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WHITE PAPER
Review of FMCSA's

*Evaluating the Potential Safety Benefits of
Electronic Hours-of-Service Recorders
Final Report*

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Introduction

The mission statement for the Federal Motor Carrier Safety Administration (FMCSA) is to focus “on reducing crashes, injuries, and fatalities involving large trucks and buses.” A primary component of FMCSA’s duties involves the regulating of the hours-of-service of commercial motor vehicle (CMV) operators, which the Agency promulgated with the idea of reducing fatigue and improving safety. All CMV drivers subject to the hours-of-service (HOS) regulations are required to keep a paper record of duty status (RODS). Nonetheless, FMCSA believes that CMV drivers may violate the HOS regulations by falsifying their paper RODS. Therefore, the Agency proposed a supplemental notice of proposed rulemaking (SNPRM) mandating the installation of electronic logging devices (ELDs).

In addition, FMCSA commissioned the Virginia Tech Transportation Institute (VTTI) and a third-party vendor to conduct a study evaluating the safety benefits of ELDs. The study, entitled *Evaluating the Potential Safety Benefits of Electronic Hours-of-Service Recorders (EHSRs) Final Report*, analyzed previously generated compliance data from participating motor carriers. The final data utilized for the study included eleven carriers, which according to the study, represented “small, medium, and large carriers.”

However, the study did provide a caveat that the research was “skewed toward large, for-hire carriers and may not represent the overall U.S. trucking population.” Upon further review of the eleven participating carriers, nine possessed over 1,000 trucks while the remaining two operated between 100 and 500 trucks. Obviously, in no way do the eleven carriers represent small or even medium sized motor carriers, as 97% of all fleets are twenty trucks or less, and 90% of all fleets are six trucks or less.

Furthermore, regarding the selection of the eleven carriers, the study stated, “Although the sample of participating carriers in the current study was a **convenience** sample, every attempt was made to obtain a sample that was representative of the general CMV population¹” (emphasis added). While attempting to recruit carriers for the study, the research team looked for motor carriers that had power units both with and without ELDs instead of looking to recruit carriers that specifically had one or the other. In addition, the researchers contacted selected carriers via email and/or telephone, which further demonstrated a selection bias in the research.

¹ Jeffrey S. Hickman et al., *Evaluating the Potential Safety Benefits of Electronic Hours-of-Service Recorders Final Report*, FMCSA (April 2014), pg. 2.

Table 1: Participating Carriers' Demographic Information

Carrier ID	Carrier Description	Number of Power Units	Number of Full-time employees
A	For hire: truckload Other: temperature control	1,001 or more	1,001-5,000
B	For hire: truckload	1,001 or more	1,001-5,000
C	For hire: truckload Private: less-than-truckload For hire: regional Other: company drivers and owner-operators	1,001 or more	5,001 or more
D	For hire: less-than-truckload	1,001 or more	5,001 or more
E	Private: truckload Private: regional	1,001 or more	5,001 or more
F	For hire: truckload For hire: less-than-truckload For hire: regional Owner-operator	101-500	101-500
G	For hire: less-than-truckload	1,001 or more	5,001 or more
H	For hire: less-than-truckload	101-500	1,001-5,000
I	For hire: truckload For hire: regional	1,001 or more	5,001 or more
J	For hire: truckload	1,001 or more	5,001 or more
L	Private: regional Private: less-than-truckload	1,001 or more	5,001 or more

* Carrier K was excluded from the analysis

According to the research, the purpose of the project was to conduct a literature synthesis and an effectiveness evaluation on EHSRs with the data that was collected. For the project, EHSRs were defined as any device that electronically records drivers' HOS. The data collected from the participating carriers was used to answer the following research questions:²

1. Do individual CMVs equipped with EHSRs have a significantly lower total crash rate than CMVs without EHSRs?
2. Do individual CMVs equipped with EHSRs have a significantly lower U.S. Department of Transportation (USDOT)-recordable crash rate than CMVs without EHSRs?
3. Do individual CMVs equipped with EHSRs have a significantly lower "preventable" crash rate than CMVs without EHSRs?
4. Do individual CMVs equipped with EHSRs have a significantly lower rate of fatigue-related crashes than CMVs without EHSRs?
5. Is there a significant difference in the HOS violation rates between CMVs with EHSRs and CMVs without EHSRs?

