



Predictive ANALYTICS

Leveraging data for fleet maintenance, operations, customer service, driver safety and retention

BY AARON HUFF

Exceptions are the norm in transportation and logistics. At any moment, a load can fall behind schedule, a driver could have an accident or a truck might break down, among other possibilities.

Fleets use a variety of technologies to see exceptions the moment they happen. Software, whether on their own servers or in the cloud, constantly monitors live data from vehicles, transportation management software systems and other sources to report on what went wrong.

While the reporting is helpful, the damage often is done by the time the information arrives, and those exceptions can be costly.

That's why more technology-savvy fleets now are looking for ways to act on predictive data rather than exceptions. Imagine a fleet manager knowing a truck is likely to break down due to a problem with its exhaust aftertreatment system. With this foresight, the manager can route the truck to a dealer and reassign its load to another truck.

The manager may get another report that identifies a driver or group of drivers who are likely to quit, allowing him to reach out to resolve the conflict. Another report could show which drivers are most likely to be in a collision and what intervention strategies will best mitigate the risk.

With so much data, computing power and software tools, these scenarios are possible by studying predictive analytics to anticipate future events and using workflow tools to change the outcomes before the exceptions take place.

Predictive maintenance

All truck OEMs now offer remote diagnostics services to help their customers reduce unplanned equipment downtime. OEMs and fleets are building on this foundation to predict maintenance needs of assets and take cost-saving preventive measures.

The data from a single fleet or the collective data an OEM has on a truck model might show a turbo is likely to fail at 270,000 miles under certain conditions, such as having routes with high elevations or certain driver behaviors and weather patterns.

"When you pull all of this together, you could start to predict component failures with enough certainty to change a \$25,000 part before it fails," says Dick Hyatt, chief executive officer of Decisiv. "It is a little bit of a dream right now, but I can see it will happen over the next several years."

Volvo, Paccar and Hino Trucks use Decisiv's cloud-based platform to manage service events for customers. The events are triggered by diagnostics trouble codes from vehicles.



Decisiv works with OEMs to categorize the severity of DTCs on a scale of high, medium and low.

For high-severity fault codes, Decisiv opens a “PM due” process. All participants in this workflow — the OEM call center, dealer network and fleet — are notified via email, text and the online dashboard.

Medium-severity faults go into a “pending work mode” and “travel with the truck,” Hyatt says. The next time the asset shows up at a shop location, technicians can look at the pending work file and recommended repair plan for the DTCs. Similarly, the low-severity faults stay with the asset profile.

Remote diagnostics is more complicated than reading fault codes, and OEMs have made big strides to analyze data to get to the root causes of problems.

Bsquare, a data analytics provider, works with OEMs and fleets to bring information together from different sources — the engine, subsystems and historical information — to “have a high level of confidence of what the issue might really be,” says Dave McCarthy, the company’s senior director of products.

Once the root cause is known, an automated workflow can identify the parts and technician skill levels needed to complete the repair at the closest service center. “All of this could happen while the truck is rolling down the road,” McCarthy says.

Bsquare is working with Paccar to develop business intelligence dashboards, analytics and workflow tools to power its remote diagnostics platforms and services.

Once a vehicle arrives at Kenworth and Peterbilt dealers, technicians are using Bsquare’s technology to guide them through a decision tree of fault codes to shorten diagnostics and repair times.

Bsquare also works with motor carriers that operate mixed fleets to bring their DTCs into a single dashboard and provide “a combined understanding of what is happening” with assets, McCarthy says.

Trailers also are entering into the predictive maintenance picture. Dean Croke, vice president of data products for

Spireon, a provider of trailer tracking and monitoring technology, says an analysis he is developing shows it is possible to predict — with a high degree of probability — which trailers will have roadside failures before they get dispatched.

However, predictive maintenance does not rely solely on remote diagnostics data. Technicians in the shop also can have the necessary tools to predict certain issues accurately.

Noregon, providers of the JPro in-shop diagnostic and repair system and TripVision real-time vehicle health and safety monitoring system, says that JPro displays the number of times a fault has become active and then inactive. This fault history, according to the company, is a strong indicator of future issues with an engine or any particular subsystem.

