Going Green: How to Bring TCO Under Control for Alternative Vehicles

How maintenance and operations teams can get ahead of the energy transition.

GEOTAB®

UPTAKE®

Table of Contents

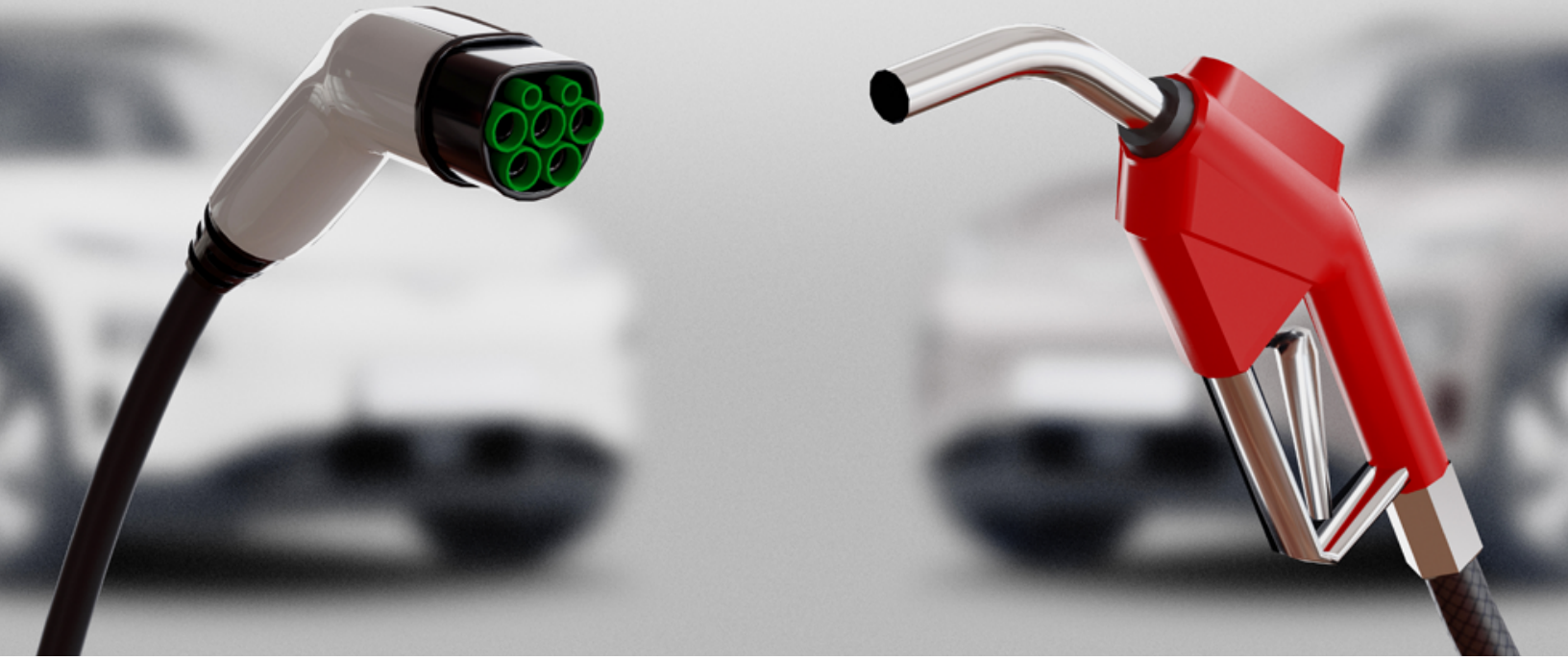
New powertrains are coming down the tracks

As on-highway fleets transition from traditional diesel and compressed natural gas, to ultimately electric or hydrogen-powered vehicles, maintenance procedures and technicians will need to stay apace. Early excitement around the development of alternative vehicles has often centered around asset procurement, vehicle performance, grid infrastructure, and the driver experience.

But how can maintenance and operations teams prepare for the future of alternative vehicles?

With the nascent development of alternative fuel vehicles, many organizations simply lack the range of in-house expertise necessary to maintain the assets of the future at scale. The vehicles themselves, for their part, have various maintenance concerns, procedures, nomenclature, and specifications that are particular to their make and model. With carriers still running traditional internal combustion engines (ICE) as the majority of their fleet, mixed-asset fleet management that includes alternative fuel vehicles may seem like a question for another day.

