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## Electronic Logging Device Controversy

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UNITED STATES OF AMERICA



The attached educational project, by Ronald Fosu, entitled Electronic Logging Device Controversy, when completed, is to be submitted to the Graduate Faculty of the University of Wisconsin- Platteville in partial fulfillment of the requirements for the (MASTER OF SCIENCE IN INTEGRATED SUPPLY CHAIN MANAGEMENT) degree.

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### **ABSTRACT**

On December 18<sup>th</sup>, 2017, the U.S. Department of Transportation implemented a controversial rule mandating truck driver(s) to keep track of their working hours using Electronic Logging Device (ELD). Electronic Logging Devices are more difficult to manipulate than paper logbooks, and more challenging for drivers to violate Hours-of-Service regulations. These rules are put in place to reduce driver fatigue, the primary goal of the rule is to reduce traffic related accidents. The paper uses data from several driver inspections and federally recorded accidents to evaluate the effectiveness of the rule. Previous research clearly illustrates the mandate achieved its main goal of boosting driver compliance with Hours of Service Regulations. However, smaller carriers and or independent owner operators are mostly impacted by this rule than larger carriers which had already adopted Electronic Logging Device systems prior to the rule. Nevertheless, there is no proof that shows the number of accidents has declined. It seems that carriers have increased the level of unsafe driving (fatigue, speeding, harassment) in response to productivity losses caused by the rule.

## **Executive Summary**

### **1.1: Brief Background**

On December 16<sup>th</sup>, 2015, The Federal Motor Carrier Safety Administration published a Final Rule that established a comprehensive revision to the Hours of Service Regulations. Under this revision, it requires motor carriers to provide their drivers with adequate time for them to rest, thus reducing the risk of fatigue-related accidents. The Federal Motor Carrier Safety Administration called for the implementation of Electronic Logging Devices to be utilized by drivers in long haul operations. This was based on data that indicated:

- (1) Fatigue-related accidents are more likely to involve long-haul driver than local or short haul carriers and,
- (2) Drivers failing to comply with the Hours of Service regulations

In order to address these issues, the Federal Motor Carrier Safety Administration believed that:

- (1) Supplying semi-trucks with Electronic Logging Device Systems will improve compliance with Hours of Service Regulations,

- (2) Improving driver compliance with Hours of Service Regulations will help reduce fatigue-related accidents and,
- (3) Electronic Logging Devices would be available in enough supply at a cost-effective price.

The 2015 Electronic Logging Device Final Rule went into effect on December 18<sup>th</sup>, 2017. “Considering the substantial cost that the final rule will impose upon the trucking industry, the Federal Motor Carrier Safety Administration determined that the rule is economically, political and socially significant (Owner-Operator Independent Drivers Association, 2016).” However, the reasons behind any rule making decision imposed on an industry can be difficult to understand. Nevertheless, many in the trucking sector believe the Federal Motor Carrier Safety Administration is failing to understand the misuse of Electronic Logging Device(s) by motor carriers, as well as underestimating the pressure placed on drivers to operate while fatigued. Carrier(s) do this to both maximize driving time and make on time pick up and or deliveries on their driver(s).

## **1.2: Introduction**

Since the 1900’s commercial trucking has played a critical role in just about every aspect of our country’s growth. And as our communities grow the more is needed. You can witness this from the building supplies for our homes, products we buy at the local store(s) to the oil that make our vehicle(s) go vroom!! Bottom line, from raw materials to finished products, everything that both directly and indirectly impacts our daily lives has probably seen

the inside of a truck. “But how do we keep up with such a demand? Well, the answer is the same that we have had in the past, truck driver(s).” (pls logistics, 2018)

The trucking industry’s ability to adapt to rapidly changing economic supply and demand has made trucking the most dominant form of freight mode in both gross freight tonnage and revenue in the world. Roughly 71% of all freight in the United States is transported by truck. The industry handles more freight than trains, ships and planes and is the reason why trucking is the backbone of our economy.

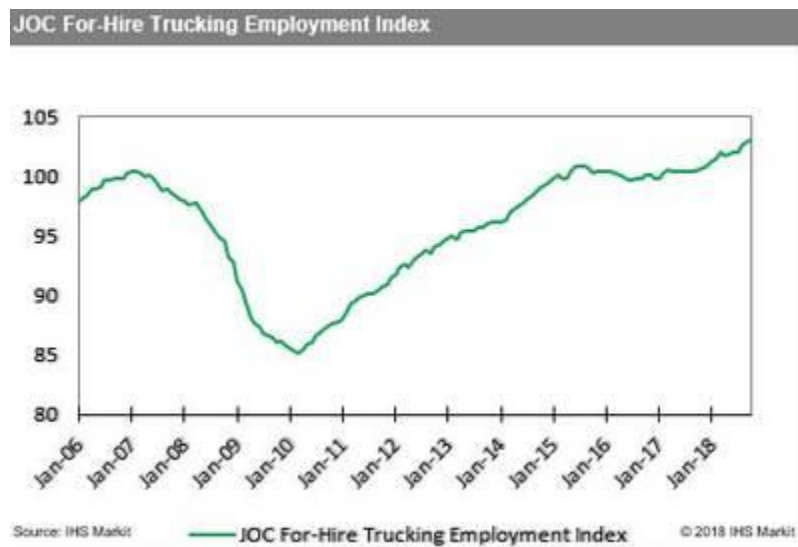
The trucking sector employs close to 7 million Americans, half of whom are behind the wheel driving, 80% of U.S. communities rely on trucking companies to transport and deliver their everyday products. Imagine if every truck were taken off the road. This would be disastrous because not every area of the U.S has access to beef, seafood, dairy, corn and wheat. Perishable items such as food and water would be consumed within days. ATM’s will also go empty in the matter of days. These consumable products may require long-distance haul that would be impossible without motor carriers.

There are small trucking outfits that operate in the owner operator model and larger companies that employ a higher number of drivers. In most cases drivers will negotiate their wages based on a rate that is centered around miles not hours. For experienced drivers this could be up to 60 cents a mile. “this means that if the driver travels at about 70 miles an hour they will make approximately 42 dollars per hour. If the total trip is about 800 miles, the driver makes a cool \$480 (Big City Driver, 2015).” Most truckers start to earn about \$28,000 but can make as much as \$68,000 a year.

Driving a truck is not the most attractive career in the world. Truckers haul any product/commodity, in peace and in war time, from the west to the east coast and various locations in between. The industry has struggled to attract qualified drivers because the lifestyle is less than ideal. Truckers will work up to 65 hours a week. Pay is less than desired for many people. Several drivers are on the road for days and weeks at a time. Time spent with family is greatly sacrificed. Several drivers I know are divorced due to the high demand of driving a truck. The average age of a truck driver is 55. Making this number 10 years older than those working in other industries like manufacturing and construction.

According to the American Trucking Association, even though over 70% of consumer goods are moved by motor carriers in the U.S., the industry needs to hire almost 900,000 more drivers to keep up with rising demand. The trucking sector has struggled with a driver shortage for the past 15 years. The last economic recession masked the effects of a driver shortage. This is because as freight volumes dropped trucking companies employed fewer drivers. So, when volumes rebounded in 2011, the shortage of drivers became a growing issue again because carriers failed to recruit the qualified talent needed to fill those seats.

Our growing economy and high freight demand made 2018 a strong year for the trucking industry, however, with a booming economy there comes a price. According to Dial-a-Truck Solutions, a US-based freight exchange service, just one truck was available for every 12 loads, making it the lowest ratio since 2005. This growing driver shortage is forcing companies to delay shipment of nonessential items or pay higher prices to get their goods delivered on time.



The second ranked issue for drivers and what this paper is going to focus on is the implementation of Electronic Logging Data Mandate enforced on Dec 18<sup>th</sup>, 2017. The Federal Electronic Logging Device Mandate only intensifies the driver shortage problem. Before this rule a driver could squeeze in more miles by not recording loading/unloading and time spent in traffic on their paper logs. Now, Electronic Logging devices document that time, resulting in a driver spending less time on the road. The fewer the miles for a driver the less money he or she will take home. It's important to point out that the Electronic Logging Data Mandate did not change the Hours of Service Laws. Not only, did the law make it more difficult for drivers to cheat their log hours, it also makes it less likely for drivers to operate a truck when fatigued.

Accidents involving large motor vehicles kill over 3,000 people a year in the United States. There are several accidents documented of truck drivers driving while excessively tired. This issue has resulted in the federal government to establish Hours of Service rules that carriers must follow. The new rule has made several changes to drive time limits to curtail driver fatigue.

While these new rules are encouraged to promote safety, several drivers, companies, professional analysts point out that the new rule will create an incentive for drivers to break the rules.

“In 2017, 37,133 people died in motor vehicle crashes, a 2 percent decline from the prior year. But large truck fatalities rose 9 percent to 4,761, an increase of 392 lives lost over the prior year. About 1,300 of the deaths were truckers (adler, More Trucking Deaths may be cause by drivers racing the clock, 2018).” Deaths from large truck accidents has reached its highest level in 30 years. Several drivers and professionals within the industry account this to bad driving habits brought on by younger drivers. However, several drivers have commented that they have no choice but to make their deliveries as fast as possible to make up for productivity losses due to Electronic Logging Data adaption. Truckers who speed increase the chances of being involved in serious or fatal accidents.