Extensive fault histories built into the tool allow fleets to examine prior issues on the vehicle to detect recurring problems, Noregon says. Coolant level problems could oscillate between active and inactive for days, which could indicate a likelihood of becoming permanently active and causing a vehicle to derate.

Escaping accidents

Motor carriers use a variety of Internet of Things devices and applications to monitor driving behaviors. Most of these technologies are designed to alert management if drivers exceed safe thresholds for speed, acceleration/deceleration, g-force and other vehicle operation and sensor data.

Many also can score driver behaviors and create risk

profiles. To get picture-perfect visibility of behaviors and metrics that can predict accidents more accurately, a growing number of fleets are using video-based driver risk management systems.

These systems use forward- and driver-facing event recorders to capture risk factors attributable to driver distractions,



Cummins’ Guidanz mobile app allows fleets and end-users to quickly read Cummins fault codes and other key information on 2007 and newer engines.



short following distances, traffic violations, lack of weather precautions and other bad habits that cannot be detected by sensors alone.

Some technology providers offer managed services and have analysts review video clips of critical events that have captured risky driving. Some also have devised powerful algorithms to correlate driving behaviors with future collision risks.

The algorithms are designed to translate a complex set of driving behaviors into easy-to-use scores and drill-down reports to help manage the fleet's overall risk.

The SmartDrive video-based safety system has a scoring algorithm that combines recent observations of risky behaviors with their predictive value. The algorithm normalizes individual driver scores for risk exposure based on hours or miles driving.

The SmartDrive Safety Score is designed to identify specific skills and behaviors that individual drivers need to improve to help reduce collision risk. Fleets use these scores alongside video clips to coach drivers and manage their behavior behind the wheel.

Postal Fleet Services, a mail hauler that contracts primarily with the U.S. Postal Service, was not using any technology to monitor driving behaviors before it deployed SmartDrive.

"We did it old-school," says Jeremy Collins, director of business and safety development. The St. Augustine, Fla.-based carrier was assessing risk by looking at motor vehicle records, employment history, logbook records and road tests, among other manual time-intensive practices.

As a result, management was "reactive" to information from Compliance Safety Accountability inspections, citizen complaints and accidents, Collins says.

Postal Fleet Services piloted the SmartDrive system and within a few weeks saw its SmartDrive Safety Score improve by 85 percent. The company since has deployed the technology across its 700-truck fleet.

Collins says the system provides Postal Fleet Services with visibility of risky driving behaviors, such as not using seatbelts and many kinds of distractions, including texting. He recalls a situation where the system discovered a driver had a bad habit of drifting to the left.

"It was a small behavior that he was not aware of," Collins says. "That is the level of detail we can get to."

Real-time risk predictions

As fleets adapt new safety technologies on the path toward autonomous vehicles, some risky driver behaviors will go away, but others may emerge.

On a monthly basis, Lytx – provider of the video-based DriveCam safety system – analyzes the correlations its proprietary algorithms find for behaviors and risk to see if "anything has significantly changed," says Michael Phillippi, vice president of software development and operations.

Lytx's algorithms use an analysis of the company's database of more than 70 billion driving miles to assign point values to risky behaviors. The Lytx score increases as drivers accumulate risks that the system has identified from previous driving events that trigger a video capture.

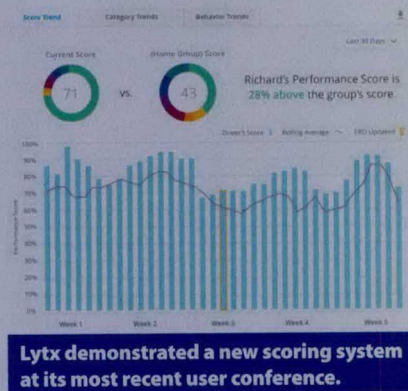
The score include both observed behaviors and combinations of those behaviors. An example of a behavior combination is a driver being distracted by a handheld cellphone while having less than two seconds of following distance. Using Lytx's algorithm, this combination would have more risk than the sum of the individual behaviors; in other words, $1+1=3$.

Lytx says its algorithms move past causal relationships of risk, such as drowsy driving, and identify correlative behaviors that multiply the risk. Not wearing a seatbelt is an example of a correlative behavior; the company's data show that an unbelted driver is 3.4 times more likely to have a collision than an average driver.

The overall goal for the Lytx score, Phillippi says, is to provide fleets and drivers with easy-to-use information that makes coaching events more effective.