The good news is that new vehicle types bring a welcome familiarity to the transportation and logistics industry — data, and lots of it. With alternative fuel vehicles, fleets will already have the data necessary to cost-effectively maintain and ensure the availability of their assets. The history of advanced analytics across heavy industries, including in on-highway fleets, will help guide carriers in the energy transition. Through the combination of telematics and predictive analytics, fleets can equip themselves with the digital tools to manage mixed fleets in a greener future.



Alternative vehicle momentum

Each passing year sees the announcement of more alternative vehicle models. While the pandemic slowed the testing and production of new vehicles, including alternative prototypes, OEMs are betting on a future powered by cleaner energy. They are joined by leading carriers, investors, regulators, legislators, industry groups, and consumers in the push towards electric and fuel cell vehicles. By 2024, at least 334 models of electric commercial trucks will debut on the market according to **ACT Research**, a market data and research firm for the commercial vehicle and transportation industry.

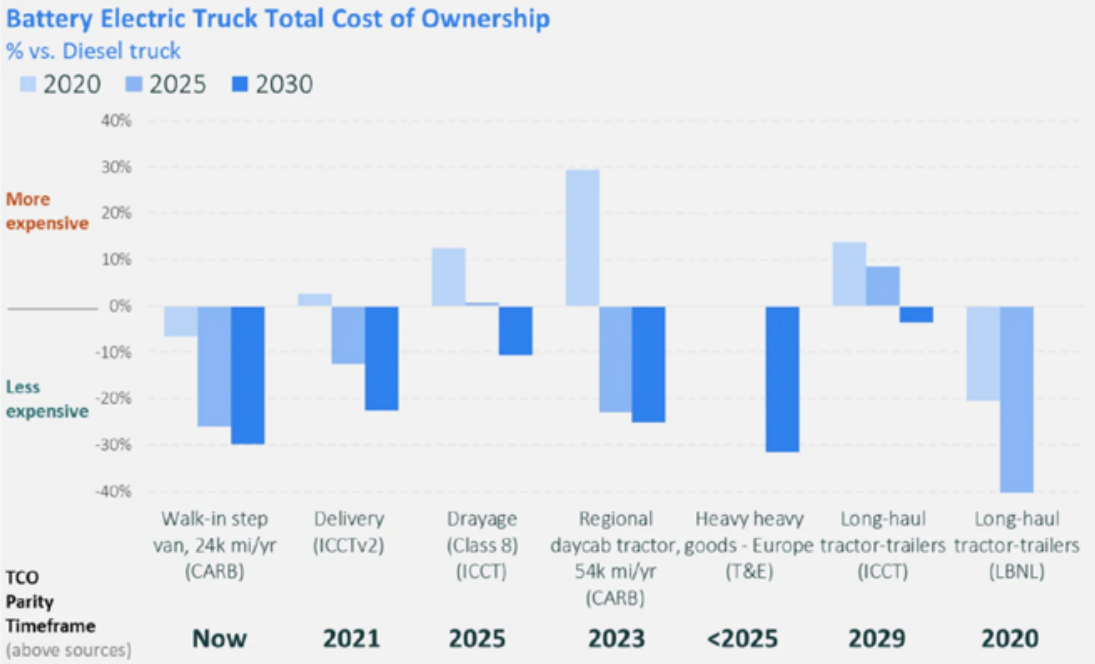
Regulatory incentives for alternative fuel vehicles have rallied manufacturers around alternative trucks. The California Air Resource Board has led the way with its **Advanced Clean Trucks (ACT) rule**, which mandates a graduated schedule for manufacturers to sell a certain percentage of zero-emission trucks in the state of California beginning in 2024. The state has also begun issuing vouchers to companies that exchange their traditional vehicles for battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV). More than 15 states have followed suit or committed to similar legislation, encouraging manufacturers and fleet operators to adopt cleaner vehicles.

Investors and consumers have also thrown their weight behind alternative vehicles, citing environmental and public health benefits. Diesel trucks, while a small percentage of all motor vehicles in the United States, account for almost one-third of motor vehicle emissions. With the adoption of alternative vehicles, California's ACT Rule alone is expected to reduce emissions by more than 17 million metric tons of CO^2 and 60,000 tons of dangerous nitrogen oxides, prevent 900 premature deaths due to pollution, and improve health with an estimated value of $9 billion through 2040. In addition to this social impact, the transportation industry is expected to save $7 billion in fuel and operational costs in California.

