



Driving Innovation: **The Rise of Driverless Trucks in Logistics**





While the promise of driverless technology is undeniable, it will still take years before these cutting-edge vehicles gain universal acceptance and make their mark on public highways.

Following the successful real-world testing of futuristic-designed, cab-less trucks in Tennessee, three startups are also testing autonomous driving in Texas, entirely removing copilots or “safety drivers” onboard the high-tech semis. Advocates believe the technology could solve key trucking industry issues such as labor shortage and limited hours of service, but it also gets increasing scrutiny from lawmakers and transportation safety proponents who think massive trucks would risk public safety when allowed to operate on roads on its own.

This whitepaper aims to provide insights into the milestones and future of driverless truck technology, including the hurdles it needs to address. Moreover, this will also discuss the importance of having robust transportation software as a complement to these modern trucks – elevating logistics operations of organizations with complex distribution and shipping requirements.



The Levels of Vehicle Autonomy Explained

Before we dive deep into the insights, let's establish a clear understanding of autonomous driving. There are levels of driving automation according to the National Highway Traffic Safety Administration ([NHTSA](#)): Level 0-3 involves human intervention, while Level 4 stands out as the most advanced in current driverless technology we have today – allowing the system to operate the vehicle autonomously in limited-service areas. Level 5 is the ultimate stage, where the system takes the wheel, rendering a human driver unnecessary.

In the [SAE J3016](#) standard, the Society of Automotive Engineers explained the main difference between Level 4 and Level 5 is that the latter can drive autonomously everywhere in all conditions.

We'll use Level 4 autonomous driving as a reference for this whitepaper, since the technology being developed and tested by most companies today falls into this category; meaning, the vehicle drives by itself under certain conditions, and often in a controlled environment. Also, we'll focus mostly on heavy duty [Class 8 trucks](#), or the big rigs with gross vehicle weight rating (GVWR) of more than 33,001, including longer 18-wheelers weighing over 80,000 pounds.



Level 0

No automation:

The driver is in complete control of the vehicle at all times.



Level 1

Driver assistance:

The vehicle can assist the driver or take control of either the vehicle's speed, through cruise control, or its lane position, through lane guidance.



Level 2

Occasional self-driving:

The vehicle can take control of both the vehicle's speed and lane position in some situations, for example on limited-access freeways.



Level 3

Limited self-driving:

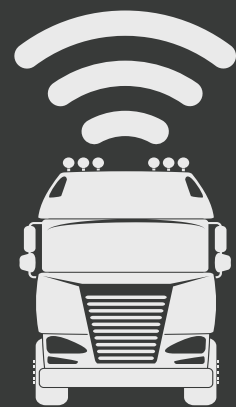
The vehicle is in full control in some situations, monitors the road and traffic and will inform the driver when they must take control.



Level 4

Full self-driving under certain conditions:

The vehicle is in full control for the entire trip in these conditions, such as urban ride-sharing.