² Ibid, pg. xii.

It is important to note the separation of the crash types into four distinct categories instead of simply utilizing DOT-reportable crashes. A DOT-reportable crash is defined as any truck involved in an accident having a gross vehicle weight rating or a gross combination weight rating over 10,000 pounds used on public highways, which results in one of the following: (1) a fatality; (2) an injury requiring immediate medical treatment away from the crash scene; or (3) a vehicle has to be towed.³ The need for more crash information other than DOT-reportable crashes is unclear, and the research does not answer this question.

Interestingly, the research team noted that they took their datasets directly from the carriers instead of only using FMCSA data. According to the study, there were a couple of limitations associated with the carrier provided data. First, the study admitted, "one issue the research team experienced was that the criteria for recording crashes varied considerably among carriers. Some carriers recorded minor crashes (e.g., scratching the truck body in a parking lot) that were often omitted by other carriers."⁴ Therefore, in order to eliminate a "severe bias in EHSR evaluation," the research team pursued a unified crash standard that included "consistency of crash definitions across carriers," by merging all the data under a common heading. However, the research team did not define what this definition is, thus it appears that they utilized additional crashes other than those considered DOT-recordable.

Furthermore, the research team admitted that the crash files obtained from the participating motor carriers might have contained errors that could have influenced the evaluation, as there was no way to determine the veracity of the crash files.⁵ Therefore, the research team not only utilized inconsistent data from the carriers, but also included data sets that may have contained errors.

To compound the problem, the study coded crashes by utilizing the first impact or harmful event. For an example, a vehicle that encroached on a truck's lane, thereby causing the truck driver to make an avoidance maneuver that resulted in the truck rear-ending another vehicle, would be coded as a rear-end collision.⁶ Thus, even though the driver did correctly by trying to avoid the crash, it was counted against the driver. The question is how an EHSR could have helped prevent the action of the encroaching vehicle?

As a result, the final data set included approximately 83,000 crashes. Even considering the large size of the eleven motor carriers, the number of crashes included in the data over the five-year span of the study appears to be unrealistic. In fact, if the number of crashes were accurate, it would demonstrate that these carriers are an imminent safety hazard regardless of their use and potential safety benefits of ELDs. Other limitations listed in the study are as follows: (additional comments are in parenthesis)

- Data set skewed toward large carriers.

³ "Definitions," Title 49 Code of Federal Regulations, Pt. 390.5.

⁴ "Evaluating the Potential Safety Benefits," pg. 17.

⁵ *Ibid*, pg. 41.

⁶ *Ibid*, pg. 23.

- One factor that was not included was driver characteristics, which might affect the crash rate. (FMCSA routinely quotes research showing that driver error is the single leading cause for over 80% of all crashes, yet the study does not take in to consideration driver characteristics.)
- No information on the functionality of the EHSRs. (The research team never actually checked to see if the EHSRs were functioning properly.)
- It is possible that carriers systematically targeted problem drivers/operations with EHSR installation.
- The design was quasi-experimental and subject to many threats to inferential validity. Could have been many confounding factors not collected that could have influenced the results. (So many confounding factors could come up in any retrospective cohort study, such as this one, that it makes any conclusions highly speculative.)
- During analysis it was determined that a large percentage of VINs did not match the VINs in the data set thus admitting it may have affected the HOS violation results. (The research team could not match a large percentage of trucks to the crashes or HOS violations yet they still made their projections.)

Methodology

The main objective for the study was to quantitatively evaluate the safety impacts and the impact on HOS violations for EHSRs, that is, whether the trucks equipped with EHSRs have a lower (or higher) crash and HOS violation risk than those without EHSRs.⁷ For the methodology, the research team followed the principles from epidemiology studies, which is the study of the distribution and control of diseases in a given population, because they could not control for exposure. Nonetheless, the study stated a page later, “the research team collected mileage information from each truck to control for differences in exposure.”⁸ In fact, the final data included 15.6 billion miles, which entertains the question, how could the research team not control for exposure. Additionally, it is important to note that the non-EHSR cohort traveled significantly more miles than the EHSR cohort did, 9,561 million vehicle miles traveled (MVM T) compared to 6,047 MVM T, respectively.