Alternative vehicles are set to unlock significant benefits for carriers and their communities. Already, national fleets are adopting alternative fuel vehicles at scale. Just in this past year, Amazon and Walmart have both committed to gradually replace their traditionally-powered fleets with net-zero carbon emission vehicles for their road delivery fleets by 2040.

For carriers, electric vehicles go green

Legislative and regulatory action is helping to subsidize the higher upfront costs of electric vehicles for carriers. However, with advances in battery technology, the initial cost of electric vehicles will reach parity with traditional diesel in the near future. **Bloomberg New Energy Finance** expects that operating cost parity will be reached by heavy-duty vehicles in 2025 and that the net cost of electric vehicles will be reached by 2030.



The timeline for medium and heavy-duty electric vehicles reaching cost parity with traditional diesel engines.
Source: **Hewlett Foundation**

For light-duty vehicles, as well as short-distance regional and drayage routes, electric vehicles can already be more cost-effective than their conventional counterparts. **The U.S. Department of Energy's Office of Scientific and Technical Information** (OSTI) found that average scheduled maintenance for a light-duty battery-electric vehicle is 6.1 cents per mile, whereas a traditional internal combustion engine vehicle is 10.1 cents per mile.

New studies on the cost-effectiveness of longer-distance heavy-duty electric vehicles are equally promising. Researchers from the **Department of Energy (DOE)'s Lawrence Berkeley National Laboratory** and the University of California, Los Angeles, found that an electric long-haul truck with a 375-mile range running daily routes would realize $200,000 in net savings over its lifetime, or about a 13% reduction in the total cost of ownership (TCO).

The study found that the development of new battery technology is likely to reduce TCO by as much as 50% per mile for long-haul routes over traditional diesel vehicles by 2030. The development of more efficient and larger capacity lithium-ion batteries, the falling price of raw cathode materials, and the scaling of the production of batteries are also likely to bring down the price of batteries, and the overall cost of electric vehicles as well.

Lighter maintenance lift in the long run

Electric vehicles promise to save carriers on maintenance costs. As compared with Class 8 diesel trucks in particular, in which fuel costs equal **half the total cost of ownership**, powering vehicles with electricity will free significant value for fleets. It should also be noted that electricity prices are much more stable than fossil fuels, meaning operation costs should be more predictable.

Beyond savings on fuel, maintenance requirements for electric vehicles are also traditionally less burdensome than conventional vehicles. For one, there is less to look after. Electric trucks have about **40% fewer parts for technicians to inspect and maintain**. In addition, many of the components of an electric vehicle, including the battery, motor, and supporting electronics, do not warrant regular maintenance. Regenerative braking lessens brake wear and there are fewer fluids, like engine oil or coolants, to tend.

Without those familiar components, the maintenance of electric vehicles presents new challenges. So does data acquisition needed for diagnostics. For one, EVs report data differently than ICE vehicles. There is not a common industry standard or regulation about data availability or access from EVs. There is no requirement around having an OBDII diagnostic port. That difference between EVs gives rise to varied practices of data acquisition and management for diagnostics, depending on the OEM, before the mechanic even may see the vehicle in the shop.

And then there is the challenge of technician training. Most technicians have not laid their hands on one before. And since electric vehicles are a newer technology, especially for medium- and heavy-duty fleets, many educational and support services have not been developed. The adoption of electric vehicles by carriers may seem like uncharted territory for maintenance and operations teams, however, they have been here before.

Onboard computers, virtual diagnostics, aftertreatment systems — changing vehicle components have been a way of life for technicians, as has been the need for continual learning and development. As with the **2007 diesel particulate filter (DPF) mandate** of the U.S. Environmental Protection Agency, diesel technicians have had to be quick studies in the emergence of new technologies. The data-backed maintenance and operation of compressed natural gas (CNG) vehicles are an exemplary middle step in the transition to alternative fuel vehicles.

