SELF-DRIVING FREIGHT IN THE FAST LANE

DRIVERLESS VEHICLES ARE ABOUT TO REWRITE THE RULES FOR TRANSPORTING NOT JUST PASSENGERS, BUT FREIGHT, TOO

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Driverless cars, which are in development by Google, Tesla, Apple, and a slew of automakers, are expected to revolutionize personal transport in the next decade. Soon, driver-free trucks and locomotives will become a new economic imperative for freight railroads and motor carriers, as well.

Specialized automated trucks are already in use at off-road and remote locations, such as mines in Australia and Chile, military bases, and container terminals. On-road, they are being tested in the United States and Europe by Freightliner/Daimler, Volvo, and Peterbilt. Driverless trucks on open roads will face the same challenges as driverless cars, although trucks' added size and weight are likely to generate even greater public-safety concerns.

Trains are easier to run in an automated manner, as they use fixed guideways and do not have to deal with unpredictable traffic. Indeed, a number of short-haul mining operations in North America have used automated trains since the 1960s. Today, some 48 city metro systems worldwide are automated, as are dozens of airport shuttle and people-mover systems. In the second half of 2015, mining company Rio Tinto is expected to start up the world's first long-distance driverless freight rail service, with 42 trains operating over 1,000 miles of track in Western Australia.

So the question is not whether the technology is feasible for self-driving trains and trucks, but what the impact will be once it becomes more widely adopted. Research and development is much further along in the automation of trucking than in freight rail, in large part because trucking is more labor intensive and the economic benefits of automation greater. The compelling economics of autonomous trucking may change the transportation landscape so radically, however, that railroads will have no choice but to respond in kind. To manage this transition safely, all parts of society – government, the private sector, and the public – will need to work in concert, with freight railroads and motor carriers leading the way.

240,000

The anticipated shortfall of truck drivers in the United States by 2023

ECONOMIC IMPACT OF AUTOMATION

A major benefit of driverless trucking would be its impact on the current and projected shortage of long-distance drivers in the United States and Europe. An aging population, lower wages (in the US, truck drivers earn only about half of what train crews do), tighter hours of service rules, and a younger generation less willing to spend long periods of time away from home mean that the US is short as many as 35,000 drivers – and could be short 240,000 by 2023, according to the American Trucking Association. Some 40 percent of truck drivers in Germany will retire over the next decade, as reported by the *Wall Street Journal*, which could lead to a shortfall of 250,000 drivers. Driverless trucks would reduce the demand for long-distance drivers; most remaining drivers could then be utilized for more complex local

pickup and delivery operations, which would solve many of the lifestyle issues faced by truck drivers.

Driverless trucks would yield other economic benefits as well: Today, trucks sit idle when drivers are in mandatory rest periods; autonomous trucks could be kept moving. This change alone could reduce driver costs by up to two-thirds and increase equipment utilization by one-third. Having trucks travel together in a closely spaced "platoon" with a driver only in the lead vehicle could cut fuel consumption by up to 10 percent. Accident rates could drop by up to 70 percent, resulting in lower casualty claims and likely lower insurance rates, especially if truck-dedicated lanes become a reality. Furthermore, it's estimated that operating driverless vehicles with closer spacing and at more consistent speeds over long distances could increase highway capacity by 200 percent or more.

While railroads currently are able to fill most of their train crew jobs due to higher pay levels versus trucking, the lifestyle similarities between train crews and truck drivers suggest that a shortage of train crew personnel may not be too far away. Automation of locomotives would decouple work from the actual movement of trains, enabling operating support jobs to be converted to regular shift assignments at fixed geographic locations and improving the appeal of railroading to employees who want more consistent schedules and to work near home.

At the same time, railroads could reduce their labor costs and boost their network capacity by running driverless trains. Asset utilization, service levels, and reliability also could improve, as they could operate more frequent, shorter trains at no cost disadvantage versus current operations – although such a change will require double-tracking the core network to enable trains to move in both directions at once in order to gain the "conveyor belt" benefits of automation. Such changes are likely to become necessary if driverless trucks reduce motor carrier costs enough to make them competitive with rail over longer distances. Otherwise, railroads could face a loss of market share that would be difficult to make up.

GOING DRIVERLESS: WHAT WILL IT TAKE?

Many of the technological building blocks for driverless trains already exist (or are being implemented) in the US and Europe: remote control systems, onboard computers that enforce speed limits and regulate movement, and software that optimizes train operation and fuel consumption.

The critical barrier at present to driverless trains is the issue of protection of the right-of-way, as trains do not have the means to detect and avoid obstacles in their paths. To overcome that impediment, several different strategies in tandem will be needed: Grade crossings may require upgrades or real-time monitoring systems to ensure the "box" within the gated area remains unobstructed. Automobile drivers will need to be more alert around crossings; in the US, for example, the Federal Railroad

250,000

The anticipated shortfall of truck drivers in Germany by 2025

Administration has partnered with Google to add all grade crossings to Google Maps. When the software is used for turn-by-turn navigation, it will warn drivers when they are approaching crossings.