Another consequence of the Electronic Logging Device Mandate is shortage of safe parking spaces for trucks, especially those hauling oversized loads. Drivers speed and or push the limits of Hours of Service and Electronic Logging Device regulations because they are not able to find a safe place to rest. In most situations’ drivers are forced to travel beyond their Hours of Service limits to find a safe place to take their mandated downtime. Several drivers refuse to park on the side of the road because they do not feel safe. The issue is that drivers are unable to shift hours to allow them time to find safe places to rest.

### **1.3: Research Objective**

The objective of this paper is to investigate the impacts the Electronic Logging Device’s mandate has on the trucking sector & supply chain. This research must look at the

relevant issues from both the Federal Motor Carrier Safety Administration and carriers/drivers. Specific research questions to focus on are:

- (1) Why is this law in place (history)?
- (2) What are the costs associated with Electronic Logging Device?
- (3) What is the impact the Electronic Logging Device mandate has on the supply chain: productivity/capacity issues, transportation rates, shippers and end users?
- (4) Will the Electronic Logging Device Mandate help improve road safety?

The study is to highlight possible policy recommendations to minimize the impact on the trucking sector. This study will be relevant to owner-operators, small, medium and large sized motor carriers, shipper and consignees. Although the truck drivers and companies are aware of this, there are several in the general public that remain misinformed. I hope this research will inform others on this new legislation.

#### **1.4 Literature Review**

I will attempt to conduct a thorough literature review to pinpoint the current information regarding Electronic Logging Device(s) and to identify the areas where additional research is needed. Gaining an understanding of advanced electronics is not an easy task. Available data trends tend to be focused around specific products and topics. Of all the challenges facing transportation today, converting that large amount of data produced by on-board electronic

equipment, Electronic Logging Devices and Automatic On-Boarding Devices, into valuable material is very significant.

A group of researchers: Alex Scott, Northeastern University; Andrew Balthrop, the University of Arkansas; and Jason Miller, Michigan State University conducted a study of how enforcement of the Electronic Logging Device rule was affecting: compliance with hours of service; accident counts; and the frequency of unsafe driving.

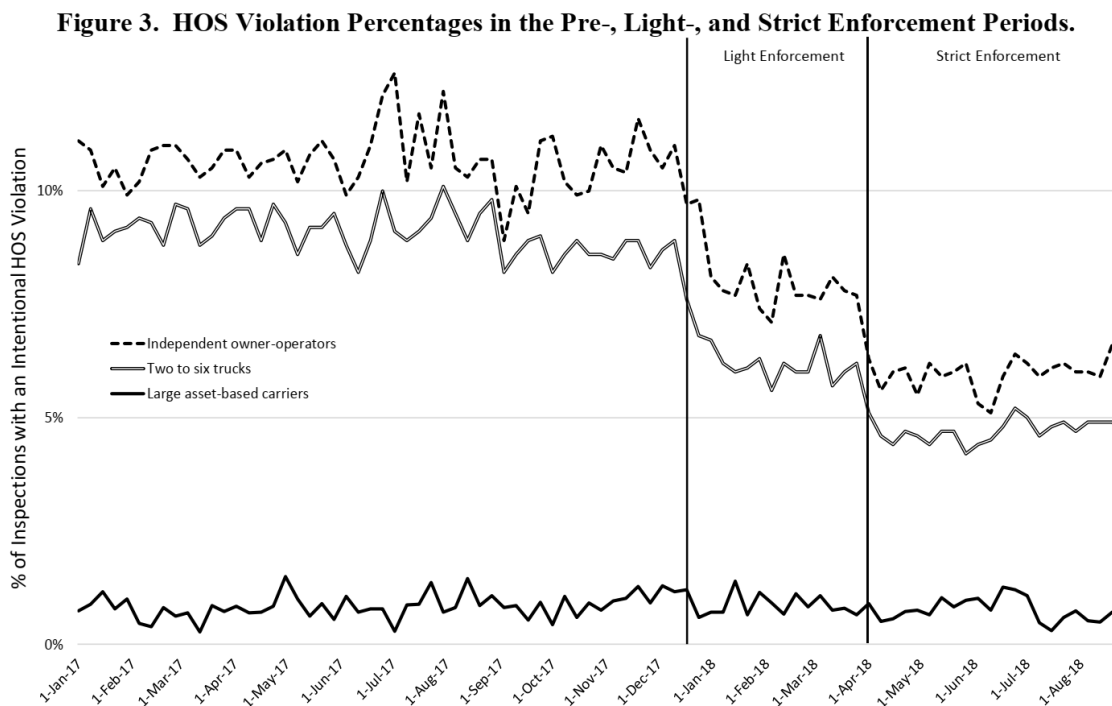
“While HOS compliance-the primary target of the ELD mandate-improved considerably, the study found that there was no decrease in the number of accidents for independent owner-operators and carriers with small fleets. It also found that unsafe driving infractions for small companies and owner-operators actually increased relative to large asset-based carriers.”

(university of arkansas, 2019)

The study focuses mostly on owner operators as they are greatly impacted by the mandate. Larger carriers like, Werner, Schneider, JB Hunt etc... already implemented less advanced Electronic Logging Device called Automatic Onboard Recording Devices prior to the December 2017 effective date and have become unchanged by issues related to Electronic Logging Device implementation. Researchers analyzed data on both driver inspections and truck related accidents between January 1, 2017 and September 1, 2018, with most data coming from the Federal Carrier Safety Administration.

The researchers recorded violations from 4 million inspectors of 224,000 carriers ranging from small to large and as well as Independent Operator-Owners. As predicted, the percentage of Hours-of-Service violations plummeted from 6 to 2.9 percent. Much of that decline came from

the small carrier segment. The rate Independent owner-operators fell from 10.7 to 6 percent, while larger carrier, the rates dropped from .85 to .75 percent.



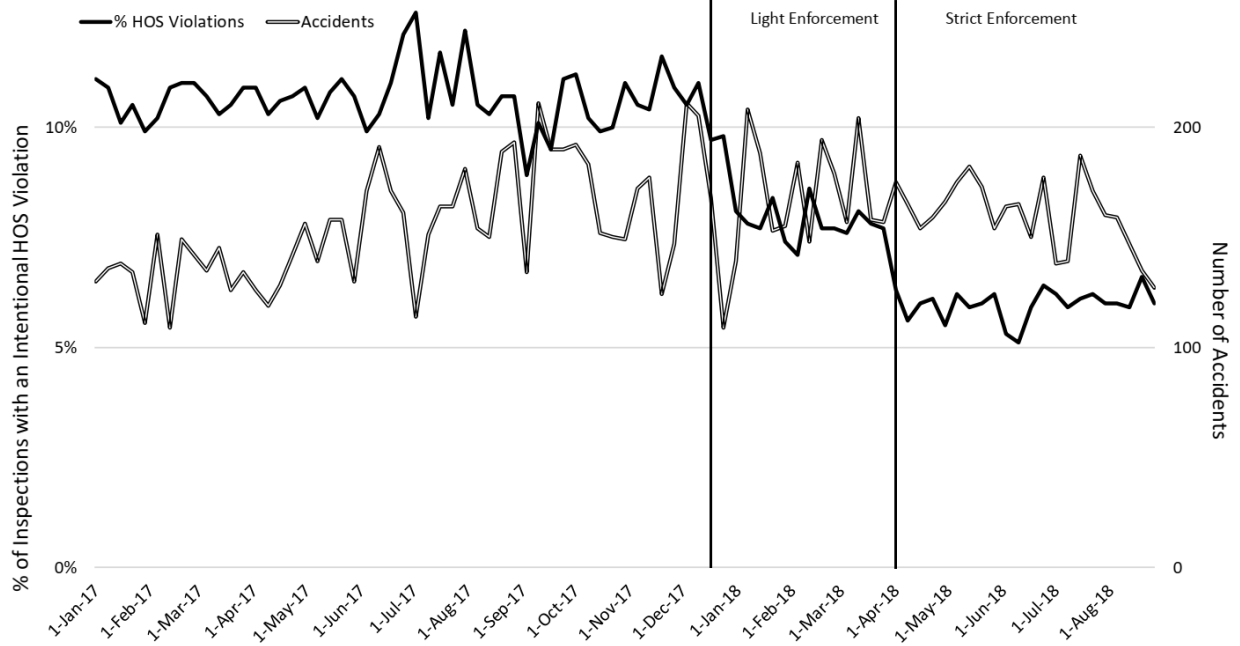
**Table 3. Average Number of Weekly HOS Violations per 1,000 Inspections by Carrier Size in the Enforcement Periods.**

Size Category	Pre-mandate	Light Enforcement	Strict Enforcement	Diff (Light)	Diff (Strict)	DD (Light)	DD (Strict)
Large asset-based carriers	8.5	8.9	7.5	0.4	-0.9	--	--
Independent owner operators	106.7	80.8	59.7	-25.9	-47.0	-26.3	-46.1
Two to six trucks	90.6	62.8	47.1	-27.8	-43.4	-28.1	-42.5
Six to 20 trucks	71.3	43.5	30.8	-27.9	-40.5	-28.2	-39.6
21 to 100 trucks	53.7	26.7	20.7	-27.0	-32.9	-27.4	-32.0
101 to 1,000 trucks	29.1	15.3	13.1	-13.8	-16.0	-14.2	-15.0
1,001 to 50,000 trucks	16.0	10.9	10.0	-5.0	-5.9	-5.4	-5.0

