Attitudes of Truck Drivers and Carriers on the Use of Electronic Logging Devices and Driver Harassment

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

November 2014

FOREWORD

The purpose of this research is to investigate issues associated with truck driver harassment by carriers, and whether harassing experiences vary due to the hours-of-service (HOS) logging method used by the driver. The research was initiated in response to a judgment that the Federal Motor Carrier Safety Administration's (FMCSA's) efforts to mandate electronic logging devices (ELDs) could not proceed due to failure to consider driver harassment. The research reviews the frequency of interactions between drivers and carriers, and whether or not drivers consider their experiences to be harassment. The analysis reviews the results among drivers as a whole, and compares the views of those who use ELDs to log their HOS to the views of those who use paper logs. A similar analysis is applied to a sample of carriers. The research uncovers rare instances of harassment (as reported by the drivers) but does not reveal a pattern where drivers who use ELDs are subject to greater harassment than those who use paper.

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16. Abstract

The research contained herein is an examination of managerial harassment experienced by drivers, and whether harassment is associated with the method used to log hours of service (HOS). Similar information was gathered from a sample of carriers.

Truck drivers were interviewed in person at truck stops in the United States; carriers were interviewed online via a Web survey. The evidence in this survey research does not support concluding that harassment occurs due to being in a situation where HOS are logged using electronic logging devices (ELDs).

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SI* (MODERN METRIC) CONVERSION FACTORS

Approximate Conversions to SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		Length		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		Area		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	Acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		Volume (volumes greater than 1,000L shall be shown in m^3)		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		Mass		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2,000 lb)	0.907	megagrams (or “metric ton”)	Mg (or “t”)
		Temperature (exact degrees)		
°F	Fahrenheit	5(F-32)/9 or (F-32)/1.8	Celsius	°C
		Illumination		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		Force and Pressure or Stress		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

Approximate Conversions from SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
		Length		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		Area		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
Ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		Volume		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		Mass		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or “t”)	megagrams (or “metric ton”)	1.103	short tons (2,000 lb)	T
		Temperature (exact degrees)		
°C	Celsius	1.8c+32	Fahrenheit	°F
		Illumination		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		Force and Pressure or Stress		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003, Section 508-accessible version September 2009.)

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

Acronym	Definition
AAPOR	American Association for Public Opinion Research
ACS	American Community Survey
AFM	Advanced Fatigue Management
ANPRM	Advance Notice of Proposed Rulemaking
AOBRD	automatic onboard recording device
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BFM	Basic Fatigue Management
BLS	Bureau of Labor Statistics
CDL	commercial driver's license
CMRS	commercial mobile radio services
CMV	commercial motor vehicle
CSA	Compliance, Safety, Accountability
CV	coefficient of variation
d.f.	degrees of freedom
DEFF	design effect
EAI	Epidemiological Appraisal Instrument
EC	European Commission
EEOC	Equal Employment Opportunity Commission
ELD	electronic logging device
EOBR	electronic onboard recorder
EVMS	electronic vehicle management system
EWD	electronic work diary
FAF3	Freight Analysis Framework Version 3.0

Acronym	Definition
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulation
FMS	fleet management system
GPS	global positioning system
HOS	hours of service
ICC	intra-class correlation coefficient
IEEE	Institute of Electrical and Electronics Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act
MCSIA	Motor Carrier Safety Improvement Act
MSA	metropolitan statistical area
MFP	multifactor productivity
NAICS	North American Industry Classification System
NRFU	non-response follow-up survey
OBC	onboard computer system
PIN	personal identification number
PSU	primary sampling unit
QR	quick response
RODS	record of duty status
SE	standard error
SEQ	sexual experiences questionnaire
SMTP	simple mail transfer protocol
SNPRM	Supplemental Notice of Proposed Rulemaking
STM	standard hours
TL	truckload
TMC	Technology and Maintenance Council
TR	trip recorder

Acronym	Definition
USB	universal serial bus
USDOT	U.S. Department of Transportation
UTC	current local time
UWE	unequal weighting
VIUS	Vehicle Inventory and Use Survey
VU	vehicle unit
ZIP	Zone Improvement Plan

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EXECUTIVE SUMMARY

This research examines the nature of harassment as viewed by truck drivers who are required to record their hours of service (HOS) for the purposes of Federal reporting regulations. As it examines their perceptions, this research also reviews:

- Whether drivers' experiences and interactions with their carriers fall into the category of harassment.
- If these experiences occur with any regularity (once or twice a month or more).
- Whether these interactions are made possible as a result of the carrier using HOS data collected via an electronic logging device (ELD) and whether it was a standalone ELD or part of a comprehensive fleet management system which included ELD capability.

These experiences and perceptions are reviewed both for truck drivers and for carrier personnel who manage truck drivers. The data collected from carrier personnel is similar to that collected from the drivers; that is, carriers were asked about the regularity of specific interactions with drivers at their firm, and whether the drivers might consider such actions (if they occur) harassment.

Drivers are analyzed according to the systems they use for logging their HOS (i.e., paper or ELD). Carrier personnel are also considered according to the primary HOS logging method used by their company.

Additional data was collected regarding attitudes about ELDs, reactions to definitions of harassment and coercion developed by the Federal Motor Carrier Safety Administration (FMCSA), ways in which drivers are compensated and evaluated, and profiles of both the drivers and the carrier companies.

The main purpose of this research is to enable the Agency to determine whether the mandatory use of ELDs would result in driver harassment. Key findings are as follows:

1. **Interactions which drivers consider harassment.** Drivers were given a list of 14 specific interactions between carriers and drivers that could be considered harassment. Fewer than 30 percent of surveyed drivers considered any one of these interactions to be harassment; 42 percent said that none of the items on the entire list would be considered harassment. The actions most commonly considered harassment included: interrupting a driver's off-duty time with a message at an inappropriate time (28 percent); asking the driver to operate when the driver judged himself to be fatigued (28 percent); asking the driver to log hours inaccurately to get more work time or to delay a break (26 percent).
2. **Frequency of experiencing interactions considered harassment.** Few drivers experience regular interactions with their carriers that they consider to be harassment. The most prevalent interaction that drivers consider to be harassment is being interrupted by a message from the carrier at an inappropriate time while off duty (12 percent at least once a month, 7 percent at least twice a month). Across the 14 interactions, there is very little difference (regarding experiencing harassing interactions) between drivers logging

their HOS with ELDs and those logging their HOS with paper. While there are occasional differences, they are rarely statistically significant, and this rarity suggests they may be due to chance.

3. **Whether harassing experiences are associated with ELDs.** Very few drivers who use ELDs associate any perceived harassment with the HOS-logging capabilities of the device. Two percent of drivers experienced an interaction that they considered to be harassment and that they associated with the HOS-logging capabilities of the ELD.

4. **Whether drivers who use ELDs have different experiences than those who use paper.** Drivers were asked to review the list of 14 specific interactions and to determine whether they experienced those interactions in a typical month. Across the 14 interactions, compared at the thresholds of both at least once per month and at least twice per month (28 comparisons), 4 differences were statistically significant. When compared to paper-logging drivers, drivers who use ELDs to log their HOS were more likely:
   - To be paid for customer delays when picking up or delivering freight at least once per month (63 percent versus 53 percent).
   - To be required to wait between loads for more than 2 hours without pay at least once per month (41 percent versus 30 percent).
   - To be interrupted when off-duty at an inappropriate time at least once per month (37 percent versus 23 percent).
   - To experience management asking customers to adjust load schedules so they were more realistic for the driver at least twice per month (32 percent versus 24 percent).

   None of the interactions in the list was more widespread among drivers who use paper logs. In addition to the 14 specific interactions, drivers were given a list of 4 more events and asked if they had experienced any of those events while employed with their current company (no specific timeframe was given). These four events were all related to the way the driver's labor and hours are logged. Twenty-nine percent of drivers said that they had experienced at least one of these events. This event was more common for drivers who use ELDs than for those who use paper (39 percent versus 19 percent), due largely to drivers being contacted by carriers to learn why the truck was not moving and due to carriers changing the duty status in the drivers' logs.

5. **Nature of attitudes toward ELDs.** Attitudes toward ELDs are broadly positive with respect to reducing the burden associated with paper logging; however, there are still some drivers who feel that ELDs limit their independence and give management too much insight into their days. There is also some skepticism regarding how much ELDs contribute to improved highway safety.

6. **Whether the perspectives of carriers are substantially different from drivers.** The carriers' responses to the interactions largely confirmed the perspectives of the drivers (i.e., that harassing interactions were not widespread). Five percent of the carriers reported asking their "average" driver to work when fatigued at least once a month, while 2 percent of carriers reported doing this at least twice a month.

7. **Reactions to FMCSA definitions of harassment and coercion.** Roughly half of surveyed drivers felt that FMCSA's definitions of harassment and coercion fit their ideas

"very well" (using a three point scale of "very well," "somewhat," or "not at all"), as did the carriers.

Table 1 shows a list of specific interactions that drivers who use ELDs experience on a monthly basis and consider harassment.

Table 1. Percent of drivers that use ELDs for HOS logging purposes and said they experienced management harassment, by type of interaction.

Types of Interactions that Drivers Considered Harassment	Percent of Drivers Who Experienced Interaction 2+ Times per Month
Interrupt your off-duty time with a message at an inappropriate time.	7%
Contact you promptly about a new job task so you didn't have to wait without pay.	1%
Require you to wait for customer delays for more than 2 hours without pay.	5%
Require you to wait between loads for more than 2 hours without pay.	5%
Arrange your loads so you had little delay time between loads.	2%
Pay you for customer delays when picking up or delivering freight.	1%
Ask you to meet a customer load schedule you view as unrealistic.	3%
Ask a customer to adjust a load schedule so it was realistic for you.	2%
Ask you to operate when you judged you were fatigued.	2%
Ask that you shut down if you felt fatigued.	1%
Ask you to log your hours inaccurately to get more work time or delay a break.	1%
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	2%
Change your log record after it was made to give you more work time or delay a break.	1%
Ask you to take sufficient time off duty to recover from fatigue.	1%

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1. INTRODUCTION

Motor carrier management and oversight of drivers' hours of service (HOS) is one of the fundamental concerns of the Federal Motor Carrier Safety Administration (FMCSA). Motor carriers began to seek automated methods of recording drivers' duty status in the mid-1980s. In April of 1985, the Federal Highway Administration (FHWA)—the predecessor Agency to FMCSA within the U.S. Department of Transportation (USDOT)—granted the first of 10 waivers allowing the use of onboard computerized records in lieu of handwritten records of duty status (RODS).

After conducting a notice-and-comment rulemaking, the Agency issued a final rule on September 30, 1988. The rule revised Part 395 of the Federal Motor Carrier Safety Regulations (FMCSRs) by allowing motor carriers the flexibility to equip commercial motor vehicles (CMVs) with automatic onboard recording devices (AOBRDs) in lieu of requiring drivers to complete handwritten RODS. The term "automatic onboard recording device" was defined under Section 395.2 as:

> *"…an electric, electronic, electromechanical, or mechanical device capable of recording drivers' duty status information accurately and automatically as required by Section 395.15. The device must be integrally synchronized with specific operations of the commercial motor vehicle in which it is installed. At a minimum, the device must record engine use, road speed, miles driven, the date, and time of day."*

Since the 1988 rulemaking, the industry has (frequently) changed the way it refers to AOBRDs. A variety of different terms and acronyms have been used through the years. This report refers to them as electronic logging devices, or ELDs.[1]

In the years following the September 1988 rulemaking, the needs of motor carriers to monitor operational productivity led to significant changes in onboard recording practices. Simultaneously, FMCSA's need to improve the efficiency and effectiveness of HOS oversight also increased. On April 5, 2010, FMCSA published a final rule that amended the FMCSRs to incorporate new performance standards for ELDs installed in CMVs manufactured on or after June 4, 2012. The new rule also called for mandatory installation of ELDs (meeting the new performance standards) in CMVs operated by motor carriers found to have serious HOS noncompliance issues. On August 26, 2011, the Seventh Circuit vacated the entire April 2010 rule. The court held that, contrary to a statutory requirement, the Agency failed to address the issue of driver harassment.

[1] This reference is consistent with usage on page 17657 of the Supplemental Notice of Proposed Rulemaking (SNPRM), which states "Beginning with this SNPRM, the term 'electronic logging device (ELD)' is substituted for the term 'EOBR'." The term "ELD" is also consistent with terminology used in MAP-21.

1.1 PROBLEM STATEMENT

FMCSA's April 2010 final rule was challenged in court based in part on concerns that ELDs could be used to harass drivers.(1) For informational purposes, the contents of Table 6 (comparing specifications over time) from the Federal Register (Volume 79, No. 60, March 28, 2014, Part II) regarding the USDOT and FMCSA "49 CFR Parts 385, 386, 390, and 395" are included in Table 2, below.

Table 2. Comparison of ELD specifications (over time) as shown in the Federal Register.

Feature/Function	1988 AOBRD Rule	2010 Electronic Onboard Recorder (EOBR) Final Rule	2013 ELD SNPRM
Integral Synchronization	Integral synchronization required, but term not defined in the Federal Motor Carrier Safety Regulations (FMCSRs).	Integral synchronization required, defined to specify signal source internal to the CMV.	Integral synchronization with the CMV engine,* to automatically capture engine power status, vehicle motion status, miles driven, engine hours.
Recording Location Information	Required at each change of duty status. Manual or automated.	Require automated entry at each change of duty status and at 60-minute intervals while CMV in motion.	Require automated entry at each change of duty status, at 60-minute intervals while CMV is in motion, at engine-on and engine-off instances, and at beginning and end of personal use and yard moves.
Graph Grid Display	Not required—"time and sequence of duty status changes"	Not required on EOBR, digital file to generate graph grid on enforcement official's portable computer.	An ELD must be able to present a graph grid of driver's daily duty status changes either on a display unit or on a printout.
HOS Driver Advisory Messages	Not addressed	Requires notification at least 30 minutes before driver reaches 24-hour and 7/8 day driving and on-duty limits.	HOS limits notification not required. "Unassigned driving time/miles" warning provided upon login.
Device "Default" Duty Status	Not addressed	On-duty not driving when the vehicle is stationary (not moving and the engine is off) 5 minutes or more.	On-duty driving, when CMV has not been in motion for 5 consecutive minutes, and driver has not responded to an ELD prompt within 1 minute. No other non-driver-initiated status change is allowed.
Clock Time Drift	Not addressed	Absolute deviation from the time base coordinated to current local time (UTC) shall not exceed 10 minutes at any time.	ELD time must be synchronized to UTC, absolute deviation must not exceed 10 minutes at any point in time.

Feature/Function	1988 AOBRD Rule	2010 Electronic Onboard Recorder (EOBR) Final Rule	2013 ELD SNPRM
Communications Methods	Not addressed—focused on interface between AOBRD support systems and printers.	Wired: universal serial bus (USB) 2.0 implementing Mass Storage Class 08H for driverless operation. Wireless: Institute of Electrical and Electronics Engineers (IEEE) 802.11g, commercial mobile radio services (CMRS)	Primary: Wireless Webservices or Bluetooth 2.1 or Email (simple mail transfer protocol [SMTP]) or Compliant Printout. Backup Wired/Proximity: USB 2.0† and (Scannable quick response [QR] codes, or TransferJet†)
Resistance to Tampering	AOBRD and support systems must be, to the maximum extent practical, tamperproof.	Must not permit alteration or erasure of the original information collected concerning the driver's hours of service, or alteration of the source data streams used to provide that information.	An ELD must not permit alteration or erasure of the original information collected concerning the driver's ELD records or alteration of the source data streams used to provide that information. An ELD must support data integrity check functions.
Identification of Sensor Failures and Edited Data	Must identify sensor failures and edited data.	The device/system must identify sensor failures and edited and annotated data when downloaded or reproduced in printed form.	An ELD must have the capability to monitor its compliance (engine connectivity, timing, positioning, etc.) for detectable malfunctions and data inconsistencies. The ELD must record these occurrences.

*For manufacture year 2000 and later, interfacing with engine control module.
†Except for "printout alternative."

Based on issues raised in the litigation, on April 13, 2011, FMCSA published a notice requesting public comment on the harassment issue.[(2)] The Agency sought and received comments on the following items:

- Experiences drivers have had regarding harassment, including coercion by carriers to evade the HOS regulations.
- Whether such carrier activity would be permitted as productivity monitoring or would be barred by other statutory or regulatory provisions.
- Whether use of ELDs would impact the ability of carriers, shippers, and other parties to harass or coerce drivers to violate HOS requirements.
- The effectiveness of mechanisms currently available under 49 CFR 392.3, 49 CFR part 395 and 49 U.S.C. 31105(a) to protect against carrier coercion.
- Whether additional regulations or guidance from FMCSA are necessary to ensure ELDs are not used to harass vehicle operators.