Level 5

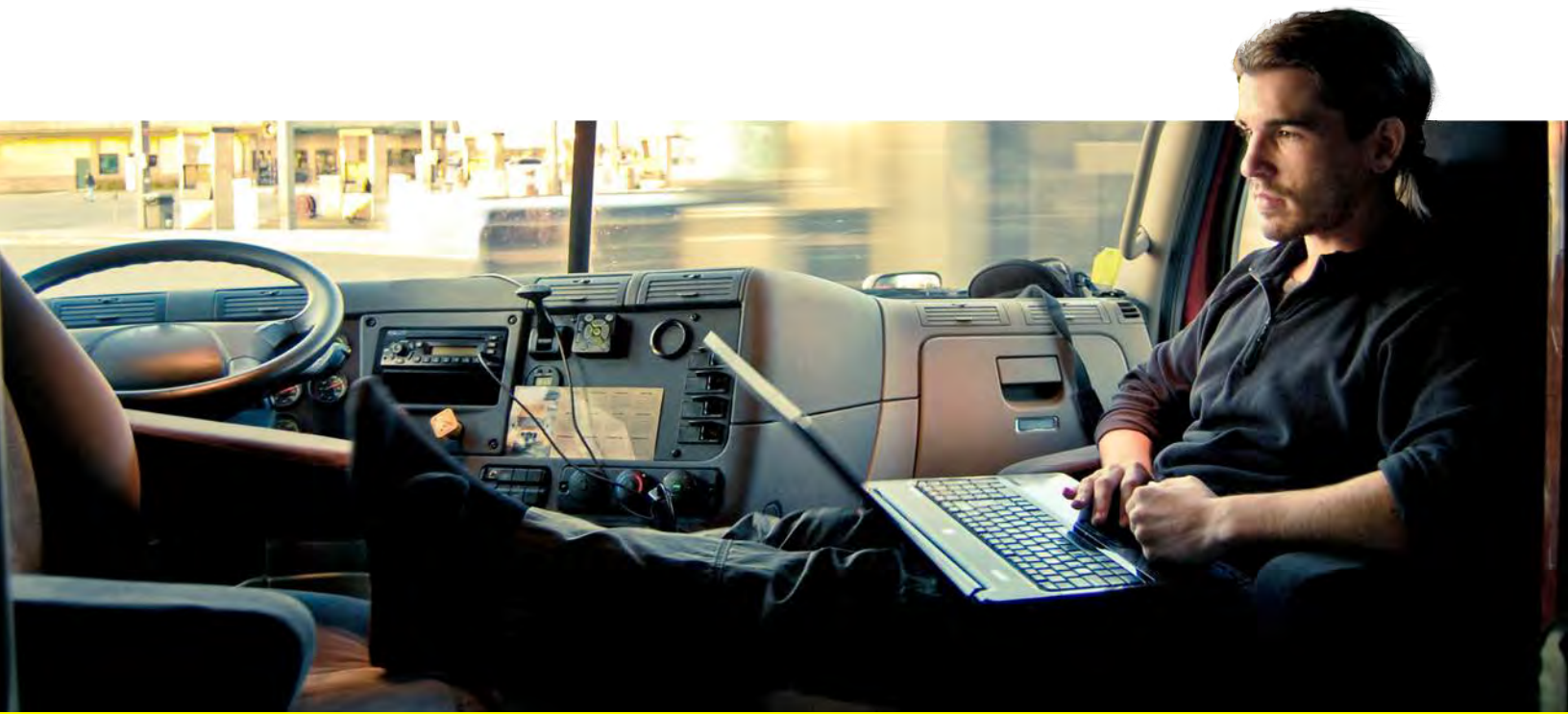
Full self-driving under all conditions:

The vehicle can operate without a human driver or occupants.

Increasing Presence of Autonomous Semi-Trucks on U.S. Roadways

Compact-sized trucks without a human onboard have been operating on public roads frequently for the last several years, and semi-trucks have started to follow suit. In 2019, [Gatik](#) started deploying two small, unmanned box trucks in Arkansas, delivering Walmart products after obtaining a permit from the state's Highway Commission to operate on a limited range on public roads. Then, in December 2021, [TuSimple](#) completed the "world's first" fully-autonomous semi-truck 80-mile drive from Tucson to Phoenix. In particular, tech startups have become confident that fully autonomous semis will soon be more commonly operated on U.S. highways and Level 5 is that the latter can drive autonomously everywhere in all conditions.





Companies Developing Driverless Technology for Semis

Taking the technology to the next level, startups, like Aurora and Kodiak who've been developing autonomous driving systems, have envisioned long haul trucks to operate soon on highways without any human intervention – like a real-life Optimus Prime from the Transformers franchise, sharing the road with passenger vehicles.