Maintenance for CNGs offers a path forward

In the face of growing competition and environmental pressure from policymakers and investors on carriers, many carriers added compressed natural gas (CNG) vehicles to their fleets. Like any alternative fuel vehicles, they also represented an uncertainty to traditional diesel technicians. The maintenance team of **one leading food and beverage company**, for example, continued to see an increase in the number of cylinder head failures. These failures, which were not picked up by fault codes, were costing up to $50,000 to repair and often required a full engine replacement.

Through the ingestion of telematics, fault codes, sensor, and work order data, the fleet used predictive analytics to reveal a previously undetected mileage band that signified the highest area of risk. Where technicians did not have the opportunity to develop on-the-job experience, analytics offered guidance. The maintenance team could then better identify cylinder head failures before they arose, with enough lead time to treat the underlying failure and prevent unplanned downtime. Now, the maintenance team catches and prevents 90% of cylinder head failures, making a $3,000 repair on a vehicle instead of a more expensive replacement.

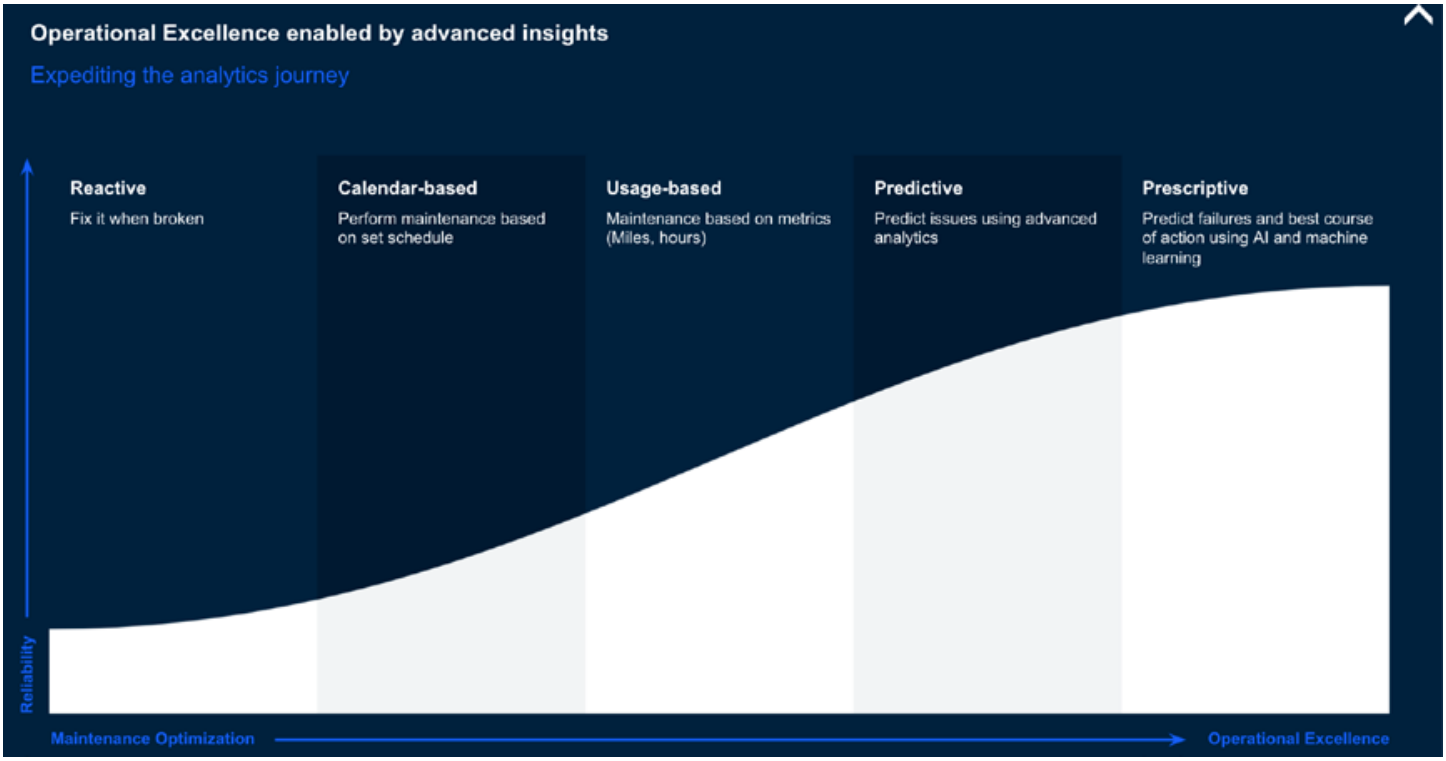
Predictive analytics guided technicians unaccustomed yet to CNGs to better maintain and ensure their availability. And so with fleet electrification, with fleet operators and their technicians left making assumptions about vehicle performance and health. Accurate benchmarks and predictive maintenance procedures enable maintenance and operations teams to proactively standardize best practices about emerging — and established — technologies.

