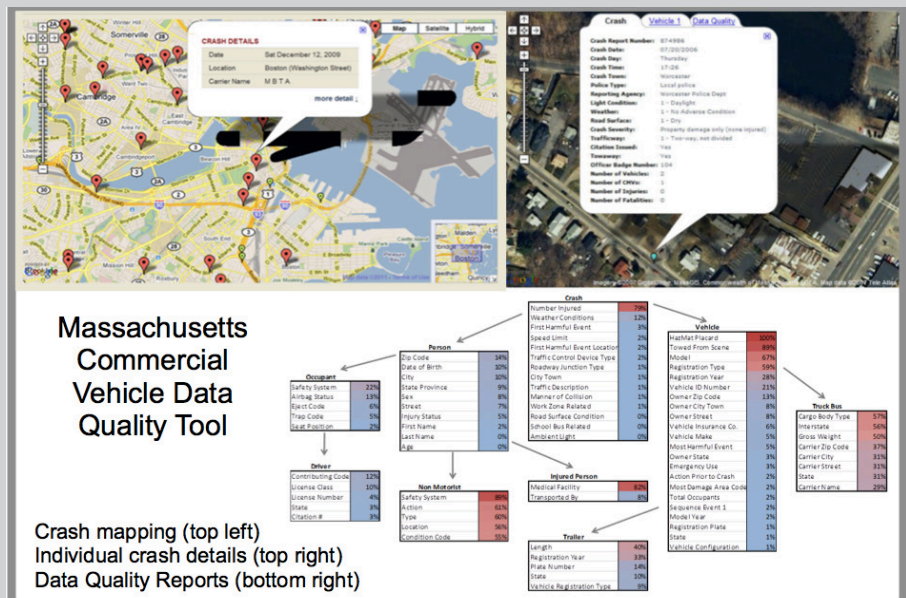
- Identify what question(s) you would like to answer with the tool;
- Determine whether those questions can be answered with descriptive, predictive, or prescriptive analytics; and
- Define a suitable technical approach based on the data at hand.

North Carolina: COVERLAB Analytics



COVERLAB is a tool developed by the Commercial Vehicle Enforcement Resource Lab (COVERLAB) in the Institute for Transportation Research and Education (ITRE) at North Carolina State University (NC State). The tool is used by the North Carolina State Highway Patrol, and tracks, measures, prioritizes, and targets enforcement activities for improving the effectiveness of tactical enforcement planning. COVERLAB Analytics delivers online scorecards to track performance measures to meet enforcement goals, dashboards for in-depth trend and comparison analyses, dynamic reports to streamline and simplify reporting requirements, and map analytics to prioritize times and locations for prioritized enforcement.

Massachusetts: UMassSafe Traffic Safety Data Warehouse



The UMassSafe Traffic Safety Data Warehouse is a central repository that maximizes the use of highway safety data by drawing from multiple sources. This repository, which contains 14 datasets, provides a historical view of events and a decision support system. Additionally, using advanced statistical methodologies, multiple datasets have been linked to create a single dataset that allows analysts to consider the comprehensive crash experience. The linked dataset includes driver behavior, crash characteristics, roadway environment, and citation data. In conjunction with the Massachusetts State Police (MSP) Commercial Vehicle Enforcement Section (CVES), UMassSafe developed the Crash Data Explorer, which is a web interface with query, mapping, and data quality components, made available for law enforcement.

Here's how to begin:

1. Gather Stakeholders

First things first. Who is needed to undertake this project?

- State MCSAP lead agencies who need easy access to data and user friendly tools
- University transportation and traffic safety programs who can create tools that can track, measure, prioritize and target enforcement activities
- Drivers licensing or other state agencies who maintain crash data (they must provide access to this data)
- Transportation departments who maintain geo-coded crash location (they must provide access to this data)

2. Find Champions

You will need support from someone who can help sell the need for the development of this best practice. It may be someone in law enforcement, public safety, the DMV or state transportation department. It might be someone who serves on your state's Traffic Records Coordinating Committee (TRCC). This person would have familiarity with all the stakeholders required for successful development of a decision management tool aimed at crash reduction.