On August 26, 2011, the U.S. Court of Appeals for the Seventh Circuit vacated the Agency's April 2010 final rule on the use of ELDs. The Court stated that contrary to statutory requirements, the Agency failed to address the issue of driver harassment, including how ELDs could be used to harass drivers and ways to ensure that ELDs were not used for this purpose. The Court also noted that the Agency had not estimated the safety benefits of ELDs currently in use and how much EOBRs increased compliance. The basis for the Court's decision was FMCSA's failure to directly address a requirement in 49 U.S.C. Section 31137(a) (2011). The statute reads as follows:

> *USE OF MONITORING DEVICES. If the Secretary of Transportation prescribes a regulation about the use of monitoring devices on commercial motor vehicles to increase compliance by operators of the vehicles with hours of service regulations of the Secretary, the regulation shall ensure that the devices are not used to harass vehicle operators. However, the devices may be used to monitor productivity of the operators.*

1.2 PURPOSE OF THE RESEARCH

The objective of this research effort is to broadly examine the issue of driver harassment and determine the extent to which ELDs are seen as being used to either harass and/or monitor driver productivity. The research must explore the relevant issues from the perspectives of both drivers and carriers. Specific research questions are as follows:

- What types of actions by motor carriers and others do CMV drivers consider harassment?
- How often does HOS-related driver harassment take place?
- Is there a statistically significant difference in the actions that drivers consider harassment between users and non-users of ELDs?
- What measures and metrics of productivity are used and how extensive is their use?
- How does the use of these productivity metrics differ between users and non-users of ELDs?
- What is the level of driver acceptance associated with these measures/metrics of productivity? What are various ways to ensure that ELDs are not used by motor carriers, shippers and others in the transportation chain to harass drivers?
- How do drivers and carriers respond to definitions of harassment and coercion developed by FMCSA?

1.3 METHODOLOGY

This is a summary of the methodology used in the current research. A detailed discussion of sample selection and weighting procedures is included in Appendix D.

The scope of the research includes the opinions and experiences of drivers and carriers, some of whom use ELDs to log HOS and others who use paper. Two phases of research were conducted with each group: a phase of in-depth telephone interviews to check questionnaire language, and a larger, quantitative phase to address the goals of the research.

The sample of drivers for the in-depth interviews was drawn from FMCSA's Motor Carrier Management Information System (MCMIS) census file and from State DOT registries. Telephone numbers for the drivers were found using a telephone matching service (based on drivers' names and addresses). The carrier sample was identified using trade lists of top trucking firms and the MCMIS database. The in-depth "check" interviews were conducted with six drivers and two carriers, with a mix in each group of those who do and do not use ELDs. Some of the respondents indicated greater familiarity with the acronym "ELD" than the prior acronym "EOBR," so it was decided to use both acronyms at the same time in the surveys. Aside from that, there were no issues with the survey language or the range of questions asked.

For the quantitative surveys, truck drivers were intercepted at truck stops and surveyed using a paper questionnaire; carriers were sent letters recruiting them to complete an online survey.

1.3.1 Truck Drivers

1.3.1.1 Selection of the Truck Stops

Truck stops were selected in two phases. A first effort was made using an Excel file developed by the National Institute of Occupational Safety and Health (NIOSH) in its National Survey of U.S. Long-Haul Truck Driver Health and Injury.(3) This file of 6,169 entries was geocoded, linking stops to the nearest metropolitan statistical area (MSA) and interstate exits in the Freight Analysis Framework Version 3.0 (FAF3) model database. Qualifying truck stops had to be within 20 miles of an MSA with a population of 500,000 or more and within 0.5 miles of an interstate exit. These truck stops were then stratified based on States/combinations and traffic volume. A further selection was made on the basis of whether or not survey agents/agencies were available to cover the truck stops, allowing for travel of an hour or more in each direction. As truck stops were reviewed and recruited, concerns developed regarding whether the database, from 2008, was sufficiently current for the project; satellite imagery indicated that in many cases the listings were obsolete, introducing the possibility that the universe might not include more recently established truck stops.

The second phase retained the small number of truck stops which had already been recruited, but replaced the original electronic database with a sample based on the 2014 edition of *The National Truck Stop Directory: The Trucker's Friend*.(4) The truck stops listed in the 48 continental States were counted, and an *nth*-ing interval[2] was chosen to select 300 truck stops. These 300 stops were then geocoded according to the same criteria used in the original 2008 file.

[2] An "*nth*-ing interval" is a forced randomization procedure. The number of items in the universe is divided by the number of pieces of sample desired to determine how many items to skip in the universe before selecting another member of the universe for the sample. For example, if a universe consists of 100 listings, and a sample of 20 is desired, the *nth*-ing interval would be 5 (100 divided by 20). A random start point in the first 10 in the universe would be selected, perhaps the second item. The next selection would be the seventh (2 + 5), followed by universe items 12, 17, 22, and so on.

Of the original 300 truck stops, 55 met these criteria. The 55 qualified truck stops were then divided into their 9 Census divisions and reviewed through satellite imagery and an online street viewing program to ensure that there would be sufficient truck traffic to support expected daily interview quotas.

1.3.1.2 Recruitment of the Truck Stops

Once truck stops were selected, outreach was conducted in one of two ways. If the truck stop was part of a truck stop chain, recruitment began with a call to the chain's headquarters to gain cooperation from the chain and its individual truck stops. If the truck stop was not part of a truck stop chain, recruitment began with a call to the manager of the truck stop. In both cases, the purpose of the research was explained, along with a description of the number of people who would be at the truck stop (i.e., two survey agents and a supervisor) and the hours of data collection. During the recruitment process, an effort was made to ensure that there would be adequate truck traffic to allow for productive data collection efforts. Truck stops were not given any financial compensation for their cooperation.

Not all truck stops desired to participate. As such, alternative truck stops were chosen from the original list of 55 stops. Whenever possible, a replacement was chosen from the same Census division. Ultimately, 30 shifts were completed at 24 stops. At 18 of these stops, survey agents completed 1 shift; at the remaining 6 stops, survey agents completed 2 shifts. A complete list of all truck stops that participated in the survey process is below (an asterisk denotes that two shifts were completed at that specific location):

- Lincoln, Alabama*
- Chandler, Arizona
- North Little Rock, Arkansas
- Sacramento, California
- Ontario, Canada
- Wheat Ridge, Colorado
- Vero Beach, Florida
- Kingsland, Georgia*
- Council Bluffs, Iowa*
- East St. Louis, Illinois
- Gary, Indiana
- Baltimore, Maryland
- Marshall, Michigan*
- Carney's Point, New Jersey*
- Geneva, Ohio

- Oklahoma City, Oklahoma
- Tulsa, Oklahoma
- Bentleyville, Pennsylvania
- West Greenwich, Rhode Island
- Kingston Springs, Tennessee
- Anna, Texas,
- Houston, Texas*

1.3.1.3 Driver Data Collection:

In the Commercial Vehicle Safety Alliance's 2011 Road Check, it was found that 14 percent of the trucks inspected were equipped with ELDs.[(5)] Thus, limits were set on the number of interviews that would be conducted with drivers who use paper logs, so as to interview more drivers who use ELDs and to ensure an adequate quantity for analysis. Day part bias was limited by ensuring that paper-logging drivers were interviewed at various points throughout the day (and not all in the morning). Based on the length of the interview, truck traffic flows, and estimates of survey agent productivity, it was originally expected that the final sample would consist of 510–520 interviews, split evenly (approximately) between those who use paper (255–260) and those who use ELDs (255–260). These expectations were exceeded; the final quantity of interviews was 628, with 285 using paper logs and not ELDs, 341 using ELDs, and 2 using only tachographs. A small number of interviewees used both ELDs and paper to log their HOS, for purposes of redundancy; in the analysis they are grouped with those who use ELDs to log their HOS, but not with those who use paper. The two drivers who only use tachographs to log their HOS are included in the total but are not analyzed as a separate group. Records were kept throughout the course of the day to tally the drivers who were not interviewed and whether they used paper logs or ELDs, as well as the number of trucks parked at the stop (at the time the survey crew arrived) and the number of trucks that came through over the course of the day. These tallies have been used to weight the drivers so that they are in their proper proportions among the truck drivers at the stops as a whole, whether or not they agreed to complete the interview.

Drivers qualified to participate in the survey if they were required to log their HOS (some were not required to; these drivers were excluded from the research). Whether or not drivers had an ELD was determined by their answer to a question about the types of equipment in their truck. If they used an ELD, or if they used paper logs and the quota for paper logs had not yet been filled, drivers were promised a $10 cash incentive to complete the survey. If they agreed to be interviewed, they read and signed a document that described the nature of the research, and the interview continued. If they did not wish to participate, the survey agent attempted to ask them a brief series of questions for the purpose of non-response analysis.

Interviewing was conducted from April 28 to May 20, 2014.

1.3.1.4 Driver Survey Content:

Survey topics for drivers included:

1. The variety of interactions drivers have with their carriers.
2. Whether drivers consider any of those interactions to be harassment.
3. If the driver uses an ELD, whether any perceived harassing interactions occur due to the HOS-logging technology of the ELD.

Other topics included job satisfaction ratings, opinions on planned Federal efforts to limit harassment, attitudes towards ELDs, and demographics. A copy of the questionnaire and "hand cards" used in the survey can be found in the appendix.

When a driver refused to participate in the survey, a very brief non-response follow-up survey (NRFU) was attempted immediately; those who were unable to complete the NRFU at that time were given a postcard-sized version of the NRFU, postage paid, and asked to complete and mail it as soon as possible.

1.3.2 Carriers

1.3.2.1 Selection of the Carriers:

Researchers selected 4,200 carriers from the MCMIS database census file. This file contains basic business information (e.g., USDOT number and mailing/physical address), operations information (e.g., types of cargo and materials transported), and business size (e.g., number of vehicles and number of interstate and intra-state drivers). The eligibility criteria for data collection were:

- Cargo transportation (motor coach businesses were not eligible).
- Entity type: carriers (brokers, shippers, and intermodal equipment providers were not eligible).

The frame information used for stratification purposes is summarized in Table 3:

Table 3. Sample size/frame count by carrier type.

Fleet Size:	Interstate Cargo Carriers	HM Interstate Carriers	Intrastate Carriers	Total
1000+	228/228	2/2	0/44	230/274
200–999	1,303/1,303	17/17	0/85	1,320/1,405
50–199	2,582/5,955	68/157	0/788	2,650/6,900
1–49	0/542,200	0/17,233	0/509,853	0/1,069,286
Total	4,113/549,686	87/17,409	0/510,770	4,200/1,077,865

Source: MCMIS census file; record selection criteria included: mailing and physical addresses not labeled undeliverable; entity type = carrier; passenger-only operations excluded.

The sample was further divided into a random selection of 200 for a small pilot (to test the expected response rate) and 4,000 for the full survey.

1.3.2.2 Carrier Data Collection:

Both phases of data collection (pilot and full survey) consisted of three mailings that recruited respondents to an online survey. Copies of the three mailings and the survey can be found in the appendix.

- The first mailing consisted of a recruitment letter on FMCSA letterhead, sent in a window envelope with the Abt SRBI logo in the return address. This letter explained the purpose of the study and asked recipients to forward the letter to someone within their organization who deals directly with employed truck drivers (if not the recipient him or herself). The letter provided a Web address for the Web survey and a personal identification number (PIN) for survey participants to enter in order to complete the survey.
- A week later, a postcard was sent to all individuals who received the first mailing. This postcard, which bore the FMCSA logo, reminded participants to fill out the survey if they had not yet completed it, and thanked them if they had.
- The third mailing, sent a week after the postcard, was a second letter. This letter, which also bore the FMCSA logo and was enclosed in an Abt SRBI window envelope, was sent only to those who had not completed the survey. It again explained the purpose of the survey and provided the Web address and the PIN.

The expected response rate for completed surveys was 10 percent, which the pilot exceeded. The few carriers in the pilot who began the survey but did not complete it abandoned the survey at different points, suggesting that there is no specific area of improvement for the survey instrument.

The first letter for the full survey was mailed to the remaining 4,000 carriers approximately 1 week after the second letter was mailed to the pilot test group.

Data collection for the full survey began on the date that the first letter was mailed (May 20, 2014); the survey was closed on June 16, 2014. By the time it was closed, 1,130 individuals had responded (resulting in a 28 percent response rate, including partially-completed surveys), with 865 completing the survey. Of the remainder, 76 were screened out for one of two reasons: either their drivers were ineligible (because they were not subject to HOS reporting requirements), or the survey respondent did not manage the drivers. A total of 189 individuals began the survey but did not finish it.

1.3.2.3 Carrier Survey Content:

Survey topics for carriers included:

- The variety of interactions carriers have with their drivers.
- Whether a carrier's employed drivers consider any of those interactions to be harassment.

- If the carrier uses ELDs, whether any perceived harassing interactions occur due to the HOS-logging technology of the ELDs.

Other topics included ratings of satisfaction with their drivers, costs of ELDs, and corporate profile.

An NRFU was conducted over the telephone with 100 carriers from June 19–20, 2014. Copies of the questionnaires can be found in the appendix.

1.4 STATISTICAL ANALYSIS

1.4.1 Between Group Comparisons

To report results and check for differences, the following procedures were followed.

- Results were first reported for the total drivers or total carriers, using weighted data.

- To compare within the drivers, the null hypothesis is that there are no differences in the interactions or harassment between those who only use paper to log their HOS and those who use ELDs.

- Similarly, to compare within the carriers, the null hypothesis is that there are no differences between those whose fleets only log HOS with paper, those whose fleets only log HOS with ELDs, and those whose fleets are a mix of the two logging methods.

- In each case (both drivers and carriers), the null hypothesis was examined by testing at 95 percent confidence, using two-tail tests. The test performed was Rao-Scott Chi-square. For drivers, that test was sufficient, as there were only two groups to compare. In the case of the carriers, further testing was done when the Rao-Scott Chi-square resulted in a *p*-value < 0.05; because there are three groups, the three possible two-group comparisons were then tested using Rao-Scott Chi-square in order to determine the source of the statistically significant difference.

- *P*-values have been reported for all questions where groups are compared. *P*-values are only shown for individual answers when the *p*-value for the question is < 0.10. When *p*-values are shown and they are > 0.01, the actual *p*-value is shown. If the *p*-value is < 0.01, it is shown as < 0.01.

1.4.2 Regression to Determine Relationship Between Logging Method and Harassment with the Variable of Fleet Size Taken into Consideration

Section 1.4.1 above describes the procedures for all tests but one. In Section 3.1.3.2, a regression analysis was performed to investigate whether harassment experiences for drivers varied as a function of HOS logging method regardless of fleet size. This analysis was conducted because there is a significant difference in company fleet size between drivers who use paper to log HOS and drivers who use ELDs to log HOS; because of this difference, it is conceivable that fleet size is a factor which contributes to harassment observations, and may increase the incidence of harassment or mask it.

The analysis conducted in Section 3.1.3.2 consists of creating predictive margins based on the regression of the outcome (i.e., the set of interactions with management or harassment) on fleet size, and then predicting the outcome assuming that the distribution of the fleet size within each group is the same as the distribution of the population as a whole. This is a purely hypothetical population; however, the magnitudes of comparisons and their significances are indicative of the differences after the size of the fleet is taken into account.

1.5 LIMITATIONS OF THE RESEARCH

There are some limits to the research which reduce the ability to draw conclusions. One limitation is that all of the data is based on respondents' self-reported answers, and not independent observation. This introduces the possibility of biases due to memory, willingness to discuss issues of a sensitive nature, and perceptions of desirable behavior. In addition, the research is cross-sectional; the drivers and carriers who use paper or ELDs for HOS logging were not randomly assigned to either logging method, and no pre-ELD observations of the groups exist.[(6)]

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2. DESCRIPTION OF RESPONDENT POPULATIONS

2.1 DRIVERS

Six hundred and twenty-eight truck drivers were interviewed at 24 different truck stops. To qualify for the survey, drivers had to be required to keep a record of their hours to comply with the Federal HOS regulations. To maximize the opportunity to compare paper-logging drivers with ELD-logging drivers, drivers who used ELDs were oversampled. Weighting was done to put these two groups in their proper proportion for analysis. Please note that percentages reported in all tables are based on weighted data. Base sizes shown at the top of each table column are unweighted base sizes. Additional detail on the sampling and weighting procedures used is included in Appendix D.

The following profile applies only to the drivers encountered at the truck stops where interviewing was taking place. Truck stops included in the study had to:

- Be located no more than 20 miles from a MSA with a minimum population of 500,000.
- Be located no more than one-half mile from a major highway.
- Have sufficient truck traffic to ensure productive use of data collection resources.