With the implementation of positive train control (PTC), freight trains will be able to send their locations via satellite to an accessible database, much like the many transit systems that already offer tracking apps. It's not hard to envision a future of mobile phones lighting up and beeping loudly to warn drivers and pedestrians of an oncoming train in their vicinity, reducing the likelihood of accidents. (All this would require is that the phone's location tracking system be turned on and that it be running in the background.)

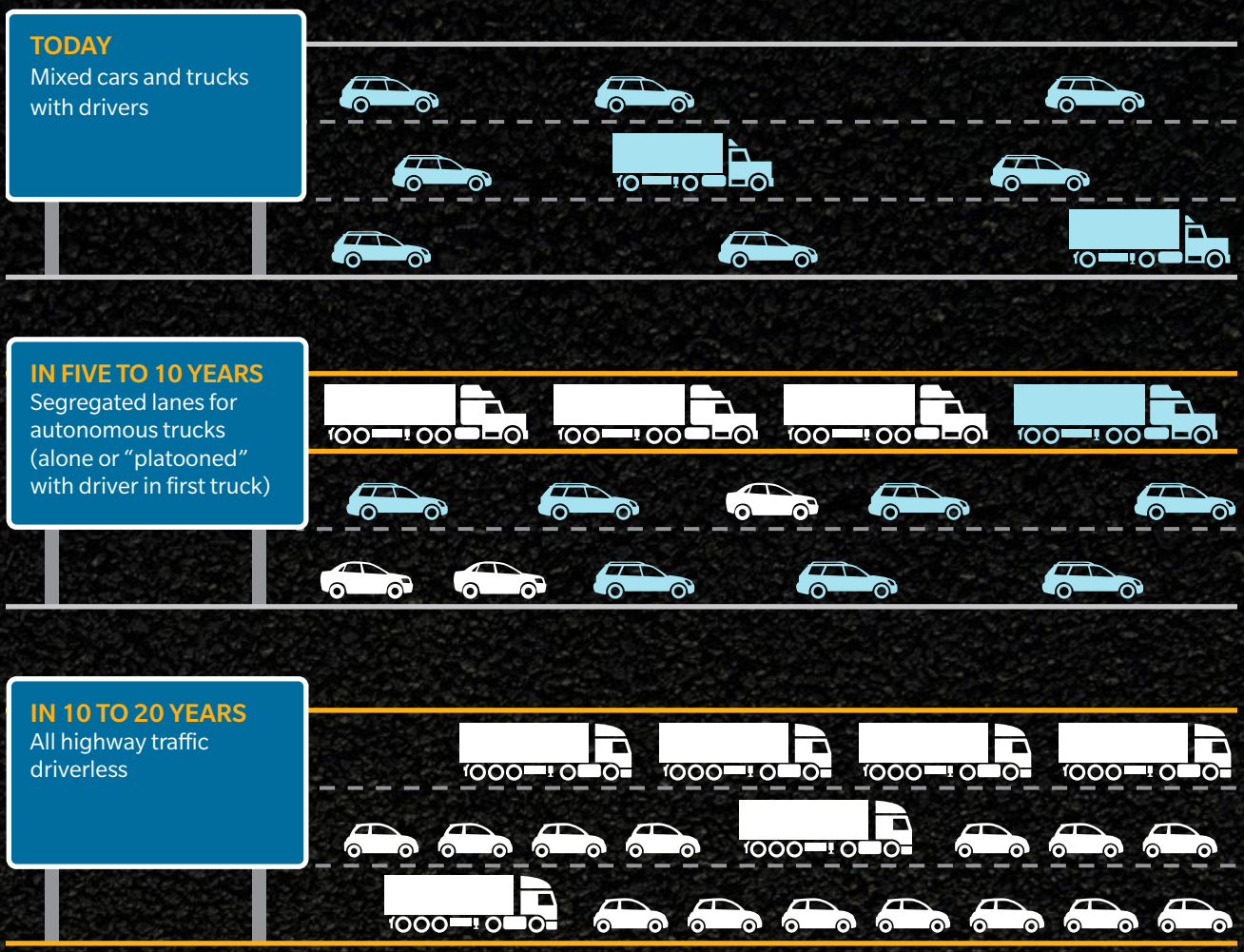
Of course, no rail corridor can be completely sealed off, which means trains will need obstacle detection and avoidance systems. Autonomous cars, for example, will use light detection and remote sensing technology, linked to the braking and steering systems, to avoid obstacles. The major challenge for an automated train will be determining what the obstacle in its path is and whether to brake for it – since sudden deceleration can create a risk of derailment. Is it a car that can't get out of the way – or a deer that can?