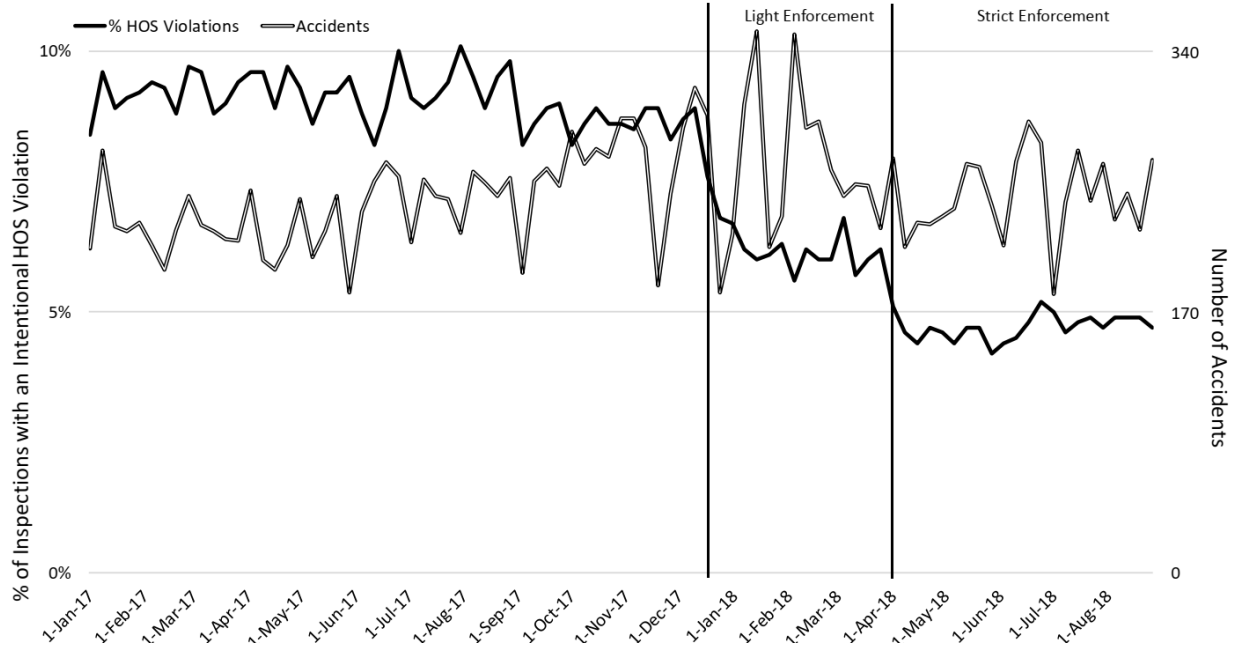
However, researchers discovered that the enforcement of Electronic Logging Device mandate has caused the number of unsafe driving violations, notably speeding, to spike among

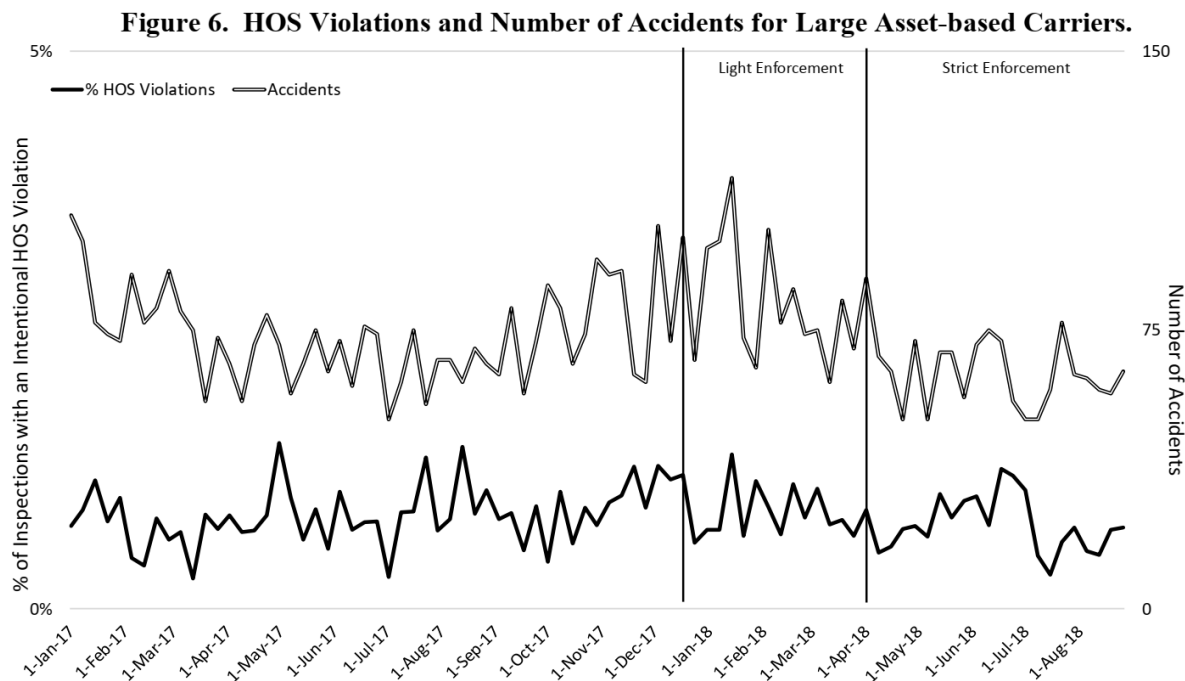
small carrier, large carrier and Independent owner-operator segments. Unsafe driving violations for carriers with two to six trucks rose nearly 18 percent. Carriers with seven to twenty trucks spiked to 12 percent. And those carriers with twenty-one to one hundred trucks climbed to 14 percent.

**Figure 4. HOS Violations and Number of Accidents for Independent Owner-Operators.**



**Figure 5. HOS Violations and Number of Accidents for Carriers with Two to Six Trucks.**





**Table 5. Average Number of Weekly Accidents by Carrier-size in the Enforcement Periods.**

Size Category	Pre-mandate	Light Enforcement	Strict Enforcement	Diff (Light)	Diff (Strict)	DD (Light)	DD (Strict)
Large asset-based carriers	73.4	83.0	64.0	9.6	-9.4	--	--
Independent owner operators	154.7	166.7	160.1	12.0	5.4	2.4	14.7
Two to six trucks	242.3	265.9	246.6	23.6	4.3	13.9	13.7
Six to 20 trucks	254.1	282.5	261.1	28.4	7.0	18.8	16.4
21 to 100 trucks	373.7	406.1	369.4	32.5	-4.3	22.8	5.1
101 to 1,000 trucks	374.3	434.7	361.5	60.4	-12.8	50.8	-3.5
1,001 to 50,000 trucks	244.7	272.7	240.4	28.0	-4.3	18.4	5.1

According to the researchers, “we find that the Electronic Logging Device mandate unequivocally enhanced Hours-of-Service Compliance. However, the Electronic Logging Device Mandate did not noticeably improve safety, and we are able to produce no statistically significant evidence that Electronic Logging Device adoption by smaller firms’ corresponded to any reduction in accident rates.” (Jaillet, 2019)

### **1.5 Legislative background**

“Transport technologies themselves have undergone large-scale changes over time, which have in turn reshaped the spatial organization of economic activity. For most of human history, the movement of goods and people were limited by physical capabilities of humans and their animals. The invention of rail reduced transport and creation of a hub and spoke transportation network was characterized by substantial fixed costs (rail yards, gas, etc...) and favored point to point travel between the central cities. The development of the internal Combustion engine in turn created greater flexibility in transportation benefiting lower-density locations relative to central cities. Even within existing transport technologies, such as maritime shipping, there have been large-scale changes in the organization of economic activity in the form of containerization and the adoption of new information and communication technologies such as the computer. The discovery of entirely new modes of transportation, such as air travel, has further transformed the relative attractiveness of locations for economic activity.” (Redding & Turner, 2014)

A topic of great concern in the trucking industry are the numbers of fatal and non-fatal accidents that are happening on our nation’s highways. Outside of the loss of life associated with traffic accidents, there are also negative financial and operational costs associated with it. Safety and congestion issues occur for several reasons.

In December of 2015, the Federal Motor Carrier Safety Administration announced a new mandate that requires the implementation of the electronic logging devices by all drivers who are currently obligated to complete paper logs. The FMCSA provided grace and transition periods for adoption over a 3-year time frame.

Phase 1: Awareness and Transition-one-year period beginning February 16, 2016 and ending December 18, 2017. Driver and companies can opt to utilize ELD's.

Phase 2: Phased in Compliance-Starting December 18, 2017 and ending December 16, 2019 the new rule requires owner operators have an ELD installed.

Phase 3: Full Compliance-After December 16, 2019 only registered ELDs can be used in the United States. FMCSA and DOT officers can formally issue fines.

An electronic Logging device automatically records a Driver's Records of Duty (RODs) and Hours of Service (HOS).

Under the Driver's Records of Duty Rule, drivers must record his or her status within a 24-hour period. Logs or Records of Duty must be maintained by showing each change in duty status. For each change in duty status: name of the city/town/village within the state must be recorded; other documents may include bill of lading, trip reports, toll/fuel receipts. The time zone must be that of the driver's home terminal.