2.1.1 Satisfaction with Job and Relationship with Management

The following two questions on the driver survey related to job satisfaction and satisfaction with management:

- Throughout this survey, we'll be talking about your job as a truck driver. Our first set of questions is about your satisfaction with your job and how you are paid. Overall, how satisfied are you with your job?

- How satisfied are you with your relationship with the people who manage you and your trips?

Based on responses to these questions, drivers are generally satisfied with their job (driving) and with the people to whom they report. As shown in Table 4, almost all (93 percent) said they were either very satisfied (57 percent) or somewhat satisfied (36 percent) with their job. This did not vary significantly according to HOS logging method (Chi-square = 5.212, 2 degrees of freedom [d.f.]; *p*-value = 0.157).

Table 4. Drivers' satisfaction with job.

Drivers' Satisfaction with Job Ratings (Total Answering: 623)	Total	Among Those Who Use Paper (283)	Among Those Who Use ELDs (338)
Very/Somewhat Satisfied	93%	94%	92%
Very Satisfied	57%	60%	54%
Somewhat Satisfied	36%	34%	38%
Somewhat/Very Dissatisfied	7%	6%	8%
Somewhat Dissatisfied	4%	2%	6%
Very Dissatisfied	3%	4%	2%
Don't Know/Not Sure	*	*	0%

*Less than 0.5 percent

Similarly, 91 percent of drivers said they were satisfied with their managers (see Table 5). Drivers who use ELDs are no more or less likely to be satisfied than those who use paper logs. This, too, did not vary significantly according to HOS logging method (Chi-square = 6.444, 3 d.f.; *p*-value = 0.092). (*P*-values for key thresholds are provided for the reader's reference because the *p*-value for the chi-square was < 0.10.)

Table 5. Drivers' satisfaction with management.

Drivers' Satisfaction with Management Ratings (Total Answering: 628)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (341)	*p*-value
Very/Somewhat Satisfied	91%	91%	90%	0.653
Very Satisfied	60%	66%	55%	0.066
Somewhat Satisfied	30%	25%	35%	**
Somewhat/Very Dissatisfied	9%	9%	10%	**
Somewhat Dissatisfied	6%	4%	7%	**
Very Dissatisfied	3%	4%	2%	**
Don't Know/Not Sure	*	0%	*	**
Refused	*	*	0%	**

*Less than 0.5 percent
**Table cell left intentionally blank.

2.1.2 ELDs and Other Technology

Drivers were asked by survey agents to identify specific items on a list that were installed in their trucks (see Table 6). Fifty percent of the drivers in this sample reported having an ELD installed in their trucks. Safety monitoring/advisory systems were less common, with 11 percent reporting they had forward collision warning systems, 9 percent reporting a driver alertness monitoring system, and 8 percent reporting a lane departure warning system. Forward collision warning systems, driver alertness monitoring systems, and lane departure warning systems were all more common with drivers using ELDs to log HOS versus those using paper logs.

Table 6. Items in truck.

Items in Truck (Total Answering: 619)	Total	Among Those Who Use Paper (278)	Among Those Who Use ELDs (341)	*p*-value
An EOBR or ELD	50%	0%	100%	<0.01
Forward collision warning system	11%	5%	16%	<0.01
Driver alertness monitoring system	9%	6%	13%	<0.01
Lane departure warning system	8%	3%	12%	<0.01
None of these	45%	89%	0%	<0.01

2.1.3 Company Fleet Size

Drivers were asked to estimate the number of trucks their company operated, across all locations. As shown in Table 7, more than half (53 percent) of the drivers surveyed worked at companies with more than 100 trucks in their fleet. About a third (34 percent) of these drivers worked for a company with 50 or fewer trucks. This characteristic was highly correlated with the use of ELDs; 78 percent of the drivers surveyed who use ELDs worked for a company with more than 100 trucks, compared to 31 percent among those using paper (Chi-square = 152.677, 9 d.f.; *p*-value < 0.01). (Some answer categories have been collapsed in the table below and are not shown.)

Table 7. Company fleet size for drivers surveyed.

Number of Trucks in Company for Drivers Surveyed (Total Answering: 627)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (340)
≤100	43%	67%	18%
≤50	34%	54%	12%
≤10	16%	27%	4%
11–50	18%	27%	7%
51–100	9%	13%	6%
≥101	53%	31%	78%
101-1,000	28%	21%	35%
≥1,001 or more	26%	9%	43%
Don't know	3%	2%	4%

2.1.4 Drivers' Status with Company

Survey agents asked drivers to denote whether they were company employees, independent owner-operators, or something else. As shown in Table 8, 70 percent of the drivers were company employees, while 29 percent were independent owner-operators. Drivers who use ELDs were more likely to be company employees than drivers who use paper (80 percent versus 62 percent) (Chi-square = 13.48, 2 d.f.; *p*-value < 0.001).

Table 8. Drivers' status with company.

Drivers' Status with Company (Total Answering: 621)	Total	Among Those Who Use Paper (282)	Among Those Who Use ELDs (337)
An employee of the company	70%	62%	80%
An independent owner-operator	29%	39%	18%
Something else	2%	2%	2%

2.1.5 Carriers for Hire versus Private Carriers

During the survey, drivers were asked whether they worked for a carrier for hire or for a private carrier. Seventy-six percent of drivers were working for carriers for hire, while 24 percent were working for private carriers (see Table 9). With this characteristic, there was no significant difference between drivers who use ELDs and those who use paper (Chi-square = 1.07, 2 d.f.; p-value=0.586).

Table 9. Carriers for hire versus private carriers.

Carriers for Hire Versus Private Carriers (Total Answering: 621)	Total	Among Those Who Use Paper (282)	Among Those Who Use ELDs (337)
Carrier for hire	76%	72%	78%
A private carrier	24%	27%	21%
Don't know	1%	1%	1%

2.1.6 Truckload versus Less-than-truckload

Survey agents asked drivers whether their firm's primary type of business was truckload, less-than-truckload, parcel, or other. As shown in Table 10, the vast majority of the drivers (84 percent) reported that their company's primary type of business was truckload, while 9 percent reported less-than-truckload, 1 percent reported parcel, and 6 percent reported other. Truckload was more common for those who use ELDs than for those who use paper (90 percent versus 79 percent) (Chi-square = 17.338, 3 d.f.; $p < 0.001$).

Table 10. Truckload versus less-than-truckload.

Truckload Versus Less Than Truckload (Total Answering: 621)	Total	Among Those Who Use Paper (282)	Among Those Who Use ELDs (337)
Truckload	84%	79%	90%
Less than truckload	9%	12%	5%
Parcel	1%	2%	*
Other	6%	7%	5%

*Less than 0.5 percent

2.1.7 Union/Covered by Collective Bargaining

When asked whether they were members of a union or covered by a collective bargaining agreement, nearly all surveyed drivers (96 percent) said no (see Table 11). This did not vary significantly according to HOS logging method (Chi-square = 0.165, 1 d.f.; *p*-value = 0.685).

Table 11. Union/covered by collective bargaining.

Whether Driver is Union/Covered By Collective Bargaining Agreement (Total Answering: 625)	Total	Among Those Who Use Paper (284)	Among Those Who Use ELDs (339)
Yes	4%	3%	3%
No	96%	97%	97%
Don't know	*	0%	*

Note: The percentage for "Yes" is higher in the "Total" column than for in the columns entitled "Among Those Who Use Paper" and "Among Those Who Use ELDs" because a high percentage of the small group using only tachographs answered "Yes."
*Less than 0.5 percent

2.1.8 Years of Experience with a Commercial Driver's License

Drivers were asked to estimate how many years they had held a commercial driver's license (CDL). As shown in Table 12, 46 percent of the drivers surveyed said they had held a CDL for more than 15 years. This was more common for drivers who use paper logs than for those who use ELDs (55 percent versus 36 percent) (Chi-square = 14.022, 5 d.f.; *p*-value=0.016).

Table 12. Number of years surveyed drivers had a CDL.

Number of Years that Drivers Held a CDL (Total Answering: 626)	Total	Among Those Who Use Paper (284)	Among Those Who Use ELDs (340)
5 years or less	25%	21%	29%
6–10 years	17%	13%	22%
11–15 years	12%	11%	13%
More than 15 years	46%	55%	36%

2.1.9 Years with Current Company

Survey agents asked drivers to estimate how long they had worked for their current company. As shown in Table 13, about half of the drivers reported being with their current company for 2 years or less. Approximately one-quarter (23 percent) of surveyed drivers said they had been at their current company for 6 years or more. This did not vary significantly according to logging method (Chi-square = 7.864, 5 d.f.; *p*-value = 0.164).

Table 13. Surveyed drivers' number of years with current company.

Drivers' Number of Years with Current Company (Total Answering: 624)	Total	Among Those Who Use Paper (283)	Among Those Who Use ELDs (340)
Less than a year	27%	25%	30%
1–2 years	27%	24%	30%
3–5 years	23%	24%	22%
6 years or more	23%	28%	18%
6–10 years	11%	11%	10%
11–15 years	4%	4%	3%
More than 15 years	8%	12%	5%

2.1.10 Driver's Age and Gender

Drivers were asked to provide their age. Survey agents observed and recorded each driver's gender. As shown in Table 14, more than half of the drivers were 45 years of age or older, with 27 percent reporting their age as 55 years or older. This did not vary significantly by logging method (Chi-square = 6.273, 4 d.f.; *p*-value = 0.18). Nearly all of the drivers surveyed were male. This, too, did not vary significantly by logging method (Chi-square = 2.085, 1 d.f.; *p*-value = 0.149).

Table 14. Surveyed drivers' age and gender.

Age and Gender of Surveyed Drivers (Total Answering: 621)	Total	Among Those Who Use Paper (282)	Among Those Who Use ELDs (338)
18–34 years of age	17%	14%	18%
35–44 years of age	26%	23%	28%
45–54 years of age	30%	28%	33%
55 years of age or older	27%	34%	21%
Male	95%	96%	93%
Female	5%	4%	7%

2.2 CARRIERS

As described earlier in this report, 865 individuals completed the carrier survey. Sixty-seven individuals were screened out because their drivers were ineligible (because they were not subject to HOS reporting requirements) or because the survey respondent did not manage the drivers. A total of 185 individuals began the survey but did not finish it. A full explanation of the sampling procedures and methodology used can be found in Appendix D.

2.2.1 Satisfaction with Job and Relationship with Drivers

Carrier respondents were asked to rate their level of satisfaction with their job and with their subordinate drivers. As shown in Table 15, nearly all (95 percent) of the carrier respondents were satisfied with their jobs, with most (62 percent) saying they were very satisfied. Carrier respondents who only use ELDs were more likely to be very satisfied than those who use paper only (68 percent versus 59 percent). *P*-values for select thresholds are shown in the table below.

Table 15. Carrier respondents' job satisfaction ratings.

Carrier Respondents' Job Satisfaction Ratings (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Very/Somewhat Satisfied	95%	98%	94%	96%	0.716	0.439	0.365
Very Satisfied	62%	59%	60%	68%	0.948	0.035	0.143
Somewhat Satisfied	33%	35%	34%	28%	**	**	**

Carrier Respondents' Job Satisfaction Ratings (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Somewhat/Very Dissatisfied	5%	5%	6%	4%	**	**	**
Somewhat Dissatisfied	5%	5%	6%	3%	**	**	**
Very Dissatisfied	*	0%	0%	1%	**	**	**

*Less than 0.5 percent
**This table cell left intentionally blank (statistical testing on the specific answer was not conducted).

Approximately three-quarters (74 percent) of the carrier respondents said that they themselves deal directly with the drivers at their company. When these respondents were asked how satisfied they were with their relationship with the drivers, satisfaction (very or somewhat satisfied) was nearly universal (97 percent), with 53 percent stating that they were "very satisfied" (as shown in Table 16). This characteristic did not vary according to methods of logging HOS (Chi-square = 0.338, 4 d.f.; *p*-value = 0.987).

Table 16. Carrier respondents' satisfaction with relationship with drivers.

Carrier Respondents' Ratings of Satisfaction with Relationships with Drivers, Among Those Dealing Directly with Drivers (Total Respondents: 635)	Total	Only Log with Paper (351)	Log with Both Paper and ELDs (104)	Only Log with ELDs (180)
Very/Somewhat Satisfied	97%	97%	98%	97%
Very Satisfied	53%	53%	56%	53%
Somewhat Satisfied	44%	45%	42%	44%
Somewhat/Very Dissatisfied	3%	3%	2%	3%
Somewhat Dissatisfied	3%	3%	2%	3%
Very Dissatisfied	0%	0%	0%	0%

2.2.2 Use of ELDs

Of the surveyed carrier representatives, 61 percent indicated that their company exclusively uses paper logs to track drivers' duty status, while 27 percent indicated that they exclusively use ELDs. Additionally, there is a group (12 percent) that uses both paper and ELDs. Carriers whose fleets use both paper and ELDs to log HOS were not asked why.

2.2.3 Number of Trucks at Company

When asked to denote the size of their company (50 or fewer, 100 or fewer, or 101 or more), 55 percent of carrier respondents reported that their company had 100 or fewer trucks (see Table 17). Companies that have ELDs installed in their trucks have larger fleets (Chi-square = 84.756, 12 d.f.; *p*-value < 0.01).

Table 17. Carrier fleet size according to carrier respondents.

Carrier Fleet Size According to Carrier Respondents (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper and ELDs (128)	Only Log with ELDs (255)
≤100	55%	64%	34%	42%
≤50	15%	20%	3%	7%
≤10	2%	3%	0%	*
11–50	13%	17%	3%	7%
51–100	40%	44%	31%	35%
≥101	45%	36%	66%	58%
101–1,000	41%	34%	61%	50%
≥1,001	4%	2%	6%	8%

*Less than 0.5 percent.

2.2.4 Company's Primary Type of Business

When offered the choice of describing their primary type of business as truckload or less-than-truckload, most carrier respondents chose truckload (61 percent on average—more so for carriers that use ELDs) (Chi-square = 48.627, 6 d.f. [with volunteered answers collapsed with "other"]; *p*-value < 0.01). However, many carrier respondents could not classify their companies in this context, so they chose to describe their freight rather than the load. Table 18 shows carrier respondents' descriptions of their company's primary type of business.

Table 18. Company's primary type of business as described by carrier respondents.

Company's Primary Type of Business According to Carrier Respondents (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper and ELDs (128)	Only Log with ELDs (255)
Truckload	61%	52%	69%	76%
Less-than-truckload	9%	8%	11%	9%
Construction-related	7%	10%	2%	1%
Heavy Equipment/Vehicles/Vehicle Drive-away	3%	5%	0%	1%
Oil/Fuel-related	3%	4%	0%	2%
Private Fleet/Own Product/Service	2%	2%	*	1%
Parcel	2%	2%	2%	1%
Passenger Transportation	2%	2%	2%	1%
Other	13%	15%	13%	7%

*Less than 0.5 percent.

2.2.5 Carrier for Hire or Private

When asked whether their companies were for hire or private, most carrier respondents described themselves as for hire (61 percent), with 39 percent calling themselves private (see Table 19). Carrier respondents whose companies use ELDs were more likely to be for hire than those who use paper only (67 percent among those using ELDs only, 78 percent among those using both paper and ELDs, and 54 percent among those using paper only). (Chi-square = 24.47, 2 d.f.; *p*-value < 0.01.)

Table 19. Whether carrier is for hire or private.

Whether Company is For Hire or Private, According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
For hire	61%	54%	78%	67%	< 0.01	< 0.01	0.052
Private	39%	46%	22%	33%	< 0.01	< 0.01	0.052

2.2.6 Drivers' Status with Company

The vast majority of carrier respondents (90 percent) said they had drivers who were company employees, with 34 percent saying they had drivers who were independent owner operators (see Table 20). (The survey did not identify whether independents were working under a lease arrangement.) Approximately one-quarter (24 percent) of carrier respondents said that some drivers were employees and some were independent owner operators.

Independent owner operators were less common for carriers that log with paper only and most common at companies with a mix of paper and ELD logging.

Table 20. Drivers' status with company.

Drivers' Status with Company According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
An Employee of the Company	90%	88%	90%	95%	0.591	< 0.01	0.072
An Independent Owner Operator	34%	28%	54%	36%	< 0.01	0.055	< 0.01
Something Else	3%	2%	5%	2%	**	**	**

**This table cell left intentionally blank (statistical testing on the specific answer was not conducted).

2.2.7 Union/Collective Bargaining Status of Carriers' Drivers

The majority (86 percent) of carrier respondents said that none of their drivers were in a union or covered by a collective bargaining agreement. Seven percent of carrier respondents said at least half of their drivers were in a union or covered by a collective bargaining agreement, while 5 percent of carrier respondents said that all of their drivers fell into this category. This characteristic was consistent across all HOS logging systems (Chi-square=0.1438; *p*-value=0.931).