Below are the leading driverless truck technology developers expecting to reshape the future of trucking in the U.S.:

- » Aurora – is expected to launch Aurora Horizon in 2024, an autonomous service designed to bring efficiency, safety and value to carriers, including fleet owners.
- » Embark Trucks – Started in 2016 by roboticist leaders, the company is the longest operating autonomous truck program in U.S. and is known for developing safer, more sustainable and efficient self-driving software that can power any fleet.
- » Einride – is a Swedish company that specializes in remotely-controlled electric trucks. Founded in 2016, its cab-less, electric-powered shipping trucks got NHTSA approval to operate on public roads in the U.S. beginning in 2022.
- » Kodiak Robotics – Founded by autonomous trucking veterans in 2018, they have developed the easy-to-swap SensorPods technology, a fully-integrated solution allowing trucks to perceive the environment.
- » Nuro – Since its inception in 2016, they have been developing and testing autonomous driving technology across a variety of vehicle platforms. In 2020, the NHTSA gave the green light, allowing the company to test its compact vehicles for delivering groceries without a human driver onboard.
- » Torc Robotics – Founded by a group of Virginia Tech students, they have partnered with Dimier Trucks and have been testing autonomous trucks on Virginia public highways since 2019.



By the end of 2024, Kodiak and Aurora will no longer include human copilots inside the cabs of high-tech cargo trucks. During the testing, human copilots, “safety drivers,” and experienced truck drivers were onboard the self-driving semi-trucks to monitor the vehicle’s movements, train the system and provide guidance.

These heavyweight, driverless vehicles will traverse Texas roads and relying on software for sensors, cameras, radar and remote sensing method called light detection and ranging or “lidar.”

Aurora claims its trucks can see distance equivalent to four football fields in advance. Embark Trucks utilizes a modern map technology allowing its autonomous trucks to see and adapt to real-time changes in the environment. Kodiak, on the other hand, has a system that automatically creates its own map including everything its truck needs to drive safely in any environment.

However, not all tech companies that have entered the autonomous driving arena offer their technology to the trucking industry. Others have focused on developing their technology for smaller vehicles, just like Waymo. The Google-founded driverless tech provider in July 2023 decided to put its commercial trucking efforts on the back burner and focus on ride-sharing.

Driverless Trucks Can Help to Reduce Costs and Improve Road Safety

Efficiency is one of the biggest benefits of autonomous trucking. Driverless trucks don't get tired, need sleep, take breaks, engage in road rage, get distracted or drive impaired while on the road. For third-party logistics (3PL) fleet owners, wholesalers and manufacturers who deliver products on their own, this means:

- » Increased productivity with extended operating hours beyond hours of service regulations
- » Reduced labor costs and workforce strains due to driver shortage
- » The ability to move more products by traveling during off-peak hours
- » Consistent and reliable transportation of products to meet delivery schedules
- » Strategically allocated resources for optimized efficiency

Stephen Volkmann, an analyst at Jefferies, suggests that unmanned semis can significantly reduce operating expenses—believing trucking companies can save as much as 20% of variable costs. Moreover, a Deloitte report predicts more than 30% cost-per-mile reduction in transporting goods.

Proponents of autonomous truck technology claim driverless trucks could improve road safety as it removes the human element which is considered a great factor in most crashes. The Federal Motor Carrier Safety Administration (FMCSA) identified over-the counter and prescription drug use, unfamiliarity with roadway, inadequate surveillance and fatigue as associated crash factors — all of which are attributed to human drivers.



Level 4 Driverless Trucks Will Take Years Before They're Fully Integrated

While autonomous vehicles have numerous benefits, critics are concerned due to the absence of unified federal regulations, transparencies and comprehensive data collection in place. Safety advocates also believe that unmanned semis could pose dangers when driven at highway speeds along with small vehicles.



States Where Commercial Autonomous Vehicles Currently Operate

State governments have predominantly developed autonomous vehicle regulations on their own as the federal government has only implemented minor regulations.