Show your champion(s) what a decision management tool looks like! One of its greatest features is the visual component – rather than complicated graphs, words, and charts, this tool provides a clear picture of the data needed to plan performance, monitor progress, and track results.

Once your champion has the opportunity to see this tool, they might identify potential uses (in addition to highway patrol and enforcement efforts) where it could be used to effectively plan, track, measure, and report performance that would positively impact crash reduction efforts.

3. Start Small

Identify one aspect of crash reduction that would benefit from use of this tool; possibly something the state police or highway patrol can identify as problematic. Troop level enforcement strategies may

involve crash, citation, inspection, roadway, or size and weight data. Determine where a decision management tool could add value to your state's operations. All transportation and public safety agencies can benefit from performance reporting and accountability. This tool is also useful to identify trends over time, which can be helpful in decision-making and resource planning.

Pilot this project to get a proof of concept you can use to sell an expanded project down the road.

4. Identify the Data You Need

You may need data from many sources. Because crash data involves personally identifiable data, you may be required to develop formal Memorandums of Agreement with regard to access and use of the data you need to collect; particularly if it comes from the DMV.

“Developing decision management tools is a perfect project partnership for law enforcement, departments of motor vehicles (DMVs) and universities. DMVs have the data that law enforcement need, and universities have the tools and skills to create a platform for accessing this data in a simple and straightforward way. However, to ensure practical and effective outcomes, it is imperative that law enforcement be involved in the development of the platform.”

~ Robin Riessman
Deputy Director, UMassSafe



5. Contact Your State's University

While there are many potential partners on the campus of your state's university, some good areas to start may be:

- College of Engineering
- Transportation Center
- Department of Criminal Justice
- Department of Computer Science

Find out what useful data they already have. Ask whether they have software that can be adapted, or whether they can develop the software that will be needed for this project.

6. Find Funding for this Project

Some states have used their state MCSAP funding to develop decision management tools. Other potential funding sources include:

- Federal Motor Carrier Safety Administration (FMCSA) – High-Priority funding, Commercial Driver's License Program Improvement funding, or other FMCSA grant opportunities

- Department of Transportation – possibly highway funds
- Highway Safety Division – possibly through the Traffic Records Coordinating Committee (TRCC) they sponsor
- National Highway Traffic Safety Administration (NHTSA)

Conclusion

At the *UMassSafe Commercial Vehicle Safety Research Summit* in November of 2016, a number of these decision management tools were demonstrated. The goal of including these tools in the conversation was to provide information regarding best practices for accessing and utilizing these innovative tools.

The overall goal of any tool used by transportation safety stakeholders is to help in the effort to drive down the incidence of crashes. Decision management tools are one way to advance these goals by simplifying the way that data is made visual, and then used for program planning and targeted enforcement.

UMassSafe

The *UMass Traffic Safety Research Program (UMassSafe)* is a multidisciplinary project housed in the *University of Massachusetts Transportation Center*. At *UMassSafe*, we seek to reduce the frequency and severity of crashes by examining and analyzing data related to crashes, driver behavior, and related factors. We have the unique ability to examine highway safety problems from the perspectives of both research and programming simultaneously, allowing us to develop distinctive solutions to transportation safety problems.

UMassSafe developed a program with the purpose of promoting partnerships between state agencies and universities that work on commercial motor vehicle (CMV) safety. The team developed and hosted a *Commercial Vehicle Safety Research Summit* and the *Commercial Vehicle Safety Technical Assistance Center (CV-STAC)*.

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For more information on *UMassSafe* or the *CV-STAC* project:
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“To ensure our enforcement is data driven and effective, we need easy access to analytic tools that are user friendly, visually impactful and efficient.”

~ Lt. Thomas Fitzgerald, Commander
 MA State Police Commercial Vehicle Enforcement Section