2.2.8 Age and Gender of the Manager

Carrier respondents were asked to provide their age and their gender. According to survey responses, two-thirds of the managers were 45 years of age or older (one-third of all managers

were 55 years of age or older). Age varied significantly by the HOS logging methods in place (Chi-square = 21.402, 6 d.f.; *p*-value < 0.01); those at companies which were only using ELDs were less likely to be age 18–34, and more likely to be age 45–54.

Most (83 percent) were male; this did not vary significantly with the HOS logging systems in place (Chi-square = 0.144, 2 d.f.; *p*-value = 0.931).

See Table 21 for a complete breakdown of carrier respondents' age and gender.

Table 21. Age and gender of carrier respondents.

Age and Gender of Carrier Respondents (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper and ELDs (128)	Only Log with ELDs (255)
18–34 years of age	10%	12%	12%	4%
35–44 years of age	25%	25%	30%	23%
45–54 years of age	32%	30%	22%	42%
55 years of age or older	34%	34%	37%	32%
Male	83%	82%	82%	83%
Female	17%	18%	18%	17%

3. DETAILED FINDINGS

3.1 HARASSMENT

This section discusses perceptions and occurrences of harassment, first from the perspective of drivers, and then from the perspective of carrier respondents. Again, please note that percentages reported in all tables are based on weighted data. Base sizes shown at the top of each table column are unweighted base sizes. The organization of this section is as follows:

For the drivers, among those with paper HOS logs and those with ELD logs:

- How often drivers have specific interactions with their carriers.
- Whether they consider those interactions harassment.
- How often they have interactions they consider harassment.
- Whether those "harassing" interactions occur because of ELD functionality (among those using ELDs).

For the carriers, among those using paper logs exclusively, those using ELDs exclusively, and those with a mix:

- Frequency of specific interactions with the typical driver.
- Whether they think their drivers might consider them harassment.
- Whether they see these interactions resulting from ELD technology (among those with ELDs).

3.1.1 Frequency of Drivers Experiencing Specific Interactions with Carriers

Drivers reviewed a list of 14 interactions they might have with their management and were asked to estimate how often they experience those interactions in a month (i.e., never, once a month, or at least twice a month). The 14 interactions were developed by the research team, with input from FMCSA, and checked for their comprehensiveness in in-depth interviewing with truck drivers and carriers.

Of the list of specified interactions, the most prevalent one pertains to management arranging drivers' loads in such a way that there is little delay between the loads. Forty-five percent of drivers said that occurred at least twice in a typical month.

Less common, but still prevalent, were the following interactions:

- Management asking drivers to shut down when they felt fatigued (38 percent).
- Management paying drivers for customer delays when picking up or delivering freight (33 percent).
- Managers asking drivers to take sufficient time off to recover from fatigue (33 percent).

- Managers contacting drivers promptly about a new task so that drivers did not have to wait without pay (33 percent).

According to survey responses, management does exert some pressure on drivers and their pay. About 20–25 percent of surveyed drivers said:

- Management might make them wait 2 hours or more between loads without pay (23 percent).
- That they might be required to wait more than 2 hours for customer delays without pay (21 percent).
- That management would ask them to log their hours accurately when inaccurate logging could have allowed them more work time or delayed a break (22 percent).

While 28 percent of drivers said that management asked customers to adjust a load schedule to be more realistic for the driver, 19 percent said that management would ask drivers to meet load schedules that they saw as unrealistic. Additionally, 19 percent of drivers said that at least twice a month management might interrupt their off-duty time with a message at an inappropriate time.

Relatively few drivers indicated that they were asked to drive when fatigued, that they were asked to log their hours inaccurately, or that management changed their logs in order to increase their work time (less than 10 percent of the drivers said this occurred twice or more in a typical month). The percentage of drivers indicating that any of these interactions occurred only once in a typical month was also low.

The differences on these measures between drivers who use papers logs and those who use ELDs were generally not statistically significant. Among those where there was no statistically significant difference are interactions which FMCSA defines as harassment:

- Management asking a driver to operate when the driver judged he or she was fatigued.
- Management asking a driver to log hours inaccurately to get more work time or to delay a break.
- Management changing a log record after it was made to give a driver more work time or to delay a break.

Statistical comparisons were made between ELD-logging drivers and paper-logging drivers on each of the 14 interactions, at two frequency thresholds (once a month or more, and twice a month or more). Of the 28 comparisons, 4 were statistically significant. Compared to drivers using paper to log their HOS, drivers using ELDs were more likely to experience:

- Their carriers paying them for customer delays when picking up or delivering freight at least once per month (63 percent versus 53 percent).
- Their carriers requiring them to wait between loads for more than 2 hours without pay at least once per month (41 percent versus 30 percent).

- Their carriers interrupting their off-duty time at an inappropriate time at least once per month (37 percent versus 23 percent).

- Their carriers asking customers to adjust a load schedule so it was realistic for the driver at least twice per month (32 percent versus 24 percent).

Table 22 presents complete results for how frequently drivers experience the 14 specified interactions in a typical month. Note that percentages in the rows do not add to 100 percent because they are different thresholds of the same question. In addition, those answering "2+ Times Per Month" are a subset of those shown under the "1+ Times Per Month" column. ("1+ Times Per Month" shows the percentage who experience it at all, based on the combination of the answers "Once A Month" and "2+ Times Per Month.")

Table 22. Frequency that drivers experienced specific interactions with management.

Specific Interactions That Drivers Experience on a Monthly Basis (Total Respondents: 628)	2+ Times Per Month	1+ Times Per Month
Paid and Unpaid Time		
Arrange your loads so you had little delay time between loads.	45%	61%
Pay you for customer delays when picking up or delivering freight.	33%	57%
Require you to wait between loads for more than 2 hours without pay.	23%	35%
Require you to wait for customer delays for more than 2 hours without pay.	21%	38%
Fatigue		
Ask that you shut down if you felt fatigued.	38%	54%
Ask you to operate when you judged you were fatigued.	7%	14%
Logging and Breaks		
Ask you to take sufficient time off duty to recover from fatigue.	33%	46%
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	22%	29%
Ask you to log your hours inaccurately to get more work time or delay a break.	5%	10%
Change your log record after it was made to give you more work time or delay a break.	5%	9%
Communications		
Contact you promptly about a new job task so you didn't have to wait without pay.	33%	48%
Interrupt your off-duty time with a message at an inappropriate time.	19%	30%
Schedules		
Ask a customer to adjust a load schedule so it was realistic for you.	28%	57%
Ask you to meet a customer load schedule you view as unrealistic.	19%	39%

Note: In this table and in all other tables in this report, interactions are grouped according to how they were presented to respondents, whether it was on the cards shown to the drivers or on the screens that carrier respondents saw during the online survey.

Table 23 presents these results according to whether drivers log their HOS with paper or with ELDs.

Table 23. Frequency that drivers experienced specific interactions with management, according to logging method.

Specific Interactions That Drivers Experience on a Monthly Basis (Total Respondents: 628)	2+ Times Per Month Among Those Who Use Paper (285)	2+ Times Per Month Among Those Who Use ELDs (341)	*p*-value	1+ Times Per Month Among Those Who Use Paper (285)	1+ Times Per Month Among Those Who Use ELDs (341)	*p*-value
Paid and Unpaid Time						
Arrange your loads so you had little delay time between loads.	46%	43%	0.504	60%	62%	0.799
Pay you for customer delays when picking up or delivering freight.	30%	37%	0.133	53%	63%	< 0.01
Require you to wait between loads for more than 2 hours without pay.	20%	25%	0.229	30%	41%	0.037
Require you to wait for customer delays for more than 2 hours without pay.	22%	20%	0.565	36%	39%	0.790
Fatigue						
Ask that you shut down if you felt fatigued.	39%	37%	0.742	54%	54%	0.929
Ask you to operate when you judged you were fatigued.	9%	6%	0.203	16%	12%	0.306
Logging and Breaks						
Ask you to take sufficient time off duty to recover from fatigue.	33%	34%	0.783	44%	48%	0.607
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	20%	23%	0.354	25%	33%	0.162
Ask you to log your hours inaccurately to get more work time or delay a break.	7%	3%	0.057	11%	9%	0.507
Change your log record after it was made to give you more work time or delay a break.	5%	4%	0.814	7%	10%	0.373
Communications						
Contact you promptly about a new job task so you didn't have to wait without pay.	34%	32%	0.703	48%	50%	0.645
Interrupt your off-duty time with a message at an inappropriate time.	15%	22%	0.145	23%	37%	0.014

Specific Interactions That Drivers Experience on a Monthly Basis (Total Respondents: 628)	2+ Times Per Month Among Those Who Use Paper (285)	2+ Times Per Month Among Those Who Use ELDs (341)	*p*-value	1+ Times Per Month Among Those Who Use Paper (285)	1+ Times Per Month Among Those Who Use ELDs (341)	*p*-value
Schedules						
Ask a customer to adjust a load schedule so it was realistic for you.	24%	32%	< 0.01	56%	58%	0.449
Ask you to meet a customer load schedule you view as unrealistic.	22%	16%	0.059	38%	40%	0.804

3.1.2 Actions That Drivers Consider To Be Harassment

Drivers were also asked which of the 14 interactions, if any, that they considered harassment.

There was a lack of unanimity among the drivers regarding what constitutes harassment. Forty-two percent of drivers said that none of the specified interactions would be considered harassment.

Three interactions were identified as harassment by 26–30 percent of the drivers:

- Interrupting a driver's off-duty time with a message at an inappropriate time (28 percent).
- Asking the driver to operate when the driver judged himself to be fatigued (28 percent).
- Asking the driver to log his or her hours inaccurately to get more work time or to delay a break (26 percent).

A second tier of four other interactions was identified as harassment by 16–20 percent of the drivers:

- Changing the driver's log record after it was made to give the driver more work time or to delay a break (19 percent).
- Requiring the driver to wait for customer delays for more than 2 hours without paying the driver (19 percent).
- Asking the driver to meet a customer load schedule that the driver viewed as unrealistic (18 percent).
- Requiring the driver to wait between loads for more than 2 hours without pay (17 percent).

Drivers were far more unanimous about what interactions do not constitute harassment. The following interactions were seen as harassment by fewer than 10 percent of the drivers:

- Asking the driver to shut down if he or she felt fatigued.
- Asking drivers to log their hours accurately when they could have had more work time or delayed a break by being inaccurate.
- Asking drivers to take sufficient time off duty to recover from fatigue.
- Contacting drivers promptly about a new job task so they didn't have to wait without pay.
- Arranging drivers' loads so they had little delay time between loads.
- Paying drivers for customer delays when picking up or delivering freight.
- Asking a customer to adjust a load schedule so it was more realistic for the driver.

Drivers logging with paper were more likely to consider it harassment when a manager asked them to log their hours inaccurately to get more work time or delay a break (30 percent versus 21 percent among drivers using ELDs). There were no other significant differences between paper-logging drivers and ELD-logging drivers. Table 24 shows complete results for this portion of the survey.

Table 24. Interactions which drivers consider to be harassment, according to logging method.

Specific Interactions That Drivers Consider Harassment (Total Respondents: 628)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (341)	*p*-value
Communications				
Interrupt your off-duty time with a message at an inappropriate time.	28%	28%	29%	0.660
Contact you promptly about a new job task so you didn't have to wait without pay.	6%	4%	6%	0.689
Fatigue				
Ask you to operate when you judged you were fatigued.	28%	30%	27%	0.525
Ask that you shut down if you felt fatigued.	4%	4%	4%	0.524
Logging and Breaks				
Ask you to log your hours inaccurately to get more work time or delay a break.	26%	30%	21%	0.049
Change your log record after it was made to give you more work time or delay a break.	19%	22%	16%	0.095
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	9%	10%	8%	0.54
Ask you to take sufficient time off duty to recover from fatigue.	4%	4%	4%	0.879
Paid and Unpaid Time				
Require you to wait for customer delays for more than 2 hours without pay.	19%	16%	22%	0.114
Require you to wait between loads for more than 2 hours without pay.	17%	15%	20%	0.236
Arrange your loads so you had little delay time between loads.	5%	3%	7%	0.141
Pay you for customer delays when picking up or delivering freight.	4%	2%	5%	0.095
Schedules				
Ask you to meet a customer load schedule you view as unrealistic.	18%	17%	19%	0.561
Ask a customer to adjust a load schedule so it was realistic for you.	4%	4%	4%	0.823
None of these.	42%	42%	42%	N/A

Drivers were also given the opportunity to identify other interactions which they considered to be harassment, although few (6 percent) did. A follow-up question (i.e., "Of those we haven't talked about, which one bothers you most?") elicited a range of answers, some of which pertained to HOS and interactions with carrier managers, rather than to ELDs per se.

The following interactions were mentioned by drivers who use paper logs:

- "Always have to wait 2–3 days for fuel card."
- "Asking me to go somewhere where I've already said I don't want to go."

- “Boss yells at me for doing something he told me to do.”
- “Brokering, because money is not getting to the trucks.”
- “Confrontation.”
- “Loading and unloading times.”
- “No communication; not taking care.”
- “Pay structure.
- “Taking workman’s comp out of my pay.”
- “Telling as opposed to asking.”
- “Wait time for 2 or 3 days; new trucks to new employees; broker load number not given.”
- “Wanting to know every move you make.”
- “When a company goes through a 3rd party broker and leaves the drivers to go through them. Sometimes it’s very hard to get compensated for your time.”

The following interactions were mentioned by drivers who use ELDs:

- “14 hours can be shortened to 10 or 8 hours.”
- “I was at home and they wanted me to work.”
- “Disciplinary action.”
- “Drivers buying required things such as chains and not getting compensated.”
- “Having to take a one-half hour break every 8 hours.”
- “Home time is like enslavement. Work 7 days earned for 24 hours.”
- “If you don’t do as they say they won’t give you any loads.”
- “It’s difficult to get the time requested off.”
- “Low miles and not enough pay.”
- “Management harassing via phone all the time.”
- “More about talking than listening. Drivers are responsible for everything.”
- “Only before ELD.” (This could be interpreted as a statement that other harassments went away with the introduction of the ELD.)
- “Pay issue; refuse to give him the payroll number. They want to scan in paperwork but there is an issue with his ID number. The scan does not post it so they have issues getting paid.”
- “Pushing to drive when tired.”

- "Safety maintenance records."
- "They give you too many loads and not enough time to recover."
- "Threats of firing."
- "Wake me up and tell me to get going and if I don't answer they call the officers."
- "Weekly/monthly testing [during] in-person terminal interviews; face to face with owner for feedback."
- "When driver wanted time off they hassle if do not comply with allotted time given." (This appears to be an interviewer paraphrase. It could be interpreted as if there is friction over when the driver can take the desired time off.)
- "When truck needs service and operator needs to take to shop they get mad."
- "Withheld pay."

3.1.3 Frequency That Drivers Experience Perceived Harassing Interactions

The combination of what interactions the drivers experience and whether they consider them to be harassing in nature will help to determine how often drivers feel that they are harassed and what the nature of that harassment is. The following questions were considered in this portion of the analysis:

- How many drivers experience a specific interaction and consider that interaction to be harassment?
- Which of the interactions identified above are most widespread?
- Across the entire list of specific interactions, do drivers who use one logging method experience more harassing interactions than their counterparts who use a different logging method?

It should be noted that there is a clear difference in fleet size between drivers who use paper and those who use ELDs. Companies of different fleet sizes may have different policies in place, which may affect adherence to HOS regulations. If there are differences in how drivers are treated according to the HOS logging method, is it certain that the differences are due to the logging method, versus the fleet size?

The results will show that drivers who use ELDs do not indicate they are being harassed to a greater extent than drivers who use paper logs—either on any single specific interaction or on the totality of the interactions. The results will also show that when fleet size is factored into the analysis, drivers with ELDs do not indicate more harassment than drivers using paper logs.

3.1.3.1 Experiencing Perceived Harassing Interactions

As shown Table 25, few drivers felt as if they actually encountered harassment from management. The most prevalent interaction considered to be harassment was "being interrupted with a message while off duty and at an inappropriate time." Seven percent of drivers identified

this as a harassing interaction that occurred twice or more in a typical month; there was no difference between those using paper (7 percent) and those using ELDs (7 percent).