The National Conference of State Legislatures (NCSL) identified 29 states across the country that have already enacted legislation for driverless vehicles. California, Indiana and New York require the presence of a qualified human driver that could take control of the autonomous trucks when needed. Florida, Georgia, Nevada, North Carolina, North Dakota, Utah and West Virginia have enacted policies allowing a SAE Level 4 or 5-capable vehicles to operate on public roads without a human driver onboard.

Because of its strategic location and limited regulation, Texas has attracted developers of autonomous truck systems. The state doesn't require self-driving trucks to have a safety driver on board, but tech companies still consider one to promote safety during the testing phase.

Regulatory state as of June 16, 2022; at least a dozen autonomous vehicle bills are pending across the country.



Source: National Conference of State Legislators, Dentons, Reuters research

Issues Developers of Driverless Truck Technology Need To Overcome

Industry experts believe it will take up to a decade before the public comfortably share the roads with huge, unmanned trucks.

Unmanned cargo trucks raise concerns about safety when operating alongside regular traffic. Specific crash data does not exist for driverless trucks, however in 2022 nearly 400 accidents involved vehicles with partial automated driver assist systems (ADAS) technology, including injuries. This data suggests potential safety risks that need careful consideration before widespread deployment of full-autonomous semis.

Cyber security poses another concern for high-tech trucks as an attack could endanger public safety or disrupt the supply chain. The thought of a hacker taking over a system operating an 80,000-pound vehicle traveling on a public road is concerning. The Cybersecurity & Infrastructure Security Agency (CISA) noted that autonomous vehicles are increasingly vulnerable to such attacks and could result in data breaches, theft, property damage, financial loss, personal injury and fatalities.

Companies that deploy autonomous trucks may find it difficult to secure insurance coverage for its fleet and operations. Accidents, no matter the scale, are more complicated when a semi is involved. With more factors in play when there is an unmanned truck, including software glitches, network outages, manufacturing defects, sensor failures or cyberattacks, these risks may make it harder to secure insurance.

Moreover, return on investment (ROI) could be an issue as owners of driverless fleets may need to impose higher fees compared with traditional trucking operations. The equipment itself is expensive. American Transportation Research Institute (ATRI) estimates tractor trucks cost around \$135,000 to \$145,000, while a driverless version could cost up to \$200,000. ATRI also emphasizes that all are focusing on whether a truck can drive by itself without a human and not considering the other non-driving obligations that are often performed by human drivers.

Torc Robotics is delaying integrating commercial driverless trucks on public roads until 2027 and is working with major fleet owners to identify how maintenance technicians and roadside assistance will change in the future.





Creating New Job Opportunities for Truck Drivers

The trucking industry is grappling with a growing shortage of truck drivers, requiring over 82,000 qualified operators by 2024, as forecasted by the American Trucking Association (ATA). The shortage of truck drivers can be attributed to factors such as an aging workforce, diversity considerations, extended hours on the road and the demanding lifestyle associated with the profession.

Without addressing potential supply chain disruptions and increased transportation costs may occur if workforce shortages remain unaddressed. Furthermore, the issue may result in an economic slowdown if there's no reliable transportation for shipping goods to customers on time.

With the advent of autonomous trucks, proponents believe that when autonomous trucks become more prevalent human drivers will no longer be needed inside semis.

The valuable skills and experience of truck drivers can be utilized across other roles in the industry.

Here are some of the jobs that truckers could pursue in the future:

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|------------------------------------|--|---------------------------------------|
| » Logistics coordinator | » Fleet manager | » Maintenance technicians |
| » Data analyst | » Account manager | » Fleet operations monitor |
| » Transportation safety specialist | » Dispatch and customer service representative | » Training and development specialist |

With new job opportunities, drivers could be able to spend more quality time with their loved ones and possibly have a healthier work-life balance.