# DRIVER'S DAILY LOG

(24 HOURS)

\_\_\_\_ / \_\_\_\_ / \_\_\_\_  
(Month) (Day) (Year)

Original - File at home terminal  
Duplicate - Driver retains in his/her possession for eight days

\_\_\_\_\_  
Total Miles Driving Today

\_\_\_\_\_  
Name of Carrier or Carriers

\_\_\_\_\_  
Main Office Address

I certify these entries are true and correct:

\_\_\_\_\_  
Truck/Tractor and Trailer Numbers or License Plate(s) / State (show each unit)

\_\_\_\_\_  
Driver's Full Signature

\_\_\_\_\_  
Co-Driver's Name

	MID-NIGHT											NOON											TOTAL HOURS
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	
1. OFF DUTY	[Vertical lines indicating duty status]																						
2. SLEEPER BERTH	[Vertical lines indicating duty status]																						
3. DRIVING	[Vertical lines indicating duty status]																						
4. ON DUTY (NOT DRIVING)	[Vertical lines indicating duty status]																						

REMARKS \_\_\_\_\_

**SHIPPING DOCUMENTS:**

B/L or Manifest No. \_\_\_\_\_

or \_\_\_\_\_

Shipper & Commodity \_\_\_\_\_

Enter name of place you reported and where released from work and when and where each change of duty occurred.

USE TIME STANDARD AT HOME TERMINAL

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# DRIVER'S DAILY LOG

(24 HOURS)

4 / 1 / 08  
(Month) (Day) (Year)

Original - File at home terminal  
Duplicate - Driver retains in his/her possession for eight days

270  
Total Miles Driving Today

WASHINGTON TRANSPORTATION  
Name of Carrier or Carriers

123 MASON ST., WASHINGTON, DC, 55555  
Main Office Address

I certify these entries are true and correct:

TT#12, TR#21  
Truck/Tractor and Trailer Numbers or License Plate(s) / State (show each unit)

John E. Doe  
Driver's Full Signature

W. R. Smith  
Co-Driver's Name

	MID-NIGHT											NOON											TOTAL HOURS
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	
1. OFF DUTY	[Vertical lines indicating duty status]																						10.5
2. SLEEPER BERTH	[Vertical lines indicating duty status]																						4.5

	MID-NIGHT											NOON											TOTAL HOURS
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	
1. OFF DUTY	[Vertical lines indicating duty status]																						10.5
2. SLEEPER BERTH	[Vertical lines indicating duty status]																						4.5
3. DRIVING	[Vertical lines indicating duty status]																						5
4. ON DUTY (NOT DRIVING)	[Vertical lines indicating duty status]																						4

REMARKS Richmond, VA. Fredericksburg, VA. Baltimore, MD. Newark, N.J. Franklin, N.J. 24

**SHIPPING DOCUMENTS:**

1673, 1674  
B/L or Manifest No.

or \_\_\_\_\_

Shipper & Commodity \_\_\_\_\_

Enter name of place you reported and where released from work and when and where each change of duty occurred.

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Hours of Service seeks to remove tired drivers from the road and ensure they get adequate rest in a timely manner before starting another cycle of driving. Drivers are required to record how much time is spent on the road, and how much time is spent off-duty. Under the Federal Mandate drivers must adhere to three types of HOS regulations: 14-hour, 11 hour and 60-hour/7 day and 70-hour/8-day duty limits.

According to the FMCSA's 14-hour rule, drivers have 14 hours to complete their job for the day. This includes naps, lunch, time spent getting loaded and unloaded. After the 14 hours have been exhausted, he or she must rest for 10 consecutive hours. The 11-hour rule takes the 14-hour rule one step further in that a driver can only drive for 11 hours within a 14-hour period.

Under a 60 hour/7day and 70-hour/8 day, the driver may not be on duty for 60 hours in 7 consecutive days or 70 hours within 8 straight days.

Day	Hour
Sunday	5
Monday	10
Tuesday	8
Wednesda	9
Thursday	11
Friday	6

---

Saturday	10
Sunday	8
Total	67

As seen in the table above since the driver has totaled 67 hours of on duty driving, he/she follows the HOS rules.

The goal of the ELD is to improve driver compliance when it comes to their HOS and ROD's. According to the FMCSA, "ELDs will save up to \$1.6 billion a year in paperwork.

Additional savings will also be found due to reduced fuel costs, decreased truck downtime and reduced crash rates (Fletcher, 2017)" Drivers will have less fatigue while driving and give more accurate logs in their HOS with this mandate.

The ELD is a device that hooks up to a trucks engine and will record driving time electronically. It will also monitor the location of the truck and the driver, miles traveled and every time the truck moves. According to the FMCSA and DOT, records show that the ELD will prevent about 20 fatal accidents and 434 injuries a year.

While the FMCSA is clear on the rules of the new mandate there are exemptions to its own rule:

- Drivers whose trucks that are manufactured before the year 2000.

- Drivers who use paper Records of Duty for less than 8 days out of the month.
- Drivers who operate within a 150 air-mile radius of their home terminal.
- Drivers who operate farm vehicles and or haul pigs/cows.

“Although these exceptions exist now, keep in mind that they will not exempt your fleet or drivers indefinitely. As the rule currently stands, many, if not all of the technical exceptions and extensions will become moot in December 2019.” (driscoll, 2017)

However, not everyone in the industry agrees with this line of reasoning. Industry experts believe that the ELD mandate is adding to an already growing driver shortage. Opposition towards ELD is stronger among owner operators and small trucking companies as the new rule affects them more than larger companies who have the funds and personal to make the necessary adjustments. There is a small amount of quantitative evidence to support the link between ELDs, HOS compliance, and improved safety benefits.

### **1.6 How'd we get here?**

The country's 3 million truck drivers and the companies they work for are subject to several federal regulations that heavily influence the day to day operations within the supply chain. Main topics tied to trucking regulation are the Hour-of-Service Rule and Electronic-Logging Device Rule. Additional trucking regulations consist of truck size and weight, driver drug testing, and driver age requirements. Understanding these federal regulations that govern the commercial trucking industry and its drivers is important.

In 1887, the US government started regulating the rates charged and the free competition within the transportation industry when it created the Interstate Commerce Commission. Before trucking, moving freight by train was the popular mode of transportation. At that time, railroads were considered a symbol of technological and social progress. Several people who became wealthy in the 19<sup>th</sup> century did so by investing in railroads.

As remarkable as railroads were, products could only travel by fixed routes, and those often lead to your more populated urban areas. From there, freight was used by horse and buggy to get to rural destinations. And as impressive as moving freight by rail was, at that time, it still relied on earlier modes of transportation and was limited in terms of what it could accomplish.

“The rise of trucking made all the difference in terms of the movement of freight, but trucking didn’t really begin until the twentieth century (Harps, 2004).” The Great Depression changed the trucking industry forever. Government policies, such as the New Deal, created more jobs and opportunities throughout the country. The American Trucking Association was created in the early 1930’s to protect the interest of truckers. By 1934, The Code of Fair Competition was formed to shield the industry from corrupt business practices that lead to the economic issues during that era.

As the interstate Highway System began to grow, truck, rather than rail became the dominate mode of transportation. This is largely due to the trucking industry’s lack of regulation which gave truck drivers an unfair advantage. The federal government responded by passing the Motor Carrier Act of 1935. The Motor Carrier Act mandated new truckers to obtain a “certificate of public convenience and necessity” from the Interstate Commerce Commission. The ICC’s primary goal was to regulate American railroads to ensure fair rates. It determined which

companies became motor carriers, what and where they hauled and the rates they charged. It also regulated other aspects of common carriers such as trucking, interstate busing and telephone companies.

Truckers had to apply for rights, or authority, to haul products in territories in which they already did business. Motor carriers had to provide documentation of prior service in a specific lane that they were applying for. It wasn't always an easy task as the ICC was very restrictive in their interpretation of proof of service. New carriers had an even tougher time. Not only did they have to apply for a certificate of public convenience and necessity, but they also had to prove there was a need for another carrier in the market. The certificate system not only had a strangle hold on the industry but also entry into specific markets. Operating certificates limited the types of commodities that could be hauled and the routes that could be taken.

While the 1935 act and the ICC seemed to promote fair competition, the regulations create strict rules that imposed extreme burdens and monopolies that caused transportation rates to increase. It wasn't until the 1980's that congress decided to usher in a new era of deregulation. The Motor Carrier Act of 1980, also called the Motor Carrier Regulatory Reform and Modernization Act helped lower the level of intra and interstate commerce regulations within the trucking industry. The passing of the act resulted in growth that doubled the number of trucking companies over a ten-year period. It encouraged new companies to enter the industry and existing motor carriers to expand their operations.

Most ICC control over interstate trucking ended by the mid 90's. The ICC Termination Act transferred the remaining powers the agency possessed, such as licensing of motor carriers and economic regulation to the Federal Highway Administration and the Surface Transportation

Board. By the end of the 90's, congress decided that a separate governing authority, called the Federal Motor Carrier Safety Administration, was needed to improve the safety of trucking operations. The FMCSA was responsible for providing oversight of brokers and freight forwarders. Its primary mission is to prevent commercial motor vehicle-related fatalities and injuries. Activities of the administration contribute to ensuring safety in motor carrier operations.

