Technology

Tennessee Highway Patrol

Agency Size: 840 Sworn Troopers

Location: Tennessee

Community Size: 42,181 Square Miles

Community Population: 6.54 Million

Fighting Fatalities with Foresight

The Tennessee Highway Patrol's Predictive Analytics program helps the agency turn information into action.

Protecting the motoring public from unsafe drivers and roads would be a lot easier with a crystal ball. In it, law enforcement could see exactly where, when, and why traffic violations were going to occur, then act appropriately to prevent them. Unfortunately, there is no such thing as a crystal ball. There is, however, something that is almost as effective: data analytics, which the Tennessee Highway Patrol (THP) leveraged in 2014 to establish its Predictive Analytics program. The program, which uses historical crash data to help officers predict and reduce traffic collisions, earned the THP the Technology Special Award in the 2016 National Law Enforcement Challenge (NLEC).

Problem Identification

In 2013, Tennessee drivers were involved in 173,510 car crashes, 26.8 percent of which were either fatal or injurious, despite the THP's unyielding efforts at enforcing traffic laws and educating citizens about why it is important to comply with them.

"Starting around 2004, we saw a decrease in traffic fatalities that lasted until 2010," explains THP Statistics Office Manager J. Patrick Dolan III. "Then, from 2010 to 2013, that trend leveled out."

Indeed, while education and enforcement have successfully reduced traffic injuries and fatalities in Tennessee, fatal and serious injury crashes continue to occur in large numbers across the Volunteer State. One reason for this, according to Dolan, is manpower. "The number of troopers we had assigned to road duty in 2013 was about the same as the number of troopers we had on the road in 1978," he says. "What that means is that while the number of vehicle miles in our state has increased quite rapidly over the past 30 years, we haven't seen an increase in our force to help deal with that."

Exploring innovative policing practices that can improve traffic safety without increasing resources is a major priority for the THP, which implemented one such innovation in 2014: the Predictive Analytics program.

"To combat our reduction in manpower versus vehicle miles, as well as our flattening fatality trend, we needed to come up with a more efficient way to deploy our resources," Dolan explains. "That's what led us to our Predictive Analytics program."

Planning

The THP laid the groundwork for its Predictive Analytics program nearly a decade ago, when it moved from paper-based crash and incident reporting to electronic data capture.

"In 2008, we implemented a new electronic crash reporting system that we made available for free to all other law enforcement agencies in the state," explains Dolan, who says geo-coded crash reports contain the crashes' latitude, longitude, severity, date, and time, among other things. "Having 100 percent of our crash reports coming in electronically means we have timely and pertinent data that we can use to make decisions, whereas before, we maybe had data that was old or not relevant to the situation on the ground. Also, it gives us more accurate location data so we can locate crashes on the ground, and more complete crash data so we can get a better understanding of what factors contributed to crashes."

The THP's electronic crash data, which is stored in its Tennessee Integrated Traffic Analysis Network (TITAN) database, forms the foundation of its Predictive Analytics program, through which the THP uses SPSS software to apply statistical models to historical crash data with the goal of predicting where and when certain kinds of crahses are going to occur.

Specifically, THP utilizes three statistical models, the first two of which were built in 2014 and the third established in 2015:

The Tennessee Highway Patrol was presented with several awards at the Highway Safety Awards Breakfast in San Diego, California: First Place, State Police/Highway Patrol 501-1,500 Sworn; the Technology Special Award; and the Traffic Incident Management Special Award.

- **Crash Reduction Analyzing Statistical History (CRASH):** The CRASH model calculates the risk of a fatal or incapacitating injury crash for every four-hour period of each day over a one-week period. The results are viewed on interactive maps that illustrate the risk of serious crashes across the state.
- **Driving Under the Influence (DUI):** The DUI model calculates the risk of DUI-related crashes and arrests for the 12-hour period extending from 4:00 p.m. to 4:00 a.m. each day, the time period during which most DUI-related activities occur, over a one-week period.
- **Commercial Motor Vehicle (CMV):** The CMV model calculates the risk of a crash involving a CMV over a three-month period.

"These models use machine learning and special algorithms that can learn from new data as we get it and revise their predictions accordingly," explains Dolan, who says the models also take into account exernal data, such as weather forecasts, special event schedules, and the locations of bars and liquor stores to further improve the accuracy of predictions in the form of color-coded crash risk maps to our officers so they can self-deploy to those areas that have the highest chance of a crash during their shift. "That allows us to more efficiently deploy our resources to the times and places were our visibility and enforcement can have the largest impact on driver behavior and, hopefully,

> **"On-the-ground engagement with supervisors and captains gave the THP the feedback they needed to make changes to the models to improve them for use in the field."**

mitigate the severity of a crash or prevent it entirely. Plus, when a crash does occur, it helps us to be closer to the event so we can respond more quickly."

The THP hired a consultant to help it build its first model, then appointed internal staff to build and manage all future models. It also provided training to ensure the tool was used to its full effect.

"For our pilot phase, we brought in a couple of supervisors, taught them how to use the predictive analytics maps, then sent them into the field to train their troopers and use these tools in their day-to-day enforcement," Dolan says. "Six months later, we made the tools available to all our troopers and did a training tour around the state where we engaged with supervisors and captains in each district and gave them hands-on training on how to use the models and interpret their outputs. That on-the-ground engagement was really important because it led us to make several changes in the models to improve them based on feedback from troopers in the field."

Outcomes

The number of fatal crashes in Tennessee decreased from 911 in 2013 to 886 in 2015, according to the THP, which says fatalities and the average crash response time likewise fell during the same period, from 995 to 960 and from 28 minutes to 22 minutes, respectively. Although improvements cannot be attributed directly to the Predictive Analytics program, Dolan is confident it played a role.

"Marrying targeted enforcement with the information coming from our Predictive Analytics program has allowed us to deploy our resources more effectively to execute our mission successfully," he concludes.◆

LESSONS LEARNED

- **INFRASTRUCTURE PRECEDES INTELLIGENCE:** Agencies must have technology infrastructure (e.g., an electronic crash reporting system) in place before they can leverage predictive analytics.
- **DEDICATED RESOURCES MAKE A DIFFERENCE:** A predictive analytics program requires dedicated staff resources that can build, manage, and maintain it.
- **UNITE BEHIND USERS:** The officers who will use the technology must be involved in building and improving the tools; without their engagement, feedback, and general buy-in, the tools will sit idle and unused.

The National Law Enforcement Challenge is a traffic safety recognition program supported by a cooperative agreement between the International Association of Chiefs of Police and the National Highway Traffic Safety Administration. It is held in partnership with the National Sheriffs' Association, the Governors Highway Safety Association, and the American Association of Motor Vehicle Administrators.