White Paper

PREDICTIVE ANALYTICS: SHEDDING NEW LIGHT ON HIDDEN HIGH-RISK FLEET DRIVERS

Fleet managers dedicated to minimizing accidents among their drivers have several options for assessing and managing risk. Until now, that has primarily involved tracking and responding to recent driver history. But an ongoing study of a new approach employing predictive analytics methodology is showing promise for more accurate and effective fleet driver risk assessment.

Added to existing best practices, predictive analytics has the potential to achieve even greater rates of fleet accident reduction than prevailing methods. Understanding that potential is perhaps best achieved by comparing historical driver risk assessment practices and success rates to the broader opportunities gained by being able to identify new high-risk drivers not yet recognized by existing methodologies.

Identifying and intervening with high-risk drivers

For the past 20 years fleet managers have employed various driver risk-assessment programs in an attempt to quantify risky driving behavior. Those programs reflect a series of studies dating back to the 1970s that found relationships between a driver's history of motor vehicle violations and accidents over a two-year period and the likelihood of being involved in an accident in the third year.

But simply identifying high-risk drivers was never the ultimate objective of those programs. The true goal has been to reduce potential future accidents by requiring drivers to complete remedial training programs intended to improve their driving habits.

Although specific judgments about how to classify and manage risk might vary by organization, those overall efforts have tended to address a series of sound management principles:

[1]See, for example, California Department of Motor Vehicles, 1981, The California Driver Fact Book, Sacramento, CA: Department of Motor Vehicles; and Stewart, J.R. and Campbell, B.J., The Statistical Association Between Past and Future Accidents and Violations, Chapel Hill, NC: Highway Safety Research Center, University of North Carolina.

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- Document driver behavior, by collecting driver Motor Vehicle Report (MVR) and accident history. This acts as both a basis for action and as protection against driver complaints of arbitrary intervention.
- Intervene with targeted training to encourage better driving behavior.
- Establish consequences for continued high-risk driving behavior.
- Maintain a record of fleet driver evaluations and interventions, as protection against potential enterprise liability for negligent entrustment.

Common methods typically involve monitoring driver performance over a rolling 36-month period. Company fleet management assigns a weighted point value to each accident or traffic violation, based on the timing and perceived severity of the incident. Fleet management also defines the number of risk categories and the range of point values used to define those risk categories, based on points accrued within a specified time frame. The rating systems used to define each category can vary from fleet to fleet. (See Table 1.)

Table 1. Example of a Time-Weighted Fleet Driver Risk Level Matrix

Time Period	Risk Level 0	Risk Level 1	Risk Level 2	Risk Level 3
12 months	0 points	1 to 4 points	5 to 7 points	8 or more points
24 months	0 points	1 to 7 points	8 to 11 points	12or more points
36 months	0 points	1 to 11 points	12 to 14 points	15 or more points

Time-weighted risk levels – based on recent driver behavior in terms of accidents and/or citations for unsafe driving behavior – are one way to identify fleet driver risk for the purpose of directing remedial education efforts aimed at-risk drivers.

Positive actions generate positive results

Reacting to documented risky driving behavior with targeted intervention enables fleet managers to command the attention of at-risk drivers. Interventions can be triggered by accumulated points that move a driver from one risk level to another, or can be based on specific measures of risk chosen by fleet management.

Through focused monitoring, training and consequences, fleet managers have been able to exert positive influence on the subsequent behavior of identified

at-risk drivers. For example, fleets using CEI, DriverCare™ accident-prevention programs have experienced, on average, a 15% reduction in accidents after three years and a 25% reduction after five years. Over the longer term, fleets have prevented thousands of accidents and cut their accident rates by as much as 35%.