Omnitracs offers seven predictive models tailored to different types of fleets and industry challenges. For larger carriers, the company builds custom models that use any data the customer is willing to share — safety, operations, finance, demographic data and more.

For smaller carriers, Omnitracs offers two predictive models that both use hours-of-service data for different purposes. One detects driver turnover risk, while the other





Omnitracs channels data from electronic logging devices to predict accidents and driver turnover.

provides accident risk. By using hours-of-service data, both predictive models have a standardized data set for analysis.

Ram Renganathan, senior data modeler for Omnitracs, says the company is

working on projects designed to enable real-time predictions and deliver them to managers and drivers. Renganathan says Omnitracs already has invested in the infrastructure to handle big data and real-time analytics.

As an example of what might be possible, imagine a tired driver getting a message that the system has detected he is fatigued and at a high accident risk and recommends he pull over to take a nap.

Omnitracs is looking for opportunities to create such real-time predictive models. As one step in this process, its Critical Event Video product could be updated with algorithms that identify traffic signs and objects. This would make it possible to capture drivers' reactions to speed limits and stoplights and to monitor their following distances, Renganathan says.

Turnover warning signs

According to the American Trucking Associations, driver turnover rates dropped to historically low levels during the first part of 2017. Truckload carriers with revenues of over \$30 million had a 74 percent annualized turnover rate, and smaller carriers had 66 percent.

While those trends may point to brighter days ahead for turnover, a more useful statistic would be to find out which drivers are more likely to leave, and why, to prevent it from happening. Driver surveys are perhaps the easiest way to identify the early signs of turnover, especially during critical periods of the employment lifecycle.

Research from Stay Metrics shows that 33 percent of new driver hires will leave their carriers within 90 days and that an additional 22 percent will quit within 180 days. The company administers driver surveys for motor carriers at the seven- and 45-day periods of employment to gather feedback on early job expectations, experiences and satisfaction levels.

The surveys are sent to drivers through text messages with a link to an online form. Stay Metrics immediately notifies the carrier via email if a driver's responses indicate

a high degree of turnover risk, such as unrealistic expectations for pay or home time.

The company also alerts fleets if drivers do not respond to the surveys in a timely manner. Stay Metrics research shows that drivers who do not respond to surveys are 48 percent more likely to leave, says Tim Hindes, CEO.

The company also administers an in-depth annual Driver Satisfaction survey for clients. The responses can be run through its predictive model to show what specific factors cause turnover at each company relative to industry peer groups for dry van, refrigerated, flatbed and other sectors.

Survey data is only one of many possible sources for predictive driver turnover models. Maven Machines recently put the finishing touches on its new fleet management platform, SmartSense. The platform includes a wireless headset that captures head movements of drivers, along with data from electronic logging devices and various telematics applications.

SmartSense sends all of its captured mobile data to a cloud platform that integrates data from other sources such as weather, traffic and fleets' back-office IT systems. The cloud platform processes "hundreds of millions

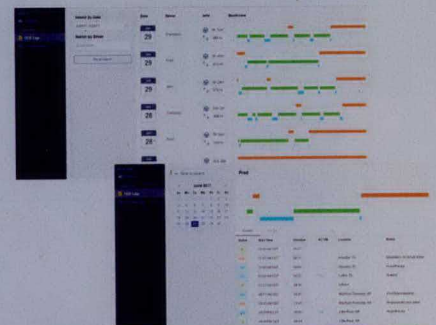
of events every hour," says Avishai Geller, CEO.

All of this data processing creates a real-time predictive score for driver safety and performance that accounts for real-time conditions. If the driver was in bad weather, fewer head movements are better, Geller says.

Maven Machines also is working on new predictive models for driver turnover. Drivers can use SmartSense's mobile app to input home-time requests to dispatchers. The company is building algorithms to help dispatchers optimally schedule loads to meet home-time commitments.

Maven is leveraging its data points to predict which drivers are at a high risk of leaving. SmartSense can capture detention time, requested home time, driver pay information and equipment quality.

"All of these are factors that go into driver satisfaction," Geller says. "We are creating a platform that helps companies operate better, end-to-end, and driver retention is a huge pain point."



Maven Machines offers the SmartSense fleet management system with real-time predictive modeling tools.