After deregulation, more carriers entered the trucking industry, competition in the market began to grow. New competitors increased pressure on less efficient companies to exit the market. It allowed the introduction of operating procedures that made important productivity improvements in the trucking industry. It forced both Less-Than Load and Truck Load firms to focus on customer needs. Shippers reported significant savings and carriers were able to provide superior service. "Service became faster and more reliable, which made it easier for manufacturers to eventually operate in a just-in-time manner and reduce inventory warehousing (US Department of Transportation: Federal Highway Administration, 2017)."

Not only did deregulation bring with it intense competition, low margins, and barriers to entry, it also introduced new technologies. These technologies included e-commerce, load matching services, electronic data exchange, tracking systems and on-board computers. Embracing new technologies gave trucking companies the ability to conduct internet-based communication with their customers and improve service quality. The trucking industry found that the internet had the ability to better manage the flow of shipment information in a fragmented industry.

"Within a span of five years, the regulatory structures of the major domestic transportation industries were substantially reformed. The new guiding philosophy was that

competition should flourish within and between the modes. The ramifications guiding individual modes were not uniform. In the rail industry, consolidation was promoted to enable railroads to earn rates congruous with their capital-intense cost structure. Trucking witnessed a bifurcation into truckload, (TL) and (TL).” (parming, 2012)

There are two freight segments within the trucking industry. Truck Load (TL) and Less-than-truck load (LTL). LTL trucking involves transporting parcels of freight for an entire trailer. Freight shipments between an average of 150 and 20,000 pounds. Regarding LTL, drivers collect freight from multiple shippers who share space on the same truck only paying for their portion, making LTL a cost-efficient method of shipping freight. However, truckload is a method of transporting freight for larger shipments that occupy more than half and up to the full trailer, which can be 48’ or 53’ worth of trailer space. This method is commonly utilized when shippers decide they have enough of an order to fill a truck, want parcel shipment to be dedicated by itself, freight that is time-sensitive or the shipper decides it’s a more cost-effective mode than other options.

As economic activity, over the past 30 years, has increased; trucks are making more deliveries, drivers are facing greater pressure to meet strict deadlines. As a result, a growing number of transportations, capacity issues, driver problems and work conditions have become critical issues over the years. Truckers are away from home for weeks at a time. It requires many miles and driving alone for long hours each week dealing with low pay, route irregularities, load and unload freight, manual lifting and other factors.

According to the University of Michigan’s Trucking Industry Program, most truck drivers do not get paid for loading, unloading and other delays in transit. They often record it as

“off duty,” this allows them to save valuable work hours and extend their work week. The office of the Inspector General of the U.S. Department of Transportation finds that each 15 minutes of delay time, costs the American truck drivers more than 1 billion per year, and increases the average expected crash rate by 6.2 percent.

“When drivers are only paid for the miles they drive, there is an incentive for drivers to stretch the rules. We have all heard the stories of drivers having multiple logbooks to cheat the system. Instances of tired drivers having accidents resulting in motorist injuries and deaths are well documented. Comedian Tracy Morgan was in a car hit by a Walmart truck driver that resulted in the death of fellow comedian Jimmy Mack. The driver had been awake for more than 24 hours. Stories like these, in addition to our own personal experiences sharing the road with trucks have led to political action (Griffin, 2018).”

Motivated by an overall desire to promote safety on U.S. roadways, the federal government on December 10, 2015, announced the ELD mandate. This new rule requires all commercial motor vehicles to be equipped with Automatic On-Board Recorder Devices or Electronic Logging Devices by the end of December 2017. ELDs makes it easier for shippers and trucking companies to track, manage, and share the record of duty status of drivers. ELD's have been around since the 1990s but have never been mandated.

The federal government has linked ELD devices with safer roads and reduces fatigue. Driver fatigue accounts for 15-20% of commercial motor vehicle accidents each year. Truckers are particularly at risk due to extended workdays irregular schedules and poor sleeping habits. For several years, the Federal Motor Carrier Safety Administration has relied on research to

support a universal Electronic Logging Device mandate that has a direct and immediate impact on restricting actions strongly linked with higher crash rates.

Technology has replaced paper logbooks that were originally used for this reason. Truckers use digital devices to record their hours of service. This is mainly to make sure they are not violating the maximum allowed driving time during their 14 hours. Both Electronic Logging Devices and Automatic Onboarding Recording Devices electronically transmit hours of service information to a recordkeeping facility or database. Recorded information is made easily accessible to the Department of Transportation authorities. Even more so, this technology helps prevent driver coercion and harassment by shippers, third party transportation brokers and other carriers from forcing drivers to exceed safety regulations.

An Automatic On-Boarding Device is technology that connects to a truck's engine. However, Electronic Logging Device records a driver's HOS by linking up to the trucks electronic control module. Even though they seem similar an AOB RD records less data. Below is a chart that provided the Federal Motor Carrier Safety Administration, highlighting the difference between ELDs and AOB RDs.

<b>ELD</b>	<b>AOBRD</b>	
<b>What Does It Record?</b>	Engine Hours Date and Time	Engine Hours Data and Time

	<p>Locations Covered</p> <p>Vehicle Miles</p> <p>Driver Info</p> <p>Duty Status</p> <p>Log in and Log out</p> <p>Motor Carrier</p> <p>Engine On and Off Status</p> <p>Malfunction Data</p>	<p>Locations Covered</p> <p>Vehicle Miles</p> <p>Drive Times</p> <p>Duty Status</p>
<b>Driving Time</b>	No allowance for editing Driving Time	Driving Time can be edited if attributed to wrong driver
<b>Locations Covered</b>	<p><b>Automatic Recording of:</b></p> <p>Change in duty status</p> <p>Engine turn off and turn on</p> <p>Start and end of yard moves</p> <p>Personal conveyance</p> <p>60-minute driving intervals</p> <p><b>Accuracy of recording:</b></p>	<p>Recorded at each duty change</p> <p>Manual entry is possible</p>

	<p>Within 1 mile when driver is on 'on-duty driving'</p> <p>Within 10 miles when driver is on personal conveyance</p>	
<b>Editing History</b>	<p>Records when edit was made and by whom</p> <p>Annotation required for all edits</p> <p>Events recorded automatically can't be edited, they can be only annotated</p> <p>Edit history readily displayed to DOT inspectors</p>	<p>Records when the edit was made and by whom</p> <p>Does not easily display edit history</p>

When electronic logging devices were introduced to trucking 20 years ago, a single ELD would cost up to \$2500. As technology has grown over the years: smartphones, tablets, etc... it has helped lower the up-front and hardware costs. Today, the average cost to install this device is about \$500 per truck with annual fees ranging between \$165-\$832 dollars. It's essential for companies and drivers to do an ELD price comparison because many suppliers have different costs, fees for installation, training and other hidden costs. Factors to consider when evaluating ELDs:

Contract length

Most suppliers require drivers and or trucking companies to commit to a contract, some lasting 5 years.

#### Upfront costs

Some ELD providers charge for hardware along with installation, training, and monthly costs. However, many suppliers offer free hardware installation because their devices can sync to a driver's smartphone and or tablet.

#### Monthly fees

Monthly fees can range from \$20-\$100 a month

#### Installation fee

Installation costs are often hidden. Some vendors can charge over \$1000 and requires professional implementation.

 CONTRACT LENGTH

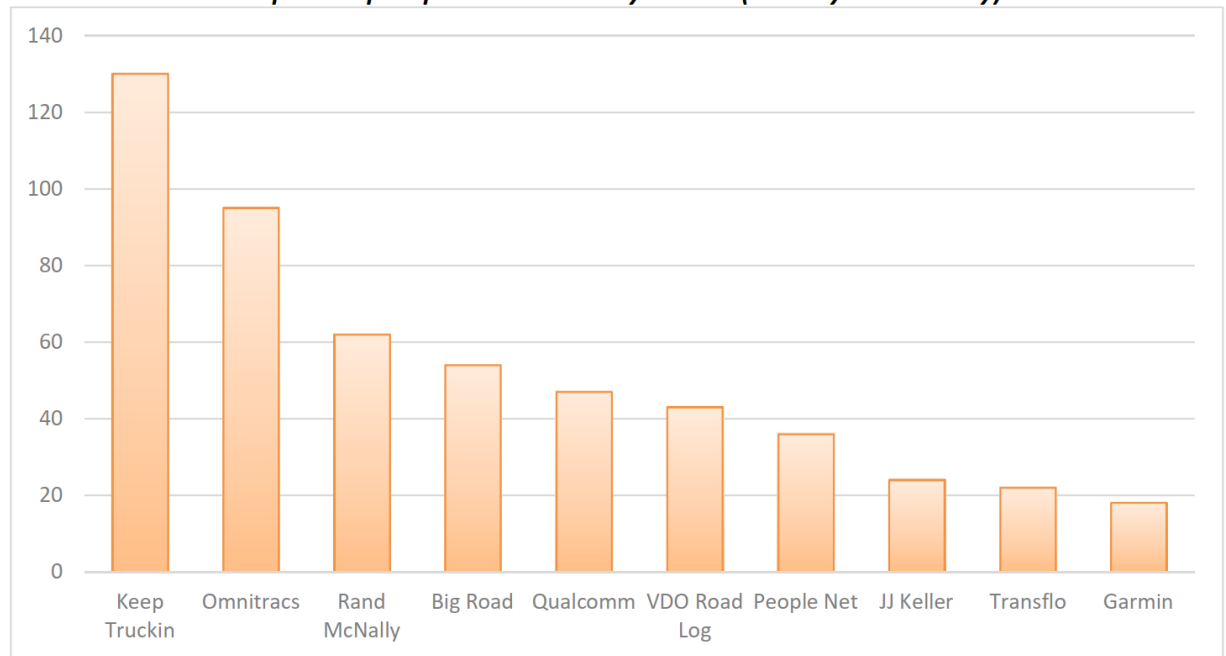
1 Year	3 Year	5 Year
<b>KeepTruckin</b>	PeopleNet Rand McNally Teletrac Telogis Zonar Fleetmatics	Omnitracs

 INSTALLATION COSTS

\$0	\$200 - \$300	\$2000 - \$4000
<b>KeepTruckin</b> Teletrac Telogis Zonar	Omnitracs	PeopleNet Rand McNally

 MONTHLY FEES

\$20 - \$40	\$40 - \$60	\$60 - \$80
<b>KeepTruckin</b> Omnitracs	PeopleNet Rand McNally Teletrac Telogis Fleetmatics	Zonar

**Graph 2: Top 10 purchased ELDs by Vendor (January 2019 Survey)**

It's critical for truck drivers to research all aspects of an Electronic Logging Device before buying. A carrier and or owner operator does not want to be stuck with a faulty or obsolete Electronic Logging Device simply because they signed a contract.