The key to that level of success has been the result of providing feedback and additional attention to drivers with elevated risk for a future accident. It's reasonable to presume, therefore, that the same treatment for a larger population of "at-risk" drivers will help to achieve even further reductions. With the total cost of the average fleet accident exceeding $22,000 – including the cost of repairs, insurance, lost productivity, and legal and administrative expenses – the savings potential for the fleet industry can be counted in billions of dollars

The search for a stronger link

Determining a precise correlation between driver risk classification and future involvement in accidents has remained elusive, until now. Both recent accident history and severity of traffic violations have proved to be incomplete statistical indicators of future accidents:

- One study found no correlation between the severity of traffic violations (as measured by point values assigned against the driver's license) and the likelihood of being involved in a subsequent crash.
- Other research found that only 12% of drivers who have an accident in a given year had another accident in either of the prior two years.
- That same research also showed that 68% of drivers having an accident in a given year were completely accident-free in both of the prior two years.

Fortunately, a statistical discipline already proven across a wide range of cost-sensitive industries – including banking, insurance, communications, e-commerce, energy, and pharmaceuticals – is showing promise for identifying that elusive link. Applied to automotive fleets, the science of predictive analytics is showing an uncanny ability to identify previously "hidden" high-risk driver characteristics that fleet managers can take advantage of their accident-reduction training efforts.

[2]Gagliardi, G., 1979, Involvement of the Problem Driver in Fatal Motor Vehicle Accidents, Washington State Department of Motor Vehicles Report 002.
[3]The California Driver Fact Book, op. cit.
[4]The California Driver Fact Book, op. cit.

A documented approach toward identifying "hidden" high-risk drivers

Achieving a practical predictive analytics model for assessing fleet driver risk has been the focus of a five-year coordinated development effort between CEI and Dr. Feng Guo, a professor at the Virginia Tech Transportation Institute. A key difference between CEI's predictive models and the current method of assessing driver risk is the former's incorporation of driver demographic data that are precluded from fleet safety policies, like gender and age, as well as the industry in which the fleet operates and whether the driver is a manager or non-managing employee. The model overlays each driver's five-year driving record with national aggregate accident frequency statistics for each variable.

Six-month interim findings from a beta test of CEI's predictive analytics model derived from that effort reveal surprising differences in driver risk assessment rankings and a high correlation between predicted and actual accident rates. (See Table 2.)Table 2.

Table 2. Traditional Risk Assessment vs. Predictive Risk Assessment

Risk Level	# Fleet Drivers	% of Drivers	Predicted Accident Rate
0	2,124	51.7%	N/A
1	1,802	43.9%	N/A
2	134	3.3%	N/A
3	87	1.1%	N/A
Total	4,107	100.0%	N/A

Risk Group	# Fleet Drivers	% of Drivers	Predicted Accident Rate	Trending Accident Rate
Safest	1,416	34.5%	16.0%	18.9%
Avg/Mod	1,671	40.7%	26.0%	25.0%
High	858	20.9%	36.1%	35.4%
Highest	162	3.9%	45.1%	46.9%
Total	4,107	100.0%	25.4%	25.0%

Because it uses a broader range of data – including historical driving behavior, selected driver demographic characteristics, and available national aggregate traffic accident data – the predictive analytics model shows a significantly different fleet driver risk profile than traditional risk assessment programs do. Most important, the predictive analytics approach resulted in better than 90% correlation between the accident rate predicted at the beginning of the test and CEI beta test fleets' trending accident rates.

Fundamental differences in methodology

For fleet driver risk assessment, predictive analytics includes inputs typically used by the auto insurance industry to assess subscriber risk and to set premiums that vary by driver. The fleet-specific model makes use of the "Big Data" increasingly available to fleets as well as nationwide driver history databases. The combination offers users a more precise, accurate and reliable tool for identifying high-risk drivers than ever before. This enables the predictive analytics model to tailor the risk profile for each fleet according to the actual characteristics of its driver base. For example, CEI's predictive model can help define the difference in risk between a 28-year-old female pharmaceutical sales representative and a 50-year old male beverage delivery route driver.