Only one other interaction—requiring drivers to wait for customer delays for more than 2 hours without pay—was identified by drivers as a harassing interaction that occurred at least twice in a typical month (5 percent). Interactions considered to be harassment and experienced by drivers at least once in a typical month (a lower threshold) are also not widespread. Most interactions identified as harassment occur for 5 percent or fewer of the drivers.

Table 25. Frequency that drivers experienced perceived harassing interactions with management.

Specific Interactions That Drivers Experience on a Monthly Basis and Consider Harassment (Total Respondents: 628)	Considered Interaction Harassment and Experienced 2+ Times Per Month	Considered Interaction Harassment and Experienced 1+ Times Per Month
Communications		
Interrupt your off-duty time with a message at an inappropriate time.	7%	12%
Contact you promptly about a new job task so you didn't have to wait without pay.	1%	2%
Paid and Unpaid Time		
Require you to wait for customer delays for more than 2 hours without pay.	5%	9%
Require you to wait between loads for more than 2 hours without pay.	4%	8%
Arrange your loads so you had little delay time between loads.	2%	3%
Pay you for customer delays when picking up or delivering freight.	1%	2%
Schedules		
Ask you to meet a customer load schedule you view as unrealistic.	4%	9%
Ask a customer to adjust a load schedule so it was realistic for you.	1%	2%
Fatigue		
Ask you to operate when you judged you were fatigued.	3%	4%
Ask that you shut down if you felt fatigued.	1%	1%
Logging and Breaks		
Ask you to log your hours inaccurately to get more work time or delay a break.	2%	3%
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	2%	3%
Change your log record after it was made to give you more work time or delay a break.	1%	3%
Ask you to take sufficient time off duty to recover from fatigue.	1%	1%
Average Number of Interactions Experienced and Seen as Harassment (Minimum 0, Maximum 14)	**0.35**	**0.61**

Paper-logging and ELD-logging drivers differed on only one of the 14 interactions regarding what they considered to be harassment and what they actually experienced. Regarding management asking drivers to log HOS inaccurately in order to get more work time in or to delay a break, 2 percent of those logging with paper and 1 percent of those logging with ELDs

said they both consider it harassment and experience it at least twice per month; while relatively rare, this was a statistically significant difference (*p*-value = 0.031). This was the only statistically significant difference of the 28 comparisons made (14 interactions, compared at the two criteria of at least once per month and at least twice per month). (See Table 26 and Table 27).

Table 26. Interactions with management which drivers experience 2+ times per month and perceived as harassment, according to logging method.

Consider Interaction Harassment and Experience 2+ Times Per Month (Total Respondents: 628)	Consider Interaction Harassment and Experience 2+ Times Per Month, Among Those Who Use Paper (285)	Consider Interaction Harassment and Experience 2+ Times Per Month, Among Those Who Use ELDs (341)	*p*-value
Communications			
Interrupt your off-duty time with a message at an inappropriate time.	7%	7%	0.977
Contact you promptly about a new job task so you didn't have to wait without pay.	1%	1%	0.79
Paid and Unpaid Time			
Require you to wait for customer delays for more than 2 hours without pay.	5%	5%	0.147
Require you to wait between loads for more than 2 hours without pay.	4%	5%	0.477
Arrange your loads so you had little delay time between loads.	1%	2%	0.508
Pay you for customer delays when picking up or delivering freight.	1%	1%	0.877
Schedules			
Ask you to meet a customer load schedule you view as unrealistic.	4%	3%	0.366
Ask a customer to adjust a load schedule so it was realistic for you.	1%	2%	0.617
Fatigue			
Ask you to operate when you judged you were fatigued.	4%	2%	0.412
Ask that you shut down if you felt fatigued.	*	1%	0.069
Logging and Breaks			
Ask you to log your hours inaccurately to get more work time or delay a break.	2%	1%	0.031
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	2%	2%	0.963
Change your log record after it was made to give you more work time or delay a break.	1%	1%	0.197
Ask you to take sufficient time off duty to recover from fatigue.	1%	1%	0.796
Average Number of Interactions Experienced and Seen as Harassment (Minimum 0, Maximum 14)	**0.35**	**0.35**	**

*Less than 0.5 percent.

**This table cell left intentionally blank (statistical testing on the specific answer was not conducted).

Table 27. Interactions with management which drivers experience 1+ times per month perceived as harassment, according to logging method.

Consider Interaction Harassment and Experience 1+ Times Per Month (Total Respondents: 628)	Consider Interaction Harassment and Experience 1+ Times Per Month, Among Those Who Use Paper (285)	Consider Interaction Harassment and Experience 1+ Times Per Month, Among Those Who Use ELDs (341)	*p*-value
Communications			
Interrupt your off-duty time with a message at an inappropriate time.	11%	13%	0.280
Contact you promptly about a new job task so you didn't have to wait without pay.	2%	3%	0.610
Paid and Unpaid Time			
Require you to wait for customer delays for more than 2 hours without pay.	7%	10%	0.319
Require you to wait between loads for more than 2 hours without pay.	6%	9%	0.221
Arrange your loads so you had little delay time between loads.	3%	3%	0.696
Pay you for customer delays when picking up or delivering freight.	1%	2%	0.485
Schedules			
Ask you to meet a customer load schedule you view as unrealistic.	8%	9%	0.831
Ask a customer to adjust a load schedule so it was realistic for you.	2%	2%	0.908
Fatigue			
Ask you to operate when you judged you were fatigued.	5%	4%	0.705
Ask that you shut down if you felt fatigued.	1%	2%	0.674
Logging and Breaks			
Ask you to log your hours inaccurately to get more work time or delay a break.	4%	2%	0.128
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	3%	3%	0.869
Change your log record after it was made to give you more work time or delay a break.	2%	3%	0.735
Ask you to take sufficient time off duty to recover from fatigue.	2%	1%	0.841
Average Number of Interactions Experienced and Seen as Harassment (Minimum 0, Maximum 14)	**0.56**	**0.67**	**

3.1.3.2 Is Fleet Size a Factor in Whether Drivers Experience Harassment?

There is a significant difference in company fleet size between drivers who use paper logs and drivers who use ELDs. Approximately a third (31 percent) of paper-logging drivers worked at companies with more than 100 trucks, while 17 percent worked at companies with only 1–5 trucks. Among drivers who use ELDs, 78 percent work at companies with more than 100 trucks.

To ensure that fleet size is not masking differences in harassment, further analysis was conducted which took fleet size into consideration and factored its effects out of the comparison between ELD-logging drivers and paper-logging drivers.

In this section of the report, the following analyses are considered:

- Analysis of each of the items and the total number of reported practices that are considered to be harassment by the drivers.
- Analysis of the frequency as at least once per month, or at least twice per month.
- Analysis of the directly estimated proportions and proportions adjusted for the fleet size composition.

For the latter analysis, the research team ran a logistic regression with Firth's bias correction,[(7)] also known as a rare events adjustment, using the final weights and cluster variables to generate the correct estimates and standard errors. The dependent variable was the 0/1 compound indicator of the self-reported harassment, and the explanatory variables were the ordinal variable of fleet size (Q37; 10 informative categories plus "Don't Know" and "Refused" categories) and the indicator of the ELD use (Q9). Then the predicted probabilities were computed for the overall (weighted) distribution of fleet size among drivers (that is, if the ELD users and non-users worked in companies that had the same size distribution equal to the overall distribution), and the average predicted probabilities were computed along with their confidence intervals. This approach is known as "predictive margins" in econometrics.[(8)] The results are given in Table 28 and Table 29.

The two apparent statistically significant differences are observed for the item, "Ask that you shut down if you felt fatigued" (direct estimate), and the item, "Ask you to log your hours inaccurately to get more work done or delay a break" (predictive margin), with a frequency of at least twice per month. The author is hesitant to consider this finding as statistically significant due to the multiple comparisons issue.

Table 28 and Table 29 compare 14 individual items plus 2 summaries of the total score using 2 different methods, thus producing 32 comparisons. The cut-off for Bonferroni adjusted *p*-value is then 5 percent/32 = 0.16 percent, below the *p*-values of 2.87 percent and 0.18 percent, respectively, for the two apparently significant items. Another way to view the multiple comparisons issue is that under the null of no difference between ELD users and non-users, one should expect the count of false positives to follow a binomial distribution with p = 5 percent and n = 32, which has a mean of 1.6 and a standard deviation of 1.23, so two rejections are not unexpected in this situation (Prob ≥ 2 rejections = 48.0 percent).

Table 28. Incidence of perceived harassing interactions, adjusted for fleet size variable effect.

Consider Interaction Harassment and Experience 2+ Times Per Month	Consider Interaction Harassment and Experience 2+ Times Per Month, Among Those Who Use Paper	Consider Interaction Harassment and Experience 2+ Times Per Month, Among Those Who Use ELDs	*p*-value
Communications			
Interrupt your off-duty time with a message at an inappropriate time.	7%	9%	0.36
Contact you promptly about a new job task so you didn't have to wait without pay.	2%	2%	0.98
Paid and Unpaid Time			
Require you to wait for customer delays for more than 2 hours without pay.	6%	6%	0.928
Require you to wait between loads for more than 2 hours without pay.	5%	6%	0.944
Arrange your loads so you had little delay time between loads.	2%	4%	0.528
Pay you for customer delays when picking up or delivering freight.	2%	3%	0.545
Schedules			
Ask you to meet a customer load schedule you view as unrealistic.	5%	5%	0.966
Ask a customer to adjust a load schedule so it was realistic for you.	2%	3%	0.377
Fatigue			
Ask you to operate when you judged you were fatigued.	4%	4%	0.999
Ask that you shut down if you felt fatigued.	1%	3%	< 0.01
Logging and Breaks			
Ask you to log your hours inaccurately to get more work time or delay a break.	3%	2%	0.027
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	2%	3%	0.455
Change your log record after it was made to give you more work time or delay a break.	2%	2%	0.630
Ask you to take sufficient time off duty to recover from fatigue.	3%	2%	0.534
Average Number of Interactions Experienced and Seen as Harassment (Minimum 0, Maximum 14)	**0.35**	**0.35**	**0.93**
Percent Experiencing Any Interactions Considered Harassment 2+ Times Per Month	**28%**	**29%**	**0.93**

Table 29. Incidence of perceived harassing interactions, adjusted for fleet size variable effect.

Consider Interaction Harassment and Experience 1+ Times Per Month	Consider Interaction Harassment and Experience 1+ Times Per Month, Among Those Who Use Paper	Consider Interaction Harassment and Experience 1+ Times Per Month, Among Those Who Use ELDs	*p*-value
Communications			
Interrupt your off-duty time with a message at an inappropriate time.	11%	14%	0.272
Contact you promptly about a new job task so you didn't have to wait without pay.	2%	5%	0.185
Paid and Unpaid Time			
Require you to wait for customer delays for more than 2 hours without pay.	7%	12%	0.197
Require you to wait between loads for more than 2 hours without pay.	7%	10%	0.337
Arrange your loads so you had little delay time between loads.	4%	4%	0.766
Pay you for customer delays when picking up or delivering freight.	2%	4%	0.237
Schedules			
Ask you to meet a customer load schedule you view as unrealistic.	8%	11%	0.534
Ask a customer to adjust a load schedule so it was realistic for you.	3%	3%	0.731
Fatigue			
Ask you to operate when you judged you were fatigued.	6%	5%	0.797
Ask that you shut down if you felt fatigued.	2%	3%	0.71
Logging and Breaks			
Ask you to log your hours inaccurately to get more work time or delay a break.	5%	3%	0.208
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	3%	4%	0.548
Change your log record after it was made to give you more work time or delay a break.	3%	4%	0.476
Ask you to take sufficient time off duty to recover from fatigue.	4%	1%	0.352
Average Number of Interactions Experienced and Seen as Harassment (Minimum 0, Maximum 14)	**0.56**	**0.68**	**0.469**
Percent Experiencing Any Interactions Considered Harassment 1+ Times Per Month	**42%**	**48%**	**0.474**

3.1.3.3 Attributing Harassment to the ELD

ELD-logging drivers were asked if they thought any perceived harassing interactions were attributable to management's use of the HOS information in their ELD; those whose ELDs had additional functionality (e.g., part of a fleet management system) were asked if the perceived harassing interactions were attributable to management's use of other information from their truck.

ELD-logging drivers rarely attributed any perceived harassing interactions to their device's HOS logging functionality. As shown in Table 30, no more than 2 percent of the drivers saw any individual harassing interaction as being the result of the HOS logging device. Answers were not significantly different for drivers with standalone ELD units versus ELDs that were part of a fleet management system.

Table 30. Perceived harassing interactions experienced by drivers at least once in a typical month and attributed to the HOS logging capability of the ELD.

Perceived Harassing Interactions That Drivers with ELDs (341) Experience on a Monthly Basis and Attribute to the HOS Logging Capability of the ELD	Percent
Communications	
Interrupt your off-duty time with a message at an inappropriate time.	1%
Contact you promptly about a new job task so you didn't have to wait without pay.	1%
Fatigue	
Ask you to operate when you judged you were fatigued.	1%
Ask that you shut down if you felt fatigued.	1%
Logging and Breaks	
Ask you to log your hours inaccurately to get more work time or delay a break.	1%
Change your log record after it was made to give you more work time or delay a break.	1%
Ask you to take sufficient time off duty to recover from fatigue.	1%
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	*
Paid and Unpaid Time	
Require you to wait between loads for more than 2 hours without pay.	2%
Require you to wait for customer delays for more than 2 hours without pay.	1%
Arrange your loads so you had little delay time between loads.	1%
Pay you for customer delays when picking up or delivering freight.	1%
Schedules	
Ask you to meet a customer load schedule you view as unrealistic.	2%
Ask a customer to adjust a load schedule so it was realistic for you.	1%
Average Number of Interactions Experienced, Seen as Harassment, and Attributed to the Logging Capability of the ELD (Minimum 0, Maximum 14)	**0.13**

*Less than 0.5 percent.

Similarly, drivers whose ELDs had additional capabilities (beyond HOS logging) rarely attributed harassment to management's use of the other information from their truck (see Table 31).

Table 31. Perceived harassing interactions experienced by drivers at least once in a typical month and attributed to the ELD's additional capabilities.

Perceived Harassing Interactions That Drivers with Non-Standalone ELDs (224) Experience on a Monthly Basis and Attribute to the ELD's Additional Capabilities	Percent
Paid and Unpaid Time	
Require you to wait between loads for more than 2 hours without pay.	3%
Require you to wait for customer delays for more than 2 hours without pay.	1%
Arrange your loads so you had little delay time between loads.	1%
Pay you for customer delays when picking up or delivering freight.	*
Communications	
Interrupt your off-duty time with a message at an inappropriate time.	1%
Contact you promptly about a new job task so you didn't have to wait without pay.	1%
Fatigue	
Ask you to operate when you judged you were fatigued.	1%
Ask that you shut down if you felt fatigued.	1%
Logging and breaks	
Ask you to log your hours inaccurately to get more work time or delay a break.	1%
Change your log record after it was made to give you more work time or delay a break	1%
Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate.	1%
Ask you to take sufficient time off duty to recover from fatigue.	*
Schedules	
Ask you to meet a customer load schedule you view as unrealistic.	1%
Ask a customer to adjust a load schedule so it was realistic for you.	1%
Average Number Experienced, Seen as Harassment, and Attributed to the ELD's Additional Capabilities (Minimum 0, Maximum 14)	**0.14**

*Less than 0.5 percent.

3.1.3.4 Other Events Which Happened at the Company

Drivers were given a list of four additional events and asked if they had experienced any of those events while at their current company. Each of these events related to the way a driver's labor and hours were logged. As shown in Table 32, 29 percent of drivers said that they had experienced at least one of these events. This was significantly more common for drivers who use ELDs than for those who use paper (39 percent versus 19 percent, p-value < 0.01), due to drivers being contacted to learn why the truck wasn't moving and due to carriers changing the duty status in the drivers' logs.

Table 32. Other events experienced by drivers at their current company.

Other Events That Surveyed Drivers Experienced While Employed at Their Current Company (Total Answering: 616)	Total	Among Those Who Use Paper (278)	Among Those Who Use ELDs (336)	*p*-value
Any in list (net)	29%	19%	39%	< 0.01
Contacted by your carrier, to find out why your truck wasn't moving	16%	11%	23%	0.004
Told to record your loading/unloading hours as off duty	12%	11%	12%	0.925
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	10%	8%	11%	0.483
Your carrier changed your duty status in your logs	7%	3%	11%	< 0.01
None of these	70%	81%	61%	< 0.01

3.1.3.5 Producing Electronic Logs for Law Enforcement

Five percent of the drivers who use ELDs said they had, at some point, been unable to produce their electronic HOS logs for law enforcement. Among this small group, only 30 percent indicated that it led to their feeling harassed, while 52 percent said it did not, and 18 percent refused to answer the question.