It's also essential to remember that the ELD conversation must involve training because the new rule isn't about installation but about its use. Training drivers is a critical element of the ELD mandate. A successful e-log rollout requires planning, training and a coordinated effort throughout the entire organization. Motor carrier companies must educate their drivers, dispatchers and fleet managers regarding the ins and outs of e-logs and the pressures and stress, drivers are under to keep moving.

If a driver is pulled over for an enforcement check, they are required to provide law enforcement with proper data from the ELD. Drivers found without an ELD in place will receive a ticket. According to the North American Transportation Association failure to comply could

result in ELD violations that can range from \$1,000 to \$10,000 dollars. The Federal Motor Carrier Safety Administration, in April, announced that ELD related violations are now included in the FMCSAs Safety Measurement System.

“The FMCSA’s Compliance, Safety and Accountability program has a few components, and SMS is one of them. It measures the safety of individual motor carriers by using roadside inspection data (not just out-of-service violations), as well as state-reported crashes, over the past 24 months. Results are measured in seven different categories, known as BASICS, which stands for Behavior Analysis and Safety Improvement Categories (hoffa).”

Law enforcement officials will give drivers tickets for failure to have the proper record of duty status and will place the driver out of service for at least 10 hours. After the 10 hours out of service period is over, the driver can continue his run to his or her final destination using paper logs. If it happens the driver is pulled over prior to reaching the customer, the driver must provide copies of inspection reports and evidence he or she is continuing the original trip. After completing the job, drivers are restricted from picking up another load and must return to their home base. Enough violations will create an alert notifying law enforcement officers to pull drivers over for an inspection any time.

Violations that count against the carrier’s safety measurement system scores according to the Federal Motor Carrier Safety Administration:

## ELD Violations in SMS

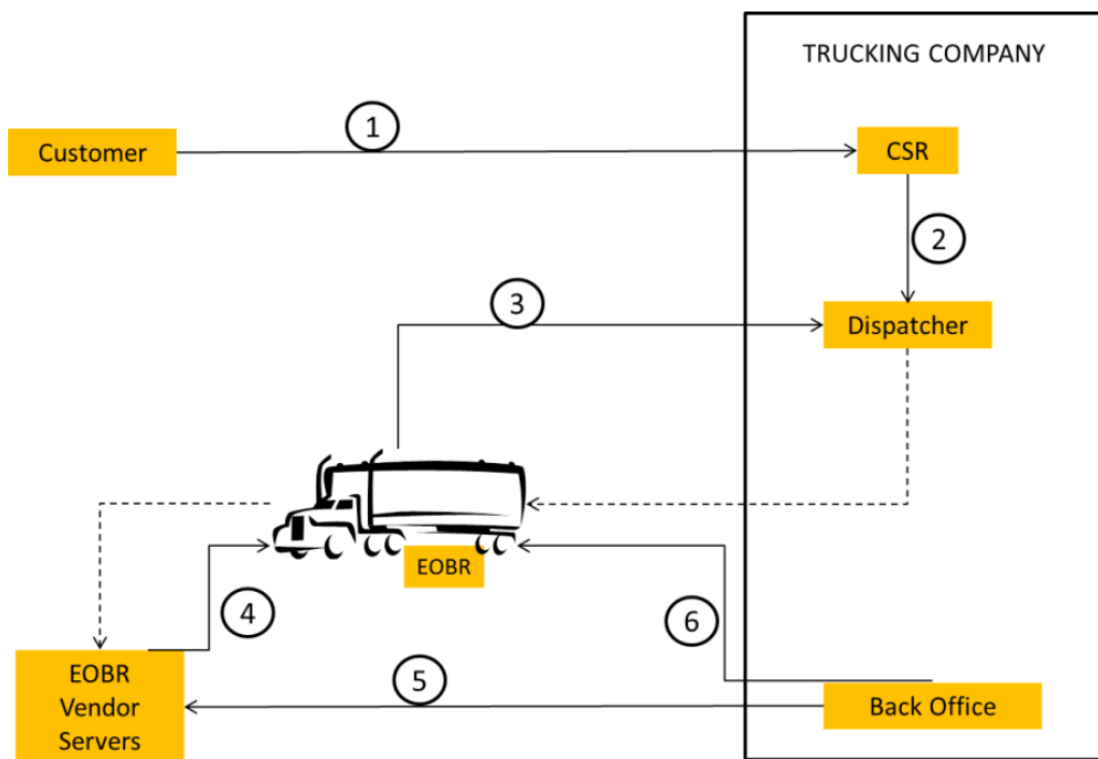
Section	Violation description	Violation group	Severity Weight
395.8A-ELD	ELD - No record of duty status (ELD Required)	Incomplete/ Wrong Log	5
395.8A-NON-ELD	No record of duty status when one is required (ELD Not Required)	Incomplete/ Wrong Log	5
395.8A1	Not using the appropriate method to record hours of service	Incomplete/ Wrong Log	5
395.11G	Failing to provide supporting documents in the driver's possession upon request	False Log	7
395.20B	The ELD's display screen cannot be viewed outside of the commercial motor vehicle.	Incomplete/ Wrong Log	5
395.22A	Operating with a device that is not registered with FMCSA	Incomplete/ Wrong Log	5
395.22G	Portable ELD not mounted in a fixed position and visible to driver	EOBR- Related	1
395.22H1	Driver failing to maintain ELD user's manual	EOBR- Related	1
395.22H2	Driver failing to maintain ELD instruction sheet	EOBR- Related	1
395.22H3	Driver failed to maintain instruction sheet for ELD malfunction reporting requirements	EOBR- Related	1
395.22H4	Driver failed to maintain supply of blank driver's records of duty status graph-grids	EOBR- Related	1
395.24C1I	Driver failed to make annotations when applicable	Other Log/Form & Manner	1
395.24C1II	Driver failed to manually add location description	Other Log/Form & Manner	1
395.24C1III	Driver failed to add file comment per safety officer's request	Other Log/Form & Manner	1
395.24C2I	Driver failed to manually add CMV power unit number	Other Log/Form & Manner	1
395.24C2II	Driver failed to manually add the trailer number	Other Log/Form & Manner	1
395.24C2III	Driver failed to manually add shipping document number	Other Log/Form & Manner	1
395.28	Driver failed to select/deselect or annotate a special driving category or exempt status	Other Log/Form & Manner	1
395.30B1	Driver failed to certify the accuracy of the information gathered by the ELD	Other Log/Form & Manner	1
395.30C	Failing to follow the prompts from the ELD when editing/adding missing information	Other Log/Form & Manner	1
395.32B	Driver failed to assume or decline unassigned driving time	Incomplete/ Wrong Log	5
395.34A1	Failing to note malfunction that requires use of paper log	Incomplete/ Wrong Log	5

**KEEP TRUCKIN**

All violations incurred by a driver will be counted against their Safety Measurement System Score (SMS). The SMS takes data from crash and roadside inspection reports over a two-year span which is used to investigate and identify motor carriers that pose the greatest risk to safety on our highways. Once a month the FMCSA updates information provided by the SMS and breaks them into seven Behavior Analysis and Safety Improvement Categories. The SMS

group's carriers that have similar safety events are then ranked. ELD violations range from 1, for not maintaining an ELD, to a 7 for failing to provide documentation upon request.

### 1.7 How Electronic Logging Devices work



*Figure 2 Flow Diagram of how EOBR is utilized daily*

Customers first reach out to a sales rep or customer service member within their carrier transportation network to place an order for a load to be picked up and delivered. The order is taken and placed in a format such as Electronic Data Interchange (EDI). Electronic Data

Interchange allows one company (customer) to send information to another business (vendor) electronically rather than with paper. The carriers' Customer Relationship Management System allows them to communicate with their drivers. They send the necessary information to the driver about his or her next assignment. For example, location of pickup/delivery, time of pick up/delivery, pick-up and delivery reference numbers, weight, total pieces and temperature if need be. This information is also sent to the trucking company's back office and others within the supply chain.