The Issue of Electrification of Driverless Trucks

Electrification is the transition from conventional, diesel-powered trucks to a much cleaner, low-emission electrified alternative, including those powered by natural gas. An electric truck doesn't release harmful gas emissions and it's much quieter than traditional counterparts, which is ideal when traveling in urban areas during nighttime.

In response to the increasing demand for environmentally friendly transportation solutions, some developers of driverless truck technologies, like Einride and Kodiak Robotics, are embracing electrification to future-proof their fleets. This strategic move aligns with states that have adopted or are actively working towards implementing the Advanced Clean Trucks (ACT) rule. Notably, these efforts are in line with California's ambitious objective of achieving 100% zero-emission vehicles in new truck sales by 2040.

For fleet owners, this could showcase a commitment to environmental responsibility, potentially attracting prospective customers and investors. Moreover, shippers can avoid logistical disruptions related to stricter emission regulations. However, Strategy&, a part of the PwC network, believes electrically powered trucks will significantly dominate the industry within the next 15 years. Meanwhile, Volvo Group North America zero-emission technology program director, Andrea Pratt said the number one barrier for electrification of large cargo vehicles is the setting up of charging infrastructures. Other brands, such as Daimler, Ford and Tesla, are currently testing electric and automated trucks but in limited capacities.

Because of the amount of electricity needed to power long-haul vehicles, manufacturers need to address battery-related issues such as limited range, longer charging times, degradation, compactness, not to mention the high cost associated with owning the equipment, which is a significant reason why many fleet owners or 3PL companies haven't shifted to electric-powered trucks.



Future-Proofing Business With Transportation Software

While autonomous vehicles are the predicted future of logistics, they're just one aspect of supply chain resiliency that requires the attention of forward-thinking businesses. To remain competitive in today's volatile markets, companies can take advantage of proven transportation management technology to optimize transportation operations, reduce costs and better meet growing customer demand.

Transportation management software (TMS) is an easy-to-use, intuitive cloud-based solution that empowers businesses by helping them select the optimal mode and ensuring cost-effective routing. This can help save up to 30% on costs and improve operational efficiencies all while improving the customer, driver and carrier experience.

Transportation Software Helps Unlock Business's Full Potential by:

- » Achieving efficient multimodal transportation management
- » Optimizing carrier selection for better shipping costs
- » Automating complex rating and zoning fees
- » Improving warehouse efficiency
- » Fostering sustainability and environmentally friendly practices
- » Gaining increased visibility into transportation data
- » Accessing comprehensive management reports
- » Reducing carbon footprint through smart logistic practices

Moreover, for organizations utilizing industry-specific enterprise resource planning (ERP) software, it's possible to tightly integrate transportation software to unlock greater automation across your entire business. Integrating ERP and TMS eliminates manual entry of orders, keeping records by hand and other inefficient practices.

Driverless Trucks Have a Long Road Ahead

Perfecting Level 4 autonomous driving in trucks could increase overall efficiency, reduce operational costs and improve safety. However, the industry needs to navigate the challenges such as public acceptance and potential cybersecurity threats to fully realize the transformative potential of the technology.

While thousands of miles of real-world testing suggest the increasing reliability of autonomous trucks becoming a reality, businesses with complex, high-volume shipping operations may still need to wait for several years as experts and technology proponents address the issues surrounding these high-tech trucks.

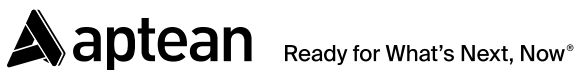
Today though, wholesalers, manufacturers and 3PLs with complex transportation operations are taking advantage of robust transportation software that enhances efficiency and helps reduce the costs of your shipping and logistics processes. Aptean stands out among providers to consider, with our robust, purpose-built solutions and commitment to serve as a comprehensive partner. We understand the very core of the logistics challenges you face so can help ensure your transportation operations are future ready.



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