3.1.4 Carrier Respondents' Perspectives on Harassment

Carrier representatives were asked a similar series of questions regarding potentially harassing interactions; however, these questions were adapted to account for the fact that carrier respondents manage multiple drivers. Carrier representatives were asked:

- How frequently a "typical" driver in their company might experience each of the listed interactions.
- For those interactions a typical driver might experience at least once a month, which ones the drivers might consider harassment.[3]
- If the carrier used ELDs in some or all of their trucks, for the interactions a typical driver might experience at least once a month, which of them are facilitated by the HOS logging functionality of the ELDs.
- If the carrier used ELDs that were part of a fleet management system in some or all of their trucks, for the interactions a typical driver might experience at least once a month, which of them are facilitated by other "non-HOS" functionality.

[3] The sequence was limited to those their drivers experience in order to limit the carrier's burden and increase survey participation.

Responses to these questions were examined for three groups of carriers: those who use only paper logs in their trucks, those who use only ELDs in their trucks, and those who use both paper and ELDs.

3.1.4.1 Frequency of Specific Interactions

Three interactions were identified by half of the carrier respondents as occurring at least twice a month for their typical drivers:

- Arranging a driver's loads so the driver had little delay time between loads (58 percent).
- Paying a driver for customer delays when picking up or delivering freight (52 percent).
- Asking a customer to adjust a load schedule so it was realistic for the driver (51 percent).

The second tier of more widespread interactions (40–50 percent) includes:

- Contacting a driver promptly about a new job task so the driver did not have to wait without pay (46 percent).
- Asking a driver to take sufficient time off duty to recover from fatigue (40 percent).

A third tier of interactions, mentioned by about 25–30 percent of the carrier respondents, includes:

- Asking a driver to log their hours accurately when the driver wanted more time to work or delay a break (30 percent).
- Asking a driver to shut down if the driver felt fatigued (28 percent).

In comparison, very few carriers—no more than 5 percent—said their drivers were asked to log their hours inaccurately for the purpose of working longer, asked to drive when fatigued, or have their logs changed in order to have them work longer.

Several interactions were more widespread for carriers who use ELDs (either alone or using a combination of ELDs and paper) than for those who use paper logs exclusively. These interactions are as follows:

- Arranging drivers' loads so that they had little delay time between loads.
- Paying drivers for customer delays when picking up or delivering freight.
- Requiring drivers to wait between loads for more than 2 hours without pay.
- Requiring drivers to wait for customer delays for more than 2 hours without pay.
- Asking a customer to adjust a load schedule so it was more realistic for the driver.
- Contacting drivers promptly about a new job task so that they did not have to wait without pay.

- Interrupting drivers' off-duty time with a message at an inappropriate time.
- Asking drivers to log their hours accurately when they wanted to work more time or to delay a break.
- Asking drivers to shut down if they felt fatigued.

Table 33 and Table 34 show results for carrier respondents' perceptions regarding the types of interactions that typical drivers experience at least twice per month and at least once per month within their companies, respectively.

Table 33. Interactions that a typical driver at a company experiences at least twice per month.

Specific Interactions That a Typical Driver Might Experience At Least Twice Per Month, According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Paid and Unpaid Time							
Arrange a driver's loads so the driver had little delay time between loads.	58%	52%	71%	65%	< 0.01	< 0.01	0.212
Pay a driver for customer delays when picking up or delivering freight.	52%	45%	61%	63%	< 0.01	< 0.01	0.740
Require a driver to wait between loads for more than 2 hours without pay.	18%	14%	28%	22%	< 0.01	0.015	0.210
Require a driver to wait for customer delays for more than 2 hours without pay.	14%	12%	22%	15%	< 0.01	0.28	0.092
Schedules							
Ask a customer to adjust a load schedule so it was realistic for the driver.	51%	47%	59%	57%	0.038	0.019	0.833
Ask a driver to meet a customer load schedule the driver viewed as unrealistic.	5%	6%	4%	5%	0.344	0.879	0.443
Communications							
Contact a driver promptly about a new job task so the driver did not have to wait without pay.	46%	41%	56%	54%	< 0.01	< 0.01	0.66
Interrupt a driver's off-duty time with a message at an inappropriate time.	7%	6%	11%	8%	0.061	0.343	0.351
Logging and Breaks							
Ask a driver to take sufficient time off duty to recover from fatigue.	40%	40%	48%	37%	0.143	0.421	0.056
Ask a driver to log hours accurately when the driver wanted more work time or to delay a break.	30%	26%	39%	34%	< 0.01	0.044	0.348
Ask a driver to log hours inaccurately to get more work time or delay a break.	2%	2%	4%	1%	0.352	0.469	0.162
Change a driver's log record after it was made to give the driver more work time or delay a break.	1%	1%	3%	0%	0.046	*	*
Fatigue							
Ask a driver to shut down if the driver felt fatigued.	28%	24%	37%	32%	< 0.01	0.035	0.332

Specific Interactions That a Typical Driver Might Experience At Least Twice Per Month, According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Ask a driver to operate when the driver felt fatigued.	3%	2%	4%	3%	0.340	0.495	0.747

*Unable to test statistically due to a frequency of zero to the answer of 2+ per month among those only using ELDs.

Table 34. Interactions that a typical driver at a company experiences at least once per month.

Specific Interactions That a Typical Driver Might Experience At Least Once Per Month, According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Paid and Unpaid Time							
Pay a driver for customer delays when picking up or delivering freight.	67%	59%	76%	81%	< 0.01	< 0.01	0.269
Arrange a driver's loads so the driver had little delay time between loads.	66%	61%	76%	74%	< 0.01	< 0.01	0.595
Require a driver to wait between loads for more than 2 hours without pay.	27%	22%	40%	33%	< 0.01	< 0.01	0.202
Require a driver to wait for customer delays for more than 2 hours without pay.	22%	18%	33%	25%	< 0.01	0.035	0.163
Schedules							
Ask a customer to adjust a load schedule so it was realistic for the driver.	70%	64%	74%	82%	0.063	< 0.01	0.093
Ask a driver to meet a customer load schedule the driver viewed as unrealistic.	18%	18%	21%	17%	0.508	0.692	0.378
Communications							
Contact a driver promptly about a new job task so the driver did not have to wait without pay.	57%	49%	67%	68%	< 0.01	< 0.01	0.88
Interrupt a driver's off-duty time with a message at an inappropriate time.	23%	18%	35%	26%	< 0.01	0.018	0.092
Logging and Breaks							
Ask a driver to take sufficient time off duty to recover from fatigue.	58%	57%	64%	58%	0.191	0.901	0.269
Ask a driver to log hours accurately when the driver wanted more work time or to delay a break.	43%	40%	43%	49%	0.527	0.02	0.277
Ask a driver to log hours inaccurately to get more work time or delay a break.	3%	3%	5%	2%	0.301	0.495	0.151
Change a driver's log record after it was made to give the driver more work time or delay a break.	3%	2%	7%	4%	< 0.01	0.162	0.251
Fatigue							
Ask a driver to shut down if the driver felt fatigued.	52%	49%	60%	55%	0.035	0.164	0.351
Ask a driver to operate when the driver felt fatigued.	5%	5%	6%	4%	0.488	0.649	0.343

3.1.4.2 Interactions Drivers Might Consider Harassment

If carrier respondents reported that certain interactions occurred at least once a month for a typical driver at their company, they were asked the following question about those interactions: "Which of these interactions, if any, do you think your drivers might consider harassment?"

According to carrier respondents, the most widespread interactions that their drivers might view as harassment related to not being paid for waiting time, unrealistic load schedules, being interrupted when off duty, and not letting drivers extend their hours. At least 10 percent of carrier respondents said that the following interactions—which drivers might consider harassment—occur at least once a month:

- Interrupting a driver's off-duty time with a message at an inappropriate time (14 percent).
- Requiring a driver to wait between loads for more than 2 hours without pay (13 percent).
- Requiring a driver to wait for customer delays for more than 2 hours without pay (12 percent).
- Asking drivers to log their hours accurately when they wanted more work time or to delay a break (10 percent).
- Ask a driver meet a customer load schedule that the driver viewed as unrealistic (10 percent).

As shown in Table 35, the incidence of harassing interactions was generally the same for carriers regardless of HOS logging method (i.e., paper only, ELD only, or a combination). The exceptions to this related to the following interactions:

- Arranging drivers' loads so that drivers had little delay between loads. This was less common among carriers using both paper and ELDs to log HOS (2 percent) than among those using only paper (5 percent) or using only ELDs (6 percent)
- Contacting drivers promptly about a new job task so they didn't have to wait without pay. This was less common among carriers using both paper and ELDs to log HOS (1 percent) than among those using only paper (4 percent) or using only ELDs (4 percent)
- Asking drivers to meet customer schedules which the driver viewed as unrealistic. This was less common among carriers using only paper to log HOS (9 percent) than among those using both paper and ELDs (16 percent)
- Asking customers to adjust load schedules so that they were more realistic for the driver. This was less common among carriers using both paper and ELDs to log HOS (less than ½ of 1 percent) than among those using only paper (7 percent) or using only ELDs (4 percent).

Table 35. Carrier respondents' perceptions on incidence of interactions that a typical driver at a company experiences at least once a month and may consider to be harassment, according to logging method.

Specific Interactions That a Typical Driver Might Experience And Consider Harassment, According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Paid and Unpaid Time							
Require a driver to wait between loads for more than 2 hours without pay.	13%	11%	18%	16%	0.463	0.793	0.627
Require a driver to wait for customer delays for more than 2 hours without pay.	12%	11%	17%	11%	0.5	0.554	0.873
Arrange a driver's loads so that the driver had little delay time between loads.	5%	5%	2%	6%	< 0.01	0.99	0.013
Pay a driver for customer delays when picking up or delivering freight.	3%	3%	2%	3%	0.206	0.534	0.393
Communications							
Interrupt a driver's off-duty time with a message at an inappropriate time.	14%	10%	27%	16%	0.903	0.297	0.088
Contact a driver promptly about a new job task so the driver didn't have to wait without pay.	4%	4%	1%	4%	< 0.01	0.331	0.08
Logging and Breaks							
Ask a driver to log hours accurately when the driver wanted more work time or to delay a break.	10%	9%	13%	11%	0.29	0.85	0.402
Ask a driver to take sufficient time off duty to recover from fatigue.	8%	8%	8%	7%	0.813	0.63	0.873
Ask a driver to log hours inaccurately to get more work time or to delay a break.	2%	2%	3%	2%	0.9	0.22	0.349
Change a driver's log record after it was made to give the driver more work time or to delay a break.	1%	1%	2%	1%	0.255	0.257	0.962
Schedules							
Ask a driver meet a customer load schedule that the driver viewed as unrealistic.	10%	9%	16%	11%	0.020	0.157	0.330
Ask a customer to adjust a load schedule so it was realistic for the driver.	5%	7%	*	4%	< 0.01	0.031	0.010
Fatigue							
Ask a driver to shut down if the driver felt fatigued.	6%	6%	8%	7%	0.690	0.718	0.939

Specific Interactions That a Typical Driver Might Experience And Consider Harassment, According to Carrier Respondents (Total Respondents: 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper and ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Ask a driver to operate when the driver felt fatigued.	4%	3%	6%	3%	0.15	0.637	0.489

*Less than 0.5 percent.

3.2 RETRIBUTION AND PUNISHMENT

Drivers were asked a series of questions gauging their reactions to company requests for them to work more than permitted by the regulations or when they felt ill or fatigued. Based on driver responses, this is not a very common occurrence: only 4 percent of paper-logging drivers and 3 percent of ELD-logging drivers said this had happened to them, which was an insignificant difference according to HOS logging method (Chi-square = 1.776, 1 d.f.; *p*-value = 0.183). The base sizes for all subsequent measures on this issue are very small (13 paper-logging drivers and 6 ELD-logging drivers) and are thus too small to merit reporting their results.

As shown in Table 36, 13 percent of carrier respondents said that drivers at their company had been asked to work more than the regulations allowed. This was more widespread at companies that use both paper and ELDs (21 percent) than at companies that use paper only (12 percent) or ELDs only (10 percent) (Chi-square = 0.016, d.f.; *p*-value = 0.016). Among the 13 percent of carriers that had requested drivers to work extended hours (beyond what the regulations allowed), the median number of times it was requested in the past year was 3.5. Two-thirds of those carriers (67 percent) said that their drivers sometimes reject those requests, with 5 percent of the carriers threatening drivers afterwards. (This did not vary significantly by logging method; Chi-square = 1.443, 2 d.f.; *p*-value = 0.486.) Carriers who use ELDs to log HOS and threatened drivers when drivers refused to work extended hours were asked a follow-up question regarding whether their ability to threaten was related to having ELD data, but the base for that follow-up question (2) was too small to analyze.

Table 36. Carrier history with extended hours requests.

Responses from Carrier Representatives	Total	Only Log with Paper	Log with Both Paper & ELDs	Only Log with ELDs
Total Respondents Answering (Carriers)	862	481	127	254
Company ever asked a driver to work more hours than the regulations allowed:	13%	12%	21%	10%
Carriers Who Had Asked Drivers to Work More Hours than the Regulations Allowed	108	59	26*	23*
Carrier asked once in the past year:	15%	14%	13%	21%
Carrier asked twice in the past year:	10%	11%	10%	6%
Carrier asked three to five times in the past year:	35%	35%	29%	40%
Carrier asked 6–10 times in the past year:	19%	16%	23%	22%
Carrier asked more than 10 times in the past year.	21%	25%	25%	11%
Median Number of Times Carrier Asked Drivers to Work More Hours than the Regulations Allowed in a Year	**3.5**	**3.5**	**3.8**	**3.1**
Following Requests to Work More Than the Regulations Allow				
Drivers sometimes reject those requests	67%	69%	73%	56%
Company has threatened drivers rejecting requests	5%	6%	0%	4%
Company has not threatened drivers rejecting requests	62%	61%	73%	52%
Drivers do not reject those requests:	33%	31%	27%	44%

*Caution: Small base.

3.3 HARASSMENT AND COERCION DEFINITIONS

Drivers and carriers read definitions of harassment and coercion (written by FMCSA) and were asked to rate how well the definitions described their own ideas of what constitutes harassment and coercion, using a scale of "very well," "somewhat," or "not at all." If the driver said he or she did not understand or did not know, this was recorded.

The definition of harassment presented to carriers and drivers is as follows:

> *Harassment is an act by a motor carrier, involving the use of information available through EOBR technology (either alone or in combination with other technology) to track a commercial motor vehicle driver's hours of service and requiring the driver to violate Federal hours-of-service rules or fatigue or ill driving restrictions.*

The definition of coercion presented to carriers and drivers is as follows:

> *Coercion is a threat by a motor carrier, shipper, receiver, or a transportation intermediary, to deny business or work based on a commercial motor vehicle driver's refusal to violate Federal regulations governing operating a commercial*

motor vehicle based, at least in part, on information available through EOBR technology or a combination of technology that includes an EOBR feature.

As shown in Table 37, about half (46 percent) of the drivers felt the definition of harassment described their idea "very well," while 38 percent said it described their idea "somewhat." Only 12 percent or drivers said "not at all." Those logging their HOS through ELDs were more likely than those using paper to log their HOS to say the definition described their own ideas "very well" (Chi-square for the question = 22.368, 5 d.f.; *p*-value < 0.001; chi-square for "very well" itself = 7.235, 1 d.f.; *p*-value < 0.01).

Similarly, 54 percent of drivers felt the definition of coercion described their idea "very well," with 33 percent saying "somewhat" and 10 percent saying "not at all" (see Table 38). There was no significant difference according to HOS logging method (Chi-square = 8.019, 5 d.f.; *p*-value = 0.155).

Carrier respondents' opinions as to how well the definitions described their ideas of harassment and coercion mirrored the drivers' opinions. Regarding harassment, 44 percent said the definition described their idea "very well," with 41 percent saying "somewhat" and 15 percent saying "not at all;" this did not vary significantly according to the logging systems in use by the carrier (Chi-square = 1.903, 4 d.f.; *p*-value = 0.754) (see Table 39).

As for coercion, 55 percent said the definitions described their idea "very well," 39 percent said "somewhat," and 6 percent said "not at all" (see Table 40). As with the definition of harassment, there were no significant differences according to the logging systems used by the carrier (Chi-square = 2.024, 4 d.f.; *p*-value = 0.731).

Table 37. Aptness of FMCSA's definition of harassment according to drivers.

Rating of How Well FMCSA's Definition of Harassment Describes Driver's Own Ideas (Total Answering: 626)	Total	Among Those Who Use Paper (284)	Among Those Who Use ELDs (340)
Very well	46%	42%	51%
Somewhat	38%	42%	34%
Not at all	12%	12%	13%
Don't know/Don't understand	3%	4%	1%
Refused	*	*	*

*Less than 0.5 percent.