GEOTAB | UPTAKE

The future of alternative vehicle maintenance starts today

Though the transition to alternative fuel vehicles may seem years or even decades away, fleets can take decisive steps today and prepare for the influx of new vehicle types. With the aid of advanced analytics, fleet operators can accurately address the concerns around the cost and operational range of their alternative vehicles while leveraging existing investments in technology and vehicles.

For one, fuel consumption readings can refine the fuel savings calculations and increase the accuracy of the financial model for alternative fuel vehicles. As the market for alternative trucks matures, carrier intelligence about the varying performance of different alternative models can inform their procurement decisions. Even when making procurement decisions, the aggregation of daily driving distance readings and maintenance expense, compared against the real-world range of electric vehicles available in the market, give fleets direction on profitability and sustainability.



Best practices for mixed-asset fleet management

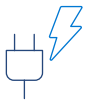
In preparing for alternative vehicles, companies can leverage best practices from mixed-asset fleet management to bring the total cost of ownership under control.

1. Defined Routes for Alternative Vehicles

The transition to alternative vehicles will be gradual. Carriers will transition to alternative vehicles in phases, depending on the type of routes that fleets are running, the maturity of the technology, and the specific total cost of ownership (TCO) associated with using those vehicles along certain routes.

Fleet managers have many options at their disposal to run more cost-effective and reliable routes. For example, battery electric vehicles (BEVs) may perform best with fixed, shorter routes, where its limited range is not much of a factor. This use case is in action already for many of the step-vans that large consumer-facing carriers have, where the TCO is lower than diesel. For long-haul routes, internal combustion engine vehicles are likely to remain the most competitive option through 2035.

As the technology of FCEVs and BEVs matures, the vehicle that gives a fleet the lowest TCO will evolve. These specific use cases for conventional and alternative vehicles are based on range, refueling costs, payload capacity, and reliability. A recent study from the **National Renewable Energy Laboratory** found that electricity price and hydrogen fuel price are the most important factors in the total cost of ownership for alternative vehicles. Companies looking to adopt more alternative fuel vehicles as part of their fleet will need to keep an eye on the evolving TCO for different alternative vehicles.



2. Smart Charging in Collaboration with Utilities

Another consideration in mixed-asset fleet management is charging. Just as with an issue on a vehicle that may not make sense to fix as soon as possible, charging does not have to occur as soon as an electric vehicle rolls into the lot or as quickly as possible. Smart charging is a term for optimizing the charging process. It involves scheduling your EVs to charge during specific times. Many electric utility companies offer better rates during times when there is less demand on the grid – called off-peak, which usually occurs overnight. By setting your EVs to charge during these hours, a fleet can further reduce their “fuel” costs.

Smart charging can also reduce the amount of charging stations required. With the newer charging capabilities, EVs can fully charge in a few hours with a level 2 charger. This means that multiple vehicles could be charged using the same equipment when scheduled properly, based on dwell times and duty cycles.

While there are tools today that offer some degree of visibility into managed charging, this software will become increasingly important to give real-time information on real-time charging and schedule tracking, fuel cost per time period, and maintenance schedules.

3. Charging Infrastructure & Service Partnerships

Working with an independent service provider for charging enables a fleet to have the support of experts from day one. Over time, it may be more cost-effective for larger fleets to bring charging infrastructure in-house.

Another helpful tip for fleets just adopting alternative vehicles, is to form partnerships with technician training organizations that have experience with the specific models of alternative vehicles in the fleet, or to a solution provider that supports them.

4. Standardized Vehicle Tracking and Data Management

The influx of new alternative vehicles will also bring along with it more and different types of data. For fleet management to gain a clear view of their assets, they will need a standard and automated way to track operations in real-time. While many fleet managers have some degree of visibility today, the data is often marked by inconsistencies between vehicle makes, models, nomenclature, and specs.