For autonomous trucks, the challenge is somewhat different, and likely greater, given that trucks operate on open roads with full public access. Many experts believe that gaining acceptance for driverless trucks will mean restricting them initially to dedicated

EXHIBIT 1: HIGHWAY TO THE FUTURE: DRIVERLESS ROADS

HOW HIGHWAYS COULD EVOLVE IN RESPONSE TO DRIVER-FREE VEHICLES

As driverless trucks come online in the next five to 10 years, they may initially be required to operate in segregated lanes. But once the practice becomes widespread, highways may be restricted to autonomous vehicles. While this transition is fraught with risk, it could yield substantial benefits.



Top Five **Benefits** of implementation

- Solve long-haul driver shortage
- Increase highway/rail capacity
- Reduce costs and increase asset utilization
- Reduce accidents and claims
- Reduce fuel consumption

Top Five **Risks** of implementation

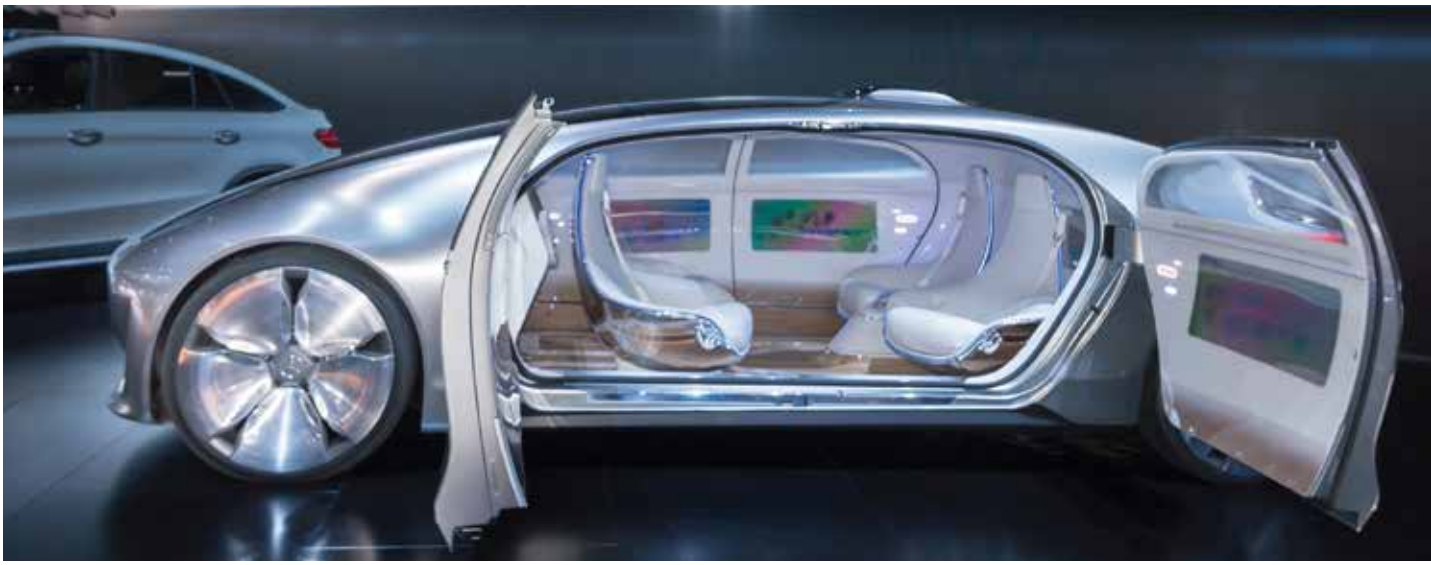
- Public perception of safety risks
- Significant funding requirements
- Some technology is still in development
- Need for regulatory change
- Labor union resistance

Indicates driver

Indicates driverless

Autonomous traffic lanes

Source: Oliver Wyman analysis



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and segregated highway truck lanes. (See Exhibit 1.) In theory, building such lanes could be funded by instituting tolls. And while converting some lanes to autonomous-only vehicles would likely add to highway capacity (and thus cut congestion), this could be a political non-starter unless there are at least two lanes in each direction (or more, in heavily congested urban areas) available for conventional driving.

A reverse solution has been suggested to restrict conventional vehicles instead to special toll lanes, as they take up more capacity and are projected to have higher accident rates than autonomous vehicles. This might be an incentive for the more efficient solution; however, it is unlikely to gain public or political goodwill until autonomous vehicles become more widespread.

AUTONOMY: THE NEXT COMPETITIVE EDGE

The technology for driverless trucks and trains will largely be in place over the next three to five years, and the economic imperative will only escalate. Driverless trucking faces more hurdles, but has more to gain in terms of solving long-term industry structural problems. Railroads could face regulatory and labor union issues, but automation would be easier to implement from a technology standpoint. Most critically, failure by the railroads to move quickly enough could lead to an erosion of their traffic base, as driverless trucking would enable motor carriers to challenge railroads across a much wider swath of their market.

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