Not only does the predictive analytics model take into account a broader base of driver characteristics and geographic data, but also tracks a five-year history of performance as compared to the three-year history of conventional driver risk-assessment programs. This enables fleet managers to take into account both an individual driver's past behavior as well as a broader historical context of the risks faced by similar driver profiles in similar driving scenarios.

Eye-opening differences in predictive outcomes

The statistics revealed in Table 2 above – based on nearly a year of beta-test results with a fleet of 4,107 drivers – show how using predictive analytics and broader ratings criteria reclassifies a significant number of drivers out of the "lowest risk" category. Equally significant is the high correlation of the trending accident rates versus the predicted accident rates for each risk category identified at the beginning of the test.

Perhaps most revealing are the significant increase in the number of drivers in two highest risk categories, and the disparity between the accident rates for those groups on the one hand, and the rates for the safer groups and the fleet as a whole. While the prevailing method identified a total of 181 drivers at elevated risk (47 in Risk Level 3 and 134 in Risk Level Two), the predictive model found 1,002 (162 rated "Highest" and 858 rated "High), a six-fold increase. Six months after the predictive model was run, the fleet's overall trending accident rate was close to the predicted rate of 26.0%, but the rate for the "Highest" risk group was nearly 47% and more than 35% for "High" group. Meanwhile, the trending rate for the" "Safest" drivers was less than the 19%.

About the research

Over the past few years, CEI has coordinated efforts with Dr. Feng Guo, an associate professor of the Department of Statistics at Virginia Tech University with a joint appointment at the Virginia Tech Transportation Institute (VTTI). With dual PhDs in transportation engineering and statistics, Dr. Guo has been actively engaged in both methodology and practice research on quantitative transportation modeling, especially in traffic safety evaluation. His major research areas include individual driver safety prediction, analyses of naturalistic driving studies, transportation infrastructure safety evaluation, advanced vehicle proactive safety device evaluation, and automatic driving research.

Table 2 presents data from CEI's beta test of its Predictive Model, Version 1.0 with a sales fleet of more than 4,100 drivers. The model was run in the first week of February 2016, and the table reflects both the model's predictions and the fleet's accident record for the following six months. For the full 12-month period, the model predicted the fleet would suffer 1,004 accidents for an accident rate of 25.4%. After six months, the fleet experienced 533 collisions, for an accident rate of 26.0%.

The fleet industry's traditional risk assessment approach classifies driver risk classification and risk categories based on past 36-month driving history only and does not calculate a predicted accident rate. The trending accident rate cited for the predictive analytics model reflects a projected 12-month total based upon actual accident incidents recorded in each risk category during the first six months of the beta test.

New opportunities opened by predictive analytics

Predicting driver accident potential provides a greater opportunity for fleet managers to take action with a broader cross-section of at-risk drivers. As with current remedial training approaches, it reinforces drivers' awareness that management is paying attention and does indeed value good driving practices. But unlike strictly remedial training, better risk assessment offers a proactive opportunity to train hidden-risk drivers on driving practices that can reduce their odds of becoming a traffic-accident or traffic-citation statistic in the near future.

Because the predictive analysis approach identifies the need for education across the entire spectrum of a fleet's driver population, it makes sense for fleet managers to use shorter, but more frequent, training sessions across the entire fleet. This will enable them to touch on driving situations and behaviors that pose the greatest danger to previously hidden at-risk drivers. In addition, because it appears as proactive training across the total fleet, it looks less like it is singling out individual drivers.

The additional management intervention among drivers who have not yet encountered a violation or accident doesn't conflict with the current practice of using remedial training for drivers with specific driving infractions. It still allows fleets to use the standard model of driver risk assessment and risk reduction, while creating the opportunity to achieve even greater accident reduction by identifying and training previously hidden high-risk drivers.

Learn more

For ongoing updates from the beta-test program as it generates one full year of documented actual performance vs. predictive modeling, please register your request with your CEI representative, or write to sales@ceinetwork.com.

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