The research team also used a retrospective cohort study, which takes information from past events (crashes) and develops a particular risk factor, while looking at a system, such as ELDs, that might have mitigated those crashes. It is extremely important when conducting a retrospective cohort study to identify what are called confounding factors, or in other words variables, which may have influenced the crashes. There are some disadvantages associated with retrospective studies, including selection and information biases that may significantly influence the outcome of the study.

⁷ Ibid, pg. xii.

⁸ Ibid, pg. xiii.

The Results

The research team originally collected all the data (i.e., data on CMV crashes, vehicles, HOS violations, and carrier demographics) from twelve large motor carriers, but the study stated that one carrier systematically, though inadvertently, targeted new drivers with ELDs, therefore that carrier was excluded from the analyses. Nevertheless, the study does not adequately address why this should be a serious issue. The purpose of the study is to evaluate the potential safety benefits of ELDs, which would include all types of drivers, new or experienced. The carrier should not have been excluded from the analysis, as thousands of new CMV drivers enter in to the trucking industry every year.

The data from the remaining eleven carriers included a total of 224,034 truck-years, 15.6 billion miles traveled, 83,943, and 970 HOS violations. Although the research team collected information on “truck-years,” they do not define what is a truck-year or the purpose of this data. The study determined the safety outcome of the cohorts with and without EHSRs by dividing the crash frequency by the mileage. Therefore, why are truck-years even needed for this study?

There were two levels of exposure status in the study, trucks with EHSRs or without EHSRs. The number of crashes that occurred for each cohort measured the safety outcomes. As stated previously, the crash frequency and mileage were collected for each truck over the five-year study period. The safety effects of the EHSRs were evaluated by comparing the crash rate between cohorts.⁹

Interestingly, the data collected from all twelve carriers included 253,227 truck years, 180,023 crashes, and 1,889 HOS violations before it was filtered by excluding all of the following data:

- Yearly mileage not provided;
- Yearly mileage less than 200 miles;
- Yearly mileage more than 300,000 miles;
- All data from Carrier K; and
- Truck ID number or VIN not provided or unable to match to vehicle data set.

Again, it is important to stress the accuracy of the number of crashes. The idea that only twelve motor carriers could account for 180,023 crashes is a scary concept. If true, these carriers do not need ELDs, they need to be removed from the road all together.

The research team concluded that trucks equipped with EHSRs had a total crash and preventable crash rates per MVM T that were significantly lower than the rates for trucks not equipped with EHSRs, twelve percent lower for total crash rate and five percent lower for preventable crash rate. Nonetheless, the study did not find any safety benefit between EHSR and non-EHSR carriers for US DOT-recordable and fatigue-related crashes.

⁹ Ibid, pg. 18.

Type of Crash	EHSR cohort	Non-EHSR cohort	Total
Total Crashes	29,093	53,850	83,943
Preventable Crashes	14,537	24,987	39,524
DOT-Recordable Crashes	3,197	5,729	11,782
Fatigue-related Crashes	328	659	987

The study's premise behind the safety of EHSR use is to increase HOS compliance, which in turn reduces driver fatigue, resulting in increased on-road safety. However, if the results of the study detect no safety benefit for DOT-recordable crashes and fatigue-related crashes, then the research team's premise is false and is not valid. Below is a following list of operational definitions for crashes utilized in the study. According to the research, EHSRs do not demonstrate any safety benefits by reducing fatigue, how then would having an ELD equipped on a truck prevent any of the following crashes?