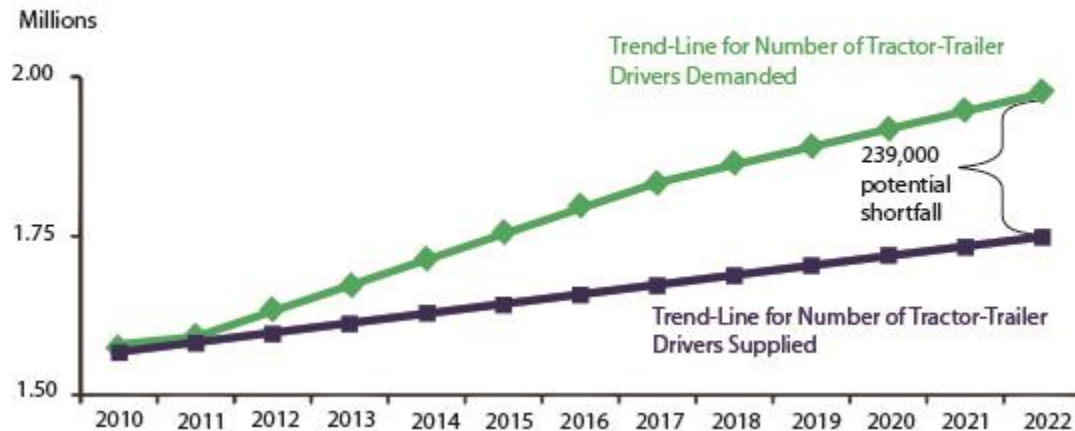
Personnel within the back office manage all records of communication taken place between the dispatcher and driver. The Electronic Onboard Recorder stores the data in their servers. In addition to the communication records, the Electronic On Boarding Recorder monitors and records all aspects that relate to the driving behavior such as speed, idle time, miles per gallon and driver logs. The carrier can then run analysis on the data to determine driving behavior.

### **1.8 ELD Impact on supply chain**

The Electronic Logging Device has been a hot topic in the transportation industry since its inception. ELDs make it easier for drivers to log their hours on the job and are more accurate than paper logs. The Goal of the ELD mandate is aimed at improving driver safety and the safety of others around them on the road. However, in order to meet customer/shipper high demands, it's not uncommon for drivers to go over their legal hours of service. While enforcement is solely

a safety measure to stop drivers from logging incorrect hours, shippers and customers will be impacted the most.

According to the Journal of Commerce, shippers will start witnessing a reduction of trucks on the road. This is because the USA is in the midst of the biggest driver shortage seen in history. The average age of commercial truck drivers is 50. As more drivers reach the retirement age, motor carriers are finding it even more difficult to find quality drivers to fill those seats. “According to the Business Insider the potential shortfall for tractor-trailer drivers is estimated to be around 239,000 by 2022 (Mckinstry).”



With nearly 70% of freight being moved by truck, 90% of those carriers are operated by owner operators or companies with less than six trucks. Truck capacity shortages will be

more felt among small and mid-sized carriers. It's a natural market reaction when there is a shortage. Pay goes up. According to the National Transportation Institute, the average salary of drivers has increased by 10%, currently making it \$60,000. Truckers are requesting more than adequate pay. For instance, 401(k), health care, paid time off, some companies are trying to attract experienced drivers with signing bonuses or referrals for staying with their companies. Several over the road drivers are paid by the mile not by the hour.

As a result of ELD mandate impacting truck capacity, shippers are noticing, not only, a shortage in drivers to haul their freight but also a rise in transportation rates. Smaller motor carriers and owner operators, who have made a living delivering in a day are now bordering on two. Larger companies will be forced to tie up their drivers for an extra day, thus having to pay their drivers more, and in turn charge more. For the shipper this will impact inventory costs. Depending on freight terms, an extra day charge in transit will result in the shipper incurring an extra day of holding costs. Consignees will have to adjust their production schedules and hold more inventory to avoid shut down of the production line.

The ELD mandate not only is transforming how motor carriers operate, but also forcing shippers and consignees to strategically plan their transportation needs, alter shipping and receiving policies, and form a close partnership in order to help business stay competitive. Shippers will have to reevaluate their distribution operations. For instance, review appointments and stick to them, preload trailers and search for other modes of transportation: rail, ship, air. Consignees will have to be more flexible to accommodate driver break downs and shutdowns.

Within the rules of the ELD mandate there is a stipulation forbidding coercion on part of the shipper. Not only do motor carriers follow these rules but shippers must abide by them too. Shippers that ignore this could face fines up to \$11,000 per incident of coercion. Shippers will be held to a much higher standard and can no longer turn a blind eye to what their trucking company or third-party provider is doing. Methods shippers can take:

- Develop a partnership and attach themselves with reputable partners. Lean on logistics professionals to help. Develop shipping and alternate plans. Involve customers in the process. Try and make everything transparent.
- Work closely with their trucking companies and 3PLs. Ask for their input. Work with carriers that are equipped with ELDs.
- Research alternative modes of transportation: intermodal transportation as it is becoming a very viable option to traditional truckload carriers. Rail can put double the capacity of one truckload by stacking containers onto one car. Rail can offset any capacity shortages and rate increases.

### **1.9 Impact of driver fatigue on driver retention**

“Let’s face it: no matter how professional or highly-skilled your truck drivers are, they will never be able to overcome their natural need for sleep.” (Meer, 2017)

Fatigue is defined as the feeling of tiredness after working for too long. It is an unyielding exhaustion that lowers a person’s energy level and ultimately affects performance, motivation and concentration at work.

**Conditions that lead to driver fatigue:**

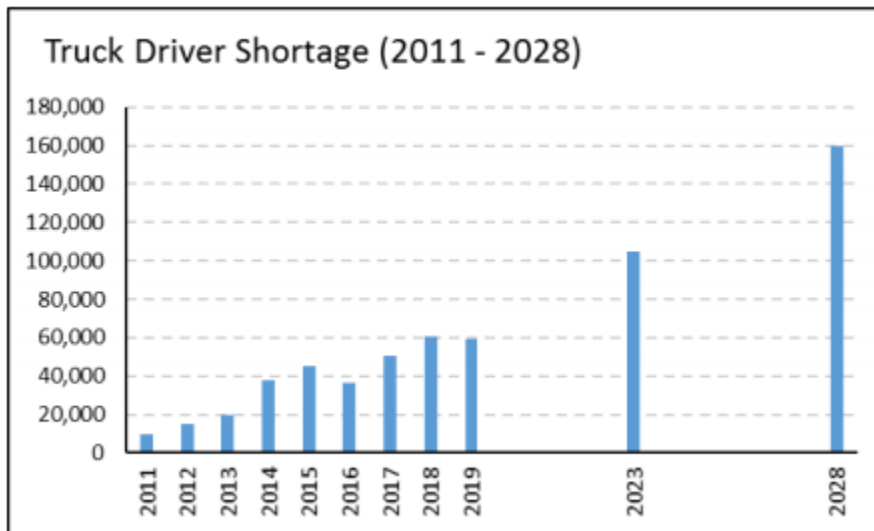
- Working Irregular Hours
- Very early start times
- Lack of quality sleep
- Working unreasonably long hours
- Extended graveyard shift.

**Symptoms of driver fatigue**

- Day dreaming
- Yawning
- Zoning out
- Heavy or sore eyes
- Deviating from your lane.

It goes without saying drivers who feel overworked will look to other avenues of employment opportunities. And when drivers are tired and fatigued, they are not focused on the job at hand. As well as the energy to pursue career growth will be greatly hindered. The career shelf life of a driver will not last long, or they will end up having an accident due to their fatigue which will permanently prevent them from driving.

In 2018 the trucking industry was down 61,000 drivers. This is nearly up 20% from 2017 number of 51,000 drivers. At this pace the shortage of drivers could grow to over 160,000 by 2028.



A 2015 study completed by the American Trucking Association stated 88% of trucking companies said they were getting enough applicants, but several were not qualified. The majority of driver turnover is due to change in the industry as drivers change carriers. As the demand for drivers grow, trucking companies try to recruit drivers from other carriers by offering sign-on bonuses, higher pay, newer trucks and better routes. In the next decade the industry will need to hire over 1 million new drivers. This comes out to 110,000 a year.