The majority of supply chain executives surveyed in a 2020 study reported that **poor data quality was inhibiting the development of advanced analytics** and that lacking master governance, or a centralized program for improving data standards and quality, was the primary reason why.

Through proper data management, fleets unlock the ability to gain a clear overview of their operational time, maintenance needs, cost to operate, charging or refueling times, and additional metrics to determine the profitability of transitioning. Data quality and consistency can enable fleets to make **data-backed decisions** about their alternative and conventional vehicles.

5. Advanced Analytics

Many repair shops today have a partial or imprecise view of how their maintenance activity impacts their bottom line. With unfamiliar vehicle types like FCEVs and BEVs coming into the fold, maintenance down the road presents new challenges to a fleet-wide understanding of asset reliability. The breakdown in a single part of the maintenance supply chain can create a backlog of cases. And the assets themselves need to be looked after differently.

To run routes with confidence, fleet managers need a comprehensive view of vehicle risk and reliability. A combined predictive and prescriptive view of maintenance — which begins with data integrity and work-order optimization — can slow the cycle of unplanned, reactive maintenance and empower maintenance teams to schedule and prioritize high-impact service for individual asset types.

As fleets evaluate which vehicle types fit which use case scenarios, a comparative view of the total cost of ownership will equip fleet managers with data to match asset utilization with business goals. Advanced analytics will save operations time and money, allowing them to reinvest in business development programs like driver and technician training.

Preparing your fleet for the alternative fuel future

All signs point green, and sooner rather than later. By eliminating low-value repairs, mitigating the risk of roadside breakdown, enhancing vehicle reliability, and planning spare parts inventory, shop managers are able to organize a more cost-effective approach to vehicle health.

Across the entire fleet, optimized maintenance results in maximized driver earnings, more efficient technicians, and a greater ability to meet delivery obligations. Before alternative vehicle adoption picks up in earnest for fleets of all sizes, optimized shop operations can ready maintenance teams for the transition.

Original equipment manufacturers, leading carriers, regulators, legislators, investors, and consumers have each paved the way for the more widespread adoption of alternative fuel vehicles. It will be up to operations and maintenance to keep the green vision, once realized, a reality.

Talk to one of our Predictive Maintenance Experts today. E-mail **learnmore@uptake.com** or call 312-242-2200.

About Uptake

Uptake is the industrial intelligence system, providing actionable insight for operators across a variety of industries. Uptake gives all departments — maintenance, reliability, operations, and financial teams — a single, shared, and contextualized view of every operational asset and interaction that affects performance. Driven by powerful data science models and cloud computing, Uptake's products deliver actionable insights that predict and prevent asset failure, increase compliance with ESG initiatives, mitigate catastrophic risk, optimize maintenance strategy, reduce repair costs, enhance productivity, and ensure operator safety. With 40+ patents and recognized for leadership in industrial intelligence by Gartner, the World Economic Forum, CNBC, and Forbes, Uptake is headquartered in Chicago with a presence in Canada, South America, Europe, India, and Australia.

To stay up-to-date on what we're doing, visit us at **www.uptake.com** and follow us on **Twitter** and **LinkedIn**.

About Geotab

Geotab is advancing security, connecting commercial vehicles to the internet and providing web-based analytics to help customers better manage their fleets. Geotab's open platform and Marketplace, offering hundreds of third-party solution options, allows both small and large businesses to automate operations by integrating vehicle data with their other data assets. As an IoT hub, the in-vehicle device provides additional functionality through IOX Add-Ons. Processing billions of data points a day, Geotab leverages data analytics and machine learning to help customers improve productivity, optimise fleets through the reduction of fuel consumption, enhance driver safety, and achieve strong compliance to regulatory changes. Geotab's products are represented and sold worldwide through Authorized Geotab Resellers.

To learn more, please visit **www.geotab.com** and follow us on Twitter **@GEOTAB** and on **LinkedIn**.

This white paper is intended to provide information and encourage discussion on topics of interest to the telematics community. Geotab is not providing technical, professional or legal advice through this white paper. While every effort has been made to ensure that the information in this white paper is timely and accurate, errors and omissions may occur, and the information presented here may become out-of-date with the passage of time.

GEOTAB®

geotab.com