Table 2: Operational definition for the uniform crash types

Crash Type	Operational Definition
Run Off Road	The truck ran off the road, and the road and/or surface caused the first damage to the truck.
Head-on	The truck had a front-end collision with another vehicle on the roadway.
Rear-end	The truck rear-ended another vehicle on the roadway.
Rear-ended	The truck was rear-ended by another vehicle on the roadway.
Sideswipe	The truck struck another vehicle/object traveling in the same direction on its side.
Opposite Sideswipe	The truck struck another vehicle traveling in the opposite direction on its side.
Backing	The truck backed up and struck another vehicle or object.
Parking Lot	The truck struck a fixed object or vehicle while maneuvering in a parking lot, dock, or truck stop.
Hit Object in Road	The truck hit an object in the roadway while driving.
Hit Animal	The truck struck an animal in the roadway.
Rollover	The truck rolled over, and the rollover was the first impact.
Jackknife	The truck jackknifed, and the jackknife was the first impact (loss of control of the trailer).
Parked	Another vehicle, person, or object damaged the truck while it was parked
Roll back	The truck rolled back into another vehicle or object after releasing the brake.
Roll Away	The truck rolled forward into another vehicle or object after releasing the brake.
Hit Fixed Object	The truck struck a fixed object not on the roadway.
Hit Pedestrian	The truck struck a person
Overhead	The truck struck an overhead object (e.g., an overpass).
Mechanical	The truck experienced some sort of mechanical failure.
Hit by Other Vehicle (OV)	Another vehicle struck the truck, but there was not enough information to classify a specific crash type.
Truck Hit OV	The truck struck another vehicle, but there was not enough information to classify a specific crash type.
Broadside	The truck had a driver/passenger side impact with another vehicle, or the OV had a driver/passenger side impact with the truck.
Other	Miscellaneous crash circumstances that did not fit into other categories
Non-contact	Any instance where there was not contact with another vehicle, object, or pedestrian (e.g., tire blowout

HOS

The research team collected HOS violation data from each of the participating carriers. However, the research team discovered that some carriers collected internal HOS data, whereas others did not, similar to the manner in which carriers collected crash data. Nonetheless, instead of attempting to unify the HOS data as the research team did with the crash data, they instead turned to FMCSA's Safety Management System (SMS) online web page. Unfortunately, the SMS web page only provides data for two years prior to the retrieval date. Thus, HOS violation data was only collected from a small portion of 2010, all of 2011, and 2012.¹⁰

Nonetheless, the study claimed that final datasets included 970 HOS violations over a 5-year period, which appears incredibly low considering a single carrier such as Swift Transportation (US DOT 54283) has 841 HOS violations in only a two-year period. The following definitions were utilized in the study to determine non-driving-related HOS violations; notice that there is no inclusion of on-board recording device violations.

- Driver's RODS not current,
- Log violation (general/form and manner),
- Driver failing to retain previous 7 days of logs,
- False report of driver's RODS,
- No driver's RODS, and
- No log book.

By looking at Swift's CSA scores, 51% of their HOS violations are on-board recording violations. It begs the question what HOS violations the research team used to reach only 970 HOS violations. Furthermore, through a survey of its members, the Owner-Operator Independent Drivers Association's (OOIDA) Foundation found that many law enforcement officials pass on conducting level 3 inspections, in other words logbook inspections, on trucks that have an ELD installed. The Foundation's study stated that 34% of its members equipped with ELDs had personally experienced a law enforcement official passing on inspecting their RODS, while another 40% stated that they saw this same event occur with other truck drivers. Therefore, it is unlikely that the research team accurately studied the HOS violations or the potential effect EHSRs have in improving HOS compliance.

Conclusion

The purpose behind the FMCSA commissioned study was to evaluate the potential safety benefits and HOS compliance of EHSRs. The study claimed that trucks equipped with EHSRs had a total crash and preventable crash rates per MVMT that were significantly lower than the rates for trucks not equipped with EHSRs, but as this review has demonstrated, the study's conclusion was based upon faulty data and a faulty interpretation. In fact, even the study itself lists numerous limitations with data sets, from a skewed representation of the trucking industry to utilizing crash data with possible errors. As

¹⁰ Ibid, pg. 22.

established earlier in the review, even the definitions used to define crashes and HOS violations contained errors while also excluding important information.

The entire premise behind safety benefits associated with the installation and use of EHSRs involves the improvement of HOS compliance, which in turn would reduce fatigue, resulting in fewer crashes. Nonetheless, the study did not find any safety benefit between the EHSR and non-EHSR equipped carriers for US DOT-recordable and fatigue-related crashes. Therefore, the hypotheses that EHSR equipped trucks are more compliant with the HOS regulations, thus reducing the drivers' fatigue, and mitigating crashes is false.

However, regardless of any results found by the research team, whether by faulty data and interpretation or not, there are too many limitations and confounding factors associated with the study for any conclusions to be valid.

Bibliography

Hickman, J. S., Camden, M. C., Guo, F., Dunn, N. J., & Hanowski, R. J. (2014). *Evaluating the Potential Safety Benefits of Electronic Hours-of-Service Recorders Final Report*. Federal Motor Carrier Safety Administration.