Table 38. Aptness of FMCSA's definition of coercion according to drivers.

Rating of How Well FMCSA's Definition of Coercion Describes Driver's Own Ideas (Total Answering: 626)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (339)
Very well	54%	49%	59%
Somewhat	33%	36%	29%
Not at all	10%	11%	9%
Don't know/don't understand	3%	3%	3%
Refused	*	*	*

*Less than 0.5 percent.

Table 39. Aptness of FMCSA's definition of harassment according to carrier personnel.

Rating of How Well FMCSA's Definition of Harassment Describes Carrier Personnel's Own Ideas (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper & ELDs (128)	Only Log with ELDs (255)
Very well	44%	43%	49%	47%
Somewhat	41%	42%	37%	40%
Not at all	15%	15%	14%	13%

Table 40. Aptness of FMCSA's definition of coercion according to carrier personnel.

Rating of How Well FMCSA's Definition of Coercion Describes Carrier Personnel's Own Ideas (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper & ELDs (128)	Only Log with ELDs (255)
Very well	55%	55%	54%	57%
Somewhat	39%	39%	42%	39%
Not at all	6%	7%	4%	4%

3.4 PROTECTIONS AND REMEDIES

3.4.1 Drivers

Drivers were asked a series of questions regarding the effectiveness of potential countermeasures against harassment and coercion and whether they saw some specific actions as good ideas.

First, drivers were read this statement: "Federal regulations state that if drivers have safety complaints, firms must not coerce them to drive when fatigued—by discriminating against the driver, or otherwise disciplining him or firing him." When asked to rate the effectiveness of these regulations, 78 percent of drivers saw them as "very" or "somewhat effective," with 40 percent saying "very effective" (see Table 41). Ten percent of surveyed drivers saw them as "not effective at all." Views of the effectiveness varied significantly according to HOS logging method, with those using ELDs being more likely to see them as effective than those using paper to log their HOS (Chi-square = 11.773, 4 d.f.; *p*-value = 0.019).

Table 41. Drivers' rating of effectiveness of Federal regulations against harassment and coercion.

Drivers' Rating of Effectiveness (Total Answering: 625)	Total	Among Those Who Use Paper (284)	Among Those Who Use ELDs (340)
Very/Somewhat effective	78%	72%	85%
Very effective	40%	33%	47%
Somewhat effective	39%	39%	37%
Not too/Not effective at all	20%	26%	14%
Not too effective	10%	13%	6%
Not effective at all	10%	13%	8%

Drivers were also given a list of specific measures which have been proposed to protect against ELD-based harassment. Drivers were asked which of these measures (if any) they thought were good ideas. As shown in Table 42, no single measure was seen as a good idea by more than half of the drivers; the measure with the broadest appeal was the drivers' ability to get copies of the logs from the device (50 percent). Four other measures were seen as good ideas by 40–45 percent of drivers:

- Carriers are explicitly prohibited from harassing drivers (45 percent).
- Enforcement actions that keep drivers' personal information private (45 percent).
- Carriers must provide drivers back copies of their logs for up to 6 months (43 percent).
- "Mute function" so that you are not bothered when off duty (40 percent).

In general, paper-logging drivers seemed more skeptical of these remedies than drivers who use ELDs. The following table shows complete results for drivers' responses to this portion of the questionnaire.

Table 42. Remedies and measures seen by drivers as good ideas for preventing harassment.

Proposed Remedies/Measures for Preventing Harassment (Total Answering: 626)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (339)	*p*-value
Drivers can get copies of the logs through the device.	50%	44%	58%	0.012
Carriers are explicitly prohibited from harassing drivers.	45%	43%	48%	0.331
Enforcement actions that keep drivers' personal information private.	45%	40%	51%	0.038
Carriers must provide drivers back-copies of their logs for up to 6 months.	43%	40%	45%	0.183
"Mute function" so that drivers are not bothered when off duty.	40%	33%	48%	0.018
A formal process for complaint procedures.	33%	27%	40%	< 0.01
An "edit" function, with edits needing mutual approval.	32%	25%	40%	0.024
Limitations on how often and when the carrier can get location from the EOBR/ELD.	26%	23%	29%	0.202
None of these.	11%	15%	7%	< 0.01

Drivers were read a list of three actions that FMCSA could take against a carrier upon determining that a carrier was harassing its drivers. Drivers were asked to indicate which of these actions would be appropriate. Seventy-three percent of drivers thought fines and penalties would be appropriate, while 37 percent thought that publication of carrier actions would be appropriate, and 35 percent thought that closer Federal monitoring would be appropriate (see Table 43). Closer Federal monitoring was seen as appropriate by significantly more drivers using ELDs than among those using paper logs.

Table 43. Drivers' opinions on the appropriateness of actions that FMCSA could take against harassing carriers.

Potential Actions That FMCSA Could Take Against Harassing Carriers (Total Answering: 623)	Total	Among Those Who Use Paper (283)	Among Those Who Use ELDs (338)	*p*-value
Fines and penalties	73%	71%	75%	0.304
Publication of carrier actions	37%	33%	41%	0.108
Closer Federal monitoring	35%	28%	43%	< 0.01
Something else	8%	11%	6%	0.057

3.4.2 Carriers

Carrier representatives were asked the same questions as drivers regarding the effectiveness of Federal regulations, remedies, and appropriate FMCSA actions after findings of harassment.

As shown in Table 44, 76 percent of carrier respondents thought that Federal regulations to prevent harassment and coercion were "very" or "somewhat effective," with 28 percent saying

"very effective." Seven percent thought they were not effective at all. These opinions were consistent regardless of HOS logging method (Chi-square = 5.433, 6 d.f.; *p*-value = 0.49).

Table 44. Carrier respondents' rating of effectiveness of Federal regulations against harassment and coercion.

Carrier Respondents' Rating of Effectiveness (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper & ELDs (128)	Only Log with ELDs (255)
Very/Somewhat effective	76%	74%	74%	80%
Very effective	28%	28%	30%	30%
Somewhat effective	47%	47%	44%	50%
Not too/Not effective at all	24%	26%	26%	20%
Not too effective	18%	19%	21%	13%
Not effective at all	7%	7%	5%	7%

Upon reviewing the list of planned preventive measures and remedies, 67 percent of carrier respondents thought it was a good idea for drivers to have the ability to obtain copies of their logs through the ELD (see Table 45). About half of carrier respondents thought that ideas such as explicit prohibition of harassment (55 percent) and a formal process for complaint procedures (52 percent) were also good ideas. A very small percentage (8 percent) thought that limits on how often a carrier could obtain location information from an ELD was a good idea.

For these measures, there were a few differences between the carriers according to their HOS logging method:

- Carriers using only paper were less likely than those using both paper and ELDs to characterize explicit prohibitions against harassing drivers as a good idea (51 percent versus 66 percent).
- Carriers using only paper were also less likely than those using only ELDs to consider muting functionality to avoid being bothered when off-duty a good idea (36 percent versus 45 percent).
- Carriers using only ELDs were less likely than those using only paper to consider limits on the frequency of obtaining location data a good idea (4 percent versus 9 percent).

Table 45. Remedies and measures seen by carrier respondents as good ideas for preventing harassment,

Proposed Remedies/Measures for Preventing Harassment (Total Respondents = 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper & ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
Drivers can get copies of the logs through the device.	67%	66%	70%	70%	0.462	0.319	0.975
Carriers are explicitly prohibited from harassing drivers.	55%	51%	66%	56%	< 0.01	0.237	0.105
A formal process for complaint procedures.	52%	49%	59%	55%	0.063	0.166	0.474
An "edit" function, with edits needing mutual approval.	45%	46%	47%	44%	0.888	0.667	0.664
Enforcement actions that keep drivers' personal information private.	42%	45%	35%	39%	0.081	0.174	0.394
"Mute function" so that drivers are not bothered when off duty.	39%	36%	42%	45%	0.22	0.02	0.578
Carriers must provide drivers back-copies of their logs for up to 6 months.	37%	39%	37%	34%	0.705	0.302	0.692
Limitations on how often and when the carrier can get location from the EOBR/ELD.	8%	9%	9%	4%	0.968	0.011	0.064
None of these.	10%	12%	5%	7%	0.055	0.034	0.638

Like the drivers, most carrier respondents thought that fines and penalties (64 percent) would be an appropriate FMCSA response to a carrier that was found to be harassing its drivers. Fewer carrier respondents thought that closer Federal monitoring (34 percent) or publication of carrier actions (23 percent) would be appropriate FMCSA responses. These results did not vary according to HOS logging method. (For "fines and penalties," Chi-square = 0.166, 2 d.f.; *p*-value = 0.92. For "closer Federal monitoring," Chi-square = 0.71, 2 d.f.; *p*-value = 0.701. For "publication of carrier actions," Chi-square = 2.324, 2 d.f.; *p*-value = 0.313.)

3.5 ATTITUDES ABOUT ELDS

Drivers and carriers were asked to rate their agreement with a series of statements using a four-point scale ("agree completely," "agree somewhat," "disagree somewhat," and "disagree completely").

3.5.1 Drivers

Positive attitudes towards ELDs are sometimes more widespread among drivers who use ELDs than among drivers who use paper to log their HOS. This does not mean, however, that paper users do not see the benefits of ELDs.

The following statements evoked agreement (either "completely" or "somewhat") from about 7 out of 10 drivers.

- ELDs mean I have less paperwork to fill out (78 percent).
- ELDs save me time and make it easier for me to comply with HOS logging (76 percent).
- ELDs enhance my relationship with my fleet manager to assure compliance and safe operations (75 percent).
- ELDs improve decisions which my fleet manager and I make about driving and rest times and management of loads (74 percent).
- ELDs protect me from management being overbearing (71 percent).

Agreement tapered off with respect to indirect benefits for the driver based on what happens in the industry at large. Approximately two-thirds (65 percent) of drivers agreed that ELDs "make me confident that other truck drivers are not overworking themselves" and that ELDs "make the roads safer for everyone."

About half of the drivers agreed with the following statements regarding an erosion of their workday independence:

- ELDs give management too much of an insight to my day (55 percent).
- ELDs prevent me from doing my job the way I want (54 percent).
- ELDs make me feel less independent (53 percent).

Drivers who use ELDs are more positively disposed toward the devices than drivers who use paper, but note that the majority of paper-logging drivers agree with the statements about paperwork reduction and reduced burden. Conversely, many drivers who use ELDs to log their hours agree that management has too much insight into their days with ELDs and that ELDs limit their ability to work their day as they would like (about half). Complete results for this portion of the survey are shown in Table 46.

Table 46. Drivers' agreement with statements about ELDs (summary of "agree completely/somewhat" ratings).

Statements about ELDs	Total (628 Respondents)	Among Those Who Use Paper (285)	Among Those Who Use ELDs (341)	*p*-value
ELDs mean I have less paperwork to fill out.	78%	74%	83%	< 0.01
ELDs save me time and make it easier for me to comply with HOS logging.	76%	68%	85%	< 0.01
ELDs enhance my relationship with my fleet managers to assure compliance and safe operations.	75%	67%	84%	< 0.01
ELDs improve decisions which my fleet manager and I make about driving and rest times, and management of loads.	74%	67%	81%	< 0.01
ELDs protect me from management being overbearing.	71%	65%	78%	< 0.01
ELDs make me confident that other truck drivers are not overworking themselves.	65%	66%	65%	0.884
ELDs make the roads safer for everyone.	65%	61%	70%	0.019
ELDs give management too much of an insight to my day.	55%	64%	46%	< 0.01
ELDs prevent me from doing my job the way I want.	54%	63%	45%	< 0.01
ELDs make me feel less independent.	53%	59%	48%	< 0.01

3.5.2 Carriers

Carrier respondents rated their agreement with a similar list of statements, adjusted for a carrier's perspective. Agreement with these statements is generally higher for the carriers than for the drivers. It is unclear if this is due to scale bias, the method of interview (in-person versus online survey), or a genuine difference in perspectives. As such, this analysis focuses on the perspectives of the carriers alone, with the exception of one statement.

As shown in Table 47, the following statements evoked agreement (either "completely" or "somewhat") by approximately four out of five carrier respondents:

- ELDs mean drivers have less paperwork to fill out (91 percent).
- ELDs save management time and make it easier for me to report HOS (85 percent).
- ELDs improve decisions which fleet managers and drivers make about driving and rest times and management of loads (84 percent).
- ELDs make management confident that other truck drivers are not overworking themselves (82 percent).
- ELDs enhance the relationship between fleet managers and drivers to assure compliance and safe operations (81 percent).

Agreement is less universal (but still acknowledged) with regard to safer industry practices and drivers' independence. About 60–70 percent of carrier respondents agreed that ELDs:

- Make the roads safer for everyone (72 percent).
- Protect drivers from management being overbearing (63 percent).
- Make drivers feel less independent (60 percent).
- Prevent drivers from doing their job the way they want (57 percent).

The only statement that a minority of carriers agreed with was that ELDs "give management too much of an insight into a driver's day" (24 percent).

As was the case with the drivers, carriers that use ELDs (either partially or exclusively) were more inclined to agree with the positive aspects of ELDs; however carriers that do not use ELDs are not oblivious to the positive or negative aspects of the devices.

Table 47. Carrier respondents' agreement with statements about ELDs (summary of "agree completely/somewhat" ratings).

Statements about ELDs (Total Respondents = 865)	Total	(A) Only Log with Paper (482)	(B) Log with Both Paper & ELDs (128)	(C) Only Log with ELDs (255)	*p*-value, A versus B	*p*-value, A versus C	*p*-value, B versus C
ELDs mean drivers have less paperwork to fill out.	91%	87%	96%	98%	0.024	< 0.01	0.258
ELDs save management time and make it easier for me to report HOS.	85%	78%	90%	97%	< 0.01	< 0.01	0.01
ELDs improve decisions which fleet managers and drivers make about driving and rest times, and management of loads.	84%	78%	94%	96%	< 0.01	< 0.01	0.467
ELDs make management confident that other truck drivers are not overworking themselves.	82%	77%	83%	93%	0.188	< 0.01	< 0.01
ELDs enhance the relationship between fleet managers and drivers to assure compliance and safe operations.	81%	72%	91%	95%	< 0.01	< 0.01	0.176
ELDs make the roads safer for everyone.	72%	65%	80%	85%	< 0.01	< 0.01	0.233
ELDs protect drivers from management being overbearing.	63%	56%	74%	75%	< 0.01	< 0.01	0.913
ELDs make drivers feel less independent.	60%	65%	54%	51%	0.027	< 0.01	0.615
Prevent drivers from doing their job the way they want	57%	60%	59%	50%	0.891	0.108	0.041
Give management too much of an insight into drivers' days	24%	29%	16%	15%	< 0.01	< 0.01	0.869

3.6 HOW DRIVERS ARE PAID AND EVALUATED

3.6.1 From the Drivers' Perspective

3.6.1.1 Basis of Pay

Drivers were asked to provide the main basis on which they are paid, as well as other bases. With respect to the main basis, most are paid by the mile (61 percent), with 22 percent paid a percentage of the revenue. Comparatively few are paid hourly (8 percent), fixed fee (5 percent), or by salary (4 percent). Significantly more drivers who use ELDs are paid by miles than those who use paper (72 percent versus 51 percent) (Chi-square = 30.146, 5 d.f.; *p*-value < 0.01).

Hourly pay and fixed fees represent important secondary pay criteria. Overall, 19 percent say "hourly" is either the main basis of their pay or an additional basis. Sixteen percent said this of

fixed fees. See Table 48 and Table 49 for a detailed list of drivers' responses to questions about payment methods.

Table 48. Main methods of payment, from the perspective of drivers.

Drivers' Responses Regarding Payment Method (628 Respondents)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (341)
Miles	61%	51%	72%
Percentage of revenue	22%	27%	18%
Hourly	8%	10%	5%
Fixed fee (e.g., flat payment per load/shipment)	5%	8%	1%
Salary	4%	4%	3%
Other	1%	1%	*

*Less than 0.5 percent.

Table 49. Total ways drivers are paid, from the perspective of drivers.

Drivers' Responses Regarding Payment Method (628 Respondents)	Total	Among Those Who Use Paper (285)	Among Those Who Use ELDs (341)	*p*-value
Total Ways Paid (Mentions of 3 Percent or More):				
Miles	64%	55%	75%	< 0.01
Percentage of revenue	26%	33%	20%	< 0.01
Hourly	19%	19%	19%	0.915
Fixed fee (e.g., flat payment per load/shipment)	16%	19%	14%	0.08
Salary	4%	5%	4%	0.287
Detention/Down time	3%	3%	3%	0.954
Loading/Unloading	3%	3%	2%	0.187
Bonus	3%	3%	3%	0.685
Layover	3%	2%	4%	0.218

*Less than 0.5 percent.