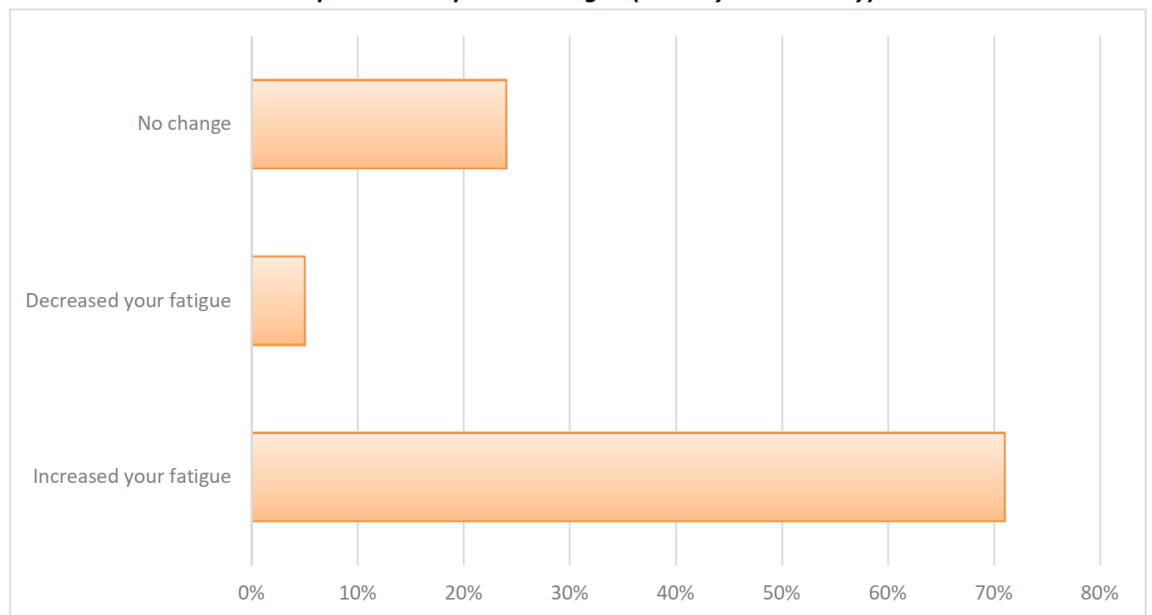
“Amid a mass nationwide truck driver shortage, Walmart has upped the ante by raising driver salaries to \$87,500 a year, an average, beginning this February, in a bid to attract the hundreds of workers it needs to fill out its fleet in 2019. The retail giant hired more than 1400 new drivers last year as same store sales grew 3 percent during 2018. The company needs another large batch of fresh drivers to keep it running. But the ultra-low unemployment rate and the job’s challenging on-the-road lifestyle mean there are fewer workers interested in taking these roles.’ (Renzulli, 2019)

**1.10 is the ELD Mandate making a difference?**

According to a survey study published by the Owner Operator Independent Driver Association (OOIDA) independent drivers state that the Electronic Logging Device Mandate is causing several issues for over the road drivers. 2,000 drivers were surveyed following the implementation of the government Mandate:

- 70 percent stated it was lowering overall safety
- 75 percent stated feeling more pressure to speed
- 72 percent felt exhausted
- 44 percent said they felt harassed.

**Graph 4: ELD impact on Fatigue (January 2019 Survey)**



Federal Motor Carrier Safety Administration (FMCSA) defines harassment as an act by a motor carrier towards one of its drivers resulting in driver(s) breaking hours of service rules. The mandate prohibits carriers from forcing drivers to drive when their judgement is impaired by fatigue, illness or other causes that violate safety.

The Federal Motor Carrier Safety Administration surveyed 628 truck drivers on the use of Electronic Logging Devices and driver harassment. Out of 341 drivers using Electronic Logging Devices 37 percent said their employers interrupt off duty time at inappropriate times at least once a month. Opposed to 258 (22 percent) of drivers using paper logs.

**Table 1: The Number of Driver Effected by Harassment and the Number of Carriers that Practice Harassment**

Specific Interactions That Drivers Experience on a Monthly Basis	1+ Times Per Month Among Those Who Use ELDs	Number of Drivers Effected by Harassment	1+ Times Per Month Among Those Who Use ELDs	Number of Carriers that Practice Harassment
<b>Paid and Unpaid Time</b>				
Require you to wait between loads for more than 2 hours without pay.	41%	943,000	35%	181,300
Require you to wait for customer delays for more than 2 hours without pay.	39%	897,000	28%	145,040
<b>Fatigue</b>				
Ask you to operate when you judged you were fatigued.	12%	276,000	5%	25,900
<b>Logging and Breaks</b>				

Ask you to log your hours inaccurately to get more work time or delay a break.	9%	207,000	3%	15,540
Change your log record after it was made to give you more work time or delay a break.	10%	230,000	5%	25,900
<b>Communications</b>				
Interrupt your off-duty time with a message at an inappropriate time.	37%	851,000	29%	150,220
<b>Schedules</b>				
Ask you to meet a customer load schedule you viewed as unrealistic	40%	920,000	18%	93,240

**Table 2: Other events experienced by drivers at their current employer**

Other Events That Surveyed Drivers Experienced While Employed at Their Current Company	Among Those Who Use ELDs	Number of Drivers Effected by Harassment
Any in list (net)	39%	897,000
Contacted by your carrier, to find out why your truck wasn't moving	23%	206,310
Told to record your loading/unloading hours as off duty	12%	107,640
Told to log your duty status as fixed number of minutes on duty, and the rest of the time as off duty while loading or unloading	11%	98,670
Your carrier changed your duty status in your logs	11%	98,670
None of these	61%	1,403,000

One of the main reasons for these violations are the various ways these rules are interpreted by dispatchers, drivers, management and others. Years ago, it was the job of the motor carrier to move freight from point A to point B at all costs without damage. In today's world, however it is different, the motor carrier walks a fine line between what is legal, satisfactory, and expected, relating to the hours of his or her drivers, while trying to fulfill expectations of the customer. Because of the new Hours of Service Regulations coupled with Electronic Logging Device Systems, motor carriers not only have to be, "a master at time management, but a master of his or her drivers' time as well." (J.J Keller's Fleet Mentor, 2013)

### 1.11 Discussion

There are several positive aspects of the Electronic Logging Device Mandate: reduced paperwork, more available information for both drivers and management, driver work schedules, better knowledge of driver work schedules, and increased pressure for more efficient warehouse operations to avoid the cost of delaying drivers at loading and unloading docks. However, regarding safety drivers are heavily incentivized to dodge accidents, and this did not change with the Electronic Logging Device Mandate. There is evidence that the Electronic Logging Device Improved Hours of Service Compliance; however, the mandate did not noticeably improve safety, and there is little statistically significant evidence that Electronic Logging Device adoption corresponds to any reduction in accident rates.

To recap, research that specifically relates to Electronic Logging Devices and their impact on Hours of Service Regulations and overall trucking industry are small but extremely useful sources of information. The question comes up, a violation, specifically an Hours of Service violation, is the direct cause of an accident. For instance, if a driver is in violation of his or her Hours of Service and it results in a crash, did that violation cause the accident?

Upon further research, the Federal Motor Carrier Safety Administration has not made a direct correlation in relationship with Hours of Service violations and fatigue related accidents. Surveys have proven that several drivers have reported an increase in driver fatigue as a result of Electronic Logging Devices. Even more struggle to find parking in a safe place. Drivers have incurred high up-front cost for installing and service fees associated with a device. 70 percent of carriers were charged per truck while those owner operators pay a fee of \$40.

Drivers have recorded that they have seen an increase in risky driving behavior. “the reason is now you are on a clock that is always pushing you. I panic when I am a shipper or receiver and I see the clock running out on my drive time. I refuse to sleep on the side of the road. It is not safe (overton, 2018).” Lastly, drivers have also noted that they have experienced increased harassment from their bosses as a result of their employer being able to view their hours. One driver stated, “carriers can see how many hours you have left and will at times pester a driver to get going in order to service the customer, disregarding the driver who may or may not be well enough to roll out (overton, 2018) .”

It’s important to understand how the Federal Motor Carrier Safety Administration made their conclusion for crash risk probability is based on a benefit-cost analysis. The Roadside Intervention Model groups violations that are similar in nature. The model is based on three estimates in developing the crash risk reduction probability for a violation group:

1. Crash risk in the group is defined as the likelihood that the unsafe behavior associated with violation contributes to a crash during one day of driving;
2. The duration of the reduction in crash risk when a violation in the group is identified at the roadside and corrected, which carried according to the violation group;
3. The correction rate for violations in the group that are corrected as a result of the intervention.

The crash risk probability divides the number of accidents with a violation by total trips with the violation. However, there is no cause of the crash only that there was a violation of the specific grouping.

$$\frac{\# \text{ Crashes With Violation (j)}}{\text{Total Trips With Violation (j)}} = \text{Likelihood of Crash With Violation (j)} = \text{CRP}$$

The next picture shows the total number of non-crash trips with a violation; however, this presents challenges as not all inspections are recorded.

$$\frac{\# \text{ Non-Crash Inspections With Violation (j)}}{\# \text{ Non-Crash Inspections Without Violation (j)}} \times \text{Total \# Non-Crash Trips} = \text{Total Non-Crash Trips With Violation (j)}$$

It's important to note that several researchers, organizations such as the Government Accountability Office, have been extremely critical of this methodology as it was based on assumption on assumption and not empirical evidence.

### **1.12 conclusion**

There are important insights to be gained from additional research on The Electronic Logging Device and its impact on the trucking industry. According to the Federal Motor Carrier Safety Administration, the goal of the rule is to lower the number of accidents caused by driver fatigue from drivers violating Hours of Service rules. The key to the rule is to improve the physical condition of drivers and allow them to drive safely.

Unfortunately, the Federal Motor Carrier Safety Administration did not acknowledge the financial burden placed on small carriers and owner operators. It also assumed that every out of service violation prevented an accident from happening. "if the reader were to accept this assumption, then it would naturally follow that every violation has the potential to save lives (Owner-Operator Independent Drivers Association, 2016)." In addition, the Federal

Motor Carrier Association failed to understand the pressure that carriers place on their drivers to operate even when they are exhausted. And lastly, “FMCSA has failed to recognize that their own research found no difference between fleets with ELDs and those without them for USDOT-recordable and fatigue related crashes, thus negating the premise behind the Final Rule.” (Owner-Operator Independent Drivers Association, 2016)

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