3.6.1.2 Basis of Work Evaluation, and Satisfaction with Evaluation Methods

Drivers were also asked to provide the main way that supervisors evaluated their work (as well as other ways). Recalling that miles were the major criterion for drivers being paid, miles were also one of the most widespread bases of evaluating a driver's work (as a "main" basis), at 31 percent, along with meeting customer service schedules, at 24 percent (see Table 50). "Loads per week" was the main criterion for 15 percent of the drivers. This did not vary significantly according to the HOS logging method (Chi-square = 8.493, 10 d.f.; *p*-value = 0.581).

As shown in Table 51, drivers listed "meeting customer service schedules" (47 percent) and "miles per week" (44 percent) as the top two criteria, once additional bases of evaluation were considered. Miles per week is a more common criterion for drivers who use ELDs (51 percent) than for those who use paper (36 percent).

Table 50. Main basis of drivers' work evaluation, from the perspective of drivers.

Drivers' Responses Regarding Work Evaluation (mentions of 2 percent or more) (Total Answering 625)	Total	Among Those Who Use Paper (284)	Among Those Who Use ELDs (339)
Miles per week	31%	26%	36%
Meeting customer service schedules	24%	24%	24%
Loads per week	15%	17%	13%
Avoiding chargeable accidents	5%	4%	5%
Avoiding recorded HOS violations	4%	4%	4%
Shipments per week	4%	4%	3%
Fuel mileage	3%	2%	4%
Avoiding freight damage claims	2%	3%	1%
Stop count (pick-ups and/or deliveries per week)	2%	2%	2%

Table 51. Total bases of drivers' work evaluation, from the perspective of drivers.

Drivers' Responses Regarding Work Evaluation (Total Answering 625)	Total	Among Those Who Use Paper (284)	Among Those Who Use ELDs (339)	*p*-value
Total Ways Work Is Evaluated:				
Meeting customer service schedules	47%	42%	51%	0.156
Miles per week	44%	36%	51%	< 0.01
Loads per week	30%	29%	31%	0.571
Avoiding recorded HOS violations	25%	25%	25%	0.884
Avoiding chargeable accidents	24%	21%	26%	0.270
Avoiding freight damage claims	23%	22%	24%	0.604
Fuel mileage	21%	15%	28%	< 0.01
Shipments per week	14%	12%	16%	0.445
Avoiding out-of-route miles	14%	10%	18%	0.144
Avoiding hard braking events	11%	6%	16%	0.035
Stop count (pick-ups and/or deliveries per week)	11%	9%	13%	0.225
Avoiding worker compensation claims	10%	8%	12%	0.179
Other	8%	8%	8%	0.015

As shown in Table 52, most of the drivers (91 percent) said they were satisfied (either very or somewhat satisfied) with the way(s) that their supervisor evaluates their work, with 57 percent stating they were very satisfied. Satisfaction with the evaluation methods did not vary according to the drivers' HOS logging method (Chi-square = 6.659, 4 d.f.; *p*-value = 0.155).

Table 52. Drivers' satisfaction with how their work is evaluated.

Drivers' Satisfaction Ratings Related to How Their Work Is Evaluated (Total Answering: 623)	Total	Among Those Who Use Paper (282)	Among Those Who Use ELDs (339)
Very/Somewhat Satisfied	91%	89%	92%
Very Satisfied	57%	59%	55%
Somewhat Satisfied	34%	31%	37%
Somewhat/Very Dissatisfied	5%	5%	5%
Somewhat Dissatisfied	2%	2%	3%
Very Dissatisfied	2%	3%	2%
Don't know/Not sure	5%	6%	3%

3.6.2 From the Carriers' Perspective

3.6.2.1 Main Way in Which Drivers Are Paid

Carrier respondents were asked to provide the main basis for their drivers' pay. As shown in Table 53, the top two bases were hourly (39 percent) and miles (32 percent). Fewer carriers based their drivers' pay on percentage of revenue (15 percent), fixed fee (6 percent), or by salary (2 percent).

Carriers who use ELDs to log HOS were more likely to base drivers' pay on miles, while those who use paper only were more likely to pay on an hourly basis. (Chi-square for the question = 78.035, 10 d.f.; p-value < 0.01.)

Table 53. Main ways drivers are paid, from the perspective of carrier respondents.

Main Ways That Drivers Are Paid, According to Carrier Respondents (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper & ELDs (128)	Only Log with ELDs (255)
Hourly	39%	48%	24%	27%
Miles	32%	22%	42%	51%
Percentage of revenue	15%	16%	21%	10%
Fixed fee (e.g., flat payment per load/shipment)	6%	7%	4%	4%
Salary	2%	3%	2%	1%
Other	6%	5%	7%	7%

3.6.2.2 Basis of Work Evaluation, and Satisfaction with Evaluation Method

According to carrier respondents, "meeting customer service schedules" (46 percent) is the criterion most broadly used for evaluating drivers' work (as a main basis). No other single criterion was mentioned by more than 12 percent of carrier respondents (see Table 54). Results varied across HOS logging methods (Chi-square = 41.158, 14 d.f.; p-value < 0.01), with meeting customer service schedules a criterion for fewer carriers that use both paper and ELDs compared to those that use only ELDs (36 percent versus 48 percent), and fewer carriers using only paper

evaluating on the basis of miles (6 percent) compared to those using ELDs exclusively or in combination with paper (19 percent each).

When secondary criteria are considered along with the primary criterion, "meeting customer service schedules" remains the most widespread criterion for evaluating drivers' work. Overall, 78 percent of carrier respondents reported that they evaluate drivers' work with meeting customer service schedules in mind. Carrier respondents who work at a company that uses a combination of paper and ELDs for HOS logging considered this more than respondents who work at a company that uses paper only (87 percent versus 75 percent).

Three in five carrier respondents reported that they consider whether the driver has avoided chargeable accidents (61 percent) and/or avoided recorded HOS violations (58 percent) when evaluating performance. Companies that use ELDs consider both of these items more often than those that use paper only.

Table 54. Basis of drivers' work evaluation according to carrier respondents.

Carrier Respondents Answers Regarding How Drivers' Work Is Evaluated at Their Company (Total Respondents: 865)	Total	Only Log with Paper (482)	Log with Both Paper & ELDs (128)	Only Log with ELDs (255)
Main Way Work Is Evaluated:				
Meeting customer service schedules	46%	46%	36%	48%
Loads per week	12%	14%	10%	8%
Avoiding recorded HOS violations	12%	13%	16%	9%
Avoiding chargeable accidents	12%	13%	11%	9%
Miles per week	11%	6%	19%	19%
Stop count (pick-ups and/or deliveries per week)	5%	4%	4%	5%
Shipments per week	2%	2%	1%	1%
Fuel mileage	1%	1%	*	1%
Total Ways Work Is Evaluated:				
Meeting customer service schedules	78%	75%	87%	82%
Avoiding chargeable accidents	61%	54%	77%	70%
Avoiding recorded HOS violations	58%	52%	70%	67%
Avoiding freight damage claims	33%	29%	48%	35%
Avoiding worker compensation claims	32%	28%	46%	36%
Fuel mileage	28%	18%	46%	42%
Loads per week	27%	27%	27%	25%
Miles per week	26%	16%	51%	38%
Avoiding out-of-route miles	23%	16%	38%	32%
Avoiding hard braking events	23%	14%	37%	38%
Stop count (pick-ups and/or deliveries per week)	13%	13%	13%	14%
Shipments per week	10%	10%	11%	9%
Other	18%	19%	12%	16%

*Less than 0.5 percent.

As shown in Table 55, the vast majority of carrier respondents (93 percent) said they were either very or somewhat satisfied with the way they evaluate their drivers (with 37 percent saying they were "very" satisfied). Satisfaction did not vary according to HOS logging method (Chi-square = 4.206, 6 d.f.; *p*-value = 0.649).

Table 55. Carrier respondents' satisfaction with how they evaluate drivers' work.

Carrier Respondents' Satisfaction Ratings Related to How They Evaluate Their Drivers' Work	Total (865 Respondents)	Only Log with Paper (482)	Log with Both Paper and ELDs (128)	Only Log with ELDs (255)
Very/Somewhat Satisfied	93%	92%	92%	95%
Very Satisfied	37%	37%	30%	40%
Somewhat Satisfied	56%	56%	62%	56%
Somewhat/Very Dissatisfied	7%	8%	7%	5%
Somewhat Dissatisfied	6%	6%	6%	4%
Very Dissatisfied	1%	2%	1%	1%

3.7 COSTS OF ELDs TO CARRIERS

Carrier respondents whose companies use ELDs (either alone or in combination) were asked what percentage of their trucks was equipped with ELDs. Seventy-two percent of carrier respondents stated that more than three-quarters of their trucks were equipped with ELDs. Forty-seven percent stated that all of their trucks (100 percent) were equipped with ELDs. Among the carriers with ELDs, the average percentage of trucks equipped with ELDs was 80 percent.

Carrier respondents whose companies use ELDs were also asked to provide the average cost of the actual ELD unit, the cost of the installation, and the yearly operational cost.[4]

As shown in Table 56, there is a wide range of costs associated with the units themselves. About one in five carriers (18 percent) reported costs per unit of less than $500, but a similar percentage (18 percent) reported costs per unit of over $2,000. The median was $1,000.

Figures in this section should be used with caution, as the individual who answered these questions may not have had accurate information at hand; in addition, information on models or specifications was not collected, and the models in use may or may not meet the requirements of the ultimate regulations.

[4] The survey results are consistent with the ELD costs reported in FMCSA's March 2014 Regulatory Impact Analysis (RIA). In the RIA, FMCSA used an ELD unit cost of $799, installation cost of $78, and yearly operational cost of $240. These costs were based on the pricing of the ELD with the largest market share at the time. Other more expensive models included additional fleet management features not required by the rule.

Table 56. Unit costs of ELDs as reported by carrier respondents.

Cost of ELD Units (Including Any Software) in Whole Dollars	Total (383 Respondents)
Less than $500	18%
$500–799	15%
$800–1,000	21%
$1,001–1,500	16%
$1,501–2,000	13%
More than $2,000	18%
Median ($)	$1,000

Table 57 shows that 26 percent of carrier respondents reported installation costs of less than $100 per unit, while 24 percent reported installation costs of $300 per unit or more. The median was $150.

Table 57. Installation cost per ELD unit, as reported by carrier respondents.

Cost of ELD Unit Installation (Per Unit) in Whole Dollars	Total (383 Respondents)
Less than $100	26%
$100–149	17%
$150–199	9%
$200–299	23%
$300 or more	24%
Median ($)	$150

While per unit operational costs surpassed $1,000 for some carriers (14 percent), for the bulk of the carriers the annual operational costs were less than $500 (51 percent), with the median cost at $480 (see Table 58). For 24 percent of carriers, the annual cost was less than $250.

Table 58. Yearly operational cost per ELD unit, as reported by carrier respondents.

Yearly Operational Cost of ELDs (Per Unit)	Total (383 Respondents)
Less than $250	24%
$250–499	27%
$500–749	28%
$750–999	6%
$1,000–1,999	9%
$2,000 or more	5%
Median ($)	$480

3.8 TYPES OF ELDs IN USE

Sixty-five percent of the drivers who use ELDs said that their unit was not a standalone ELD, but that it was part of a system with other functionality. When asked to describe the hardware set-up, 64 percent of drivers identified it (from a list) as a "console/display that is not a smartphone or computer, branded with a manufacturer's name." Eleven percent of drivers said their hardware set-up consisted of a laptop synced to the engine, 9 percent said that their hardware set-up

consisted of a smartphone synced to the engine, and 9 percent said the device was something else. The remainder simply did not know how to describe the device.

Eighty-three percent of the carrier respondents whose companies use ELDs also said that their ELD units were part of a fleet management system, with 29 percent saying their trucks had standalone ELDs (some carriers had both types). Approximately two-thirds of carrier respondents (66 percent) said they were able to process logged HOS for long haul and short haul separately (22 percent said they were not able to do this, and 12 percent said they did not know if their units provided this capability). Seventy-three percent of carrier respondents said their hardware set-up consisted of a console or display (that was not a smartphone or laptop), while 5 percent said their hardware set-up consisted of a smartphone synced to the engine, and 5 percent said it consisted of a laptop synced to the engine. Others mentioned branded items without specifying if they were synced to the engine.

4. DISCUSSION

Section 2 and Section 3 reviewed numerous examples of how the experiences and profiles of drivers using ELDs to log their HOS are different from those using paper to log HOS. To briefly revisit, these included the following:

- Drivers using ELDs to log HOS tend to work at companies with larger fleets and are more likely to be company employees.
- Drivers using ELDs are more likely to be in trucks that are equipped with safety monitoring/advisory systems.
- Drivers using ELDs were more likely to be paid on the basis of miles and less likely to be paid a percentage of revenue compared to those using paper to log their HOS.
- Consistent with the basis on which they are paid, drivers using ELDs to log HOS were more likely to be evaluated on the basis of miles driven.
- Drivers logging their HOS with ELDs were more likely than those using paper to be paid for customer delays when picking up or delivering freight; to be required to wait between loads for more than 2 hours without pay; to be interrupted during their off-duty time at an inappropriate time; and to experience management asking customers to adjust a load schedule so it was realistic for the driver.

That having been said, there are other aspects where drivers using ELDs are very similar to drivers using paper logs. For example, their satisfaction with their job and their relationship with management is not significantly different. In addition, their views on what constitutes harassment are similar (the sole difference regarding the interactions in the questionnaire was that those using paper were more likely to consider it harassment when a manager asked them to log inaccurately to get more work time in or to delay a break.

The most significant area where there is a lack of difference between the two groups is with respect to experiencing interactions which drivers consider harassment. Drivers' reactions to the 14 pre-listed interactions were compared regarding what percent experience them at least twice per month and consider them harassment, as well as what percent experience them at least once per month and consider them harassment. Of these 28 opportunities for a statistically significant difference to manifest itself, it only occurred once; the one instance in which it did was regarding management asking drivers to log HOS inaccurately in order to get more work time in or to delay a break (this was at low levels, with 2 percent of those logging with paper and 1 percent of those logging with ELDs saying they both consider it to be harassment and they experience it at least twice per month—note that it is those logging with paper who have a higher level than those logging with ELDs).

In recognition that drivers logging HOS with ELDs tend to work at companies with larger fleets, an alternative explanation for the lack of differences was accepted; that is, that companies with larger fleets also have different attitudes about safety and in-labor practices. If true, it might be that the size of the company (and its concurrent practices) might mask differences in harassment which would otherwise be apparent. The analysis in Section 3.1.3.2 addressed this by conducting

a regression which incorporated fleet size as a factor. It looked at 32 different dependent variables with fleet size accounted for, and in only 2 of the 32 tests was there an estimated difference between the 2 groups of drivers. Notably, for one of the tests it was estimated that drivers with ELDs were more likely to have the harassing experience, but in the other it was estimated that drivers logging with paper were more likely to have the harassing experience. When one considers 1) the number of tests conducted for this examination, and 2) that higher standards for rejecting the null hypothesis are often recommended when many tests are being conducted, 2 "statistically significant" results out of 64 might not be considered compelling; one could reasonably conclude that the two apparently significant results are due to chance. In other words, considering the significance of these specific items in isolation from the multitude of other tests undertaken most likely constitutes type I error (false positive), as the methods that provide a better control for type I error, such as Bonferroni corrections, do not flag these findings as statistically significant.

A more significant observation occurred when drivers were handed a list of other potentially harassing events and asked whether or not they had experienced them at their current company (discussed in Section 3.1.3.4). Drivers using ELDs were more likely to have experienced being contacted by management with a query as to why their truck was not moving or the carrier changing their status in their logs.

5. CONCLUSIONS

The charge to FMCSA that the Agency consider the potential for driver harassment with respect to ELDs was the genesis of this research project. The research has shown that few truck drivers feel as if they are harassed, regardless of the method used to log their HOS. The incidence of harassment may be too rare to be detected in a research project such as this.

Generally, the research observations do not suggest that harassment is greater for drivers who use ELDs to log HOS than it is for drivers who use paper. There are statistically significant differences, but they are rare among the many comparisons made, and one could legitimately conclude that those statistically significant differences are such a small proportion of all the comparisons made that their rising to the level of "statistical significance" is due to chance or sampling error.

It is acknowledged that, when asked about other interactions which they might have experienced at their company, drivers who use ELDs indicated a greater likelihood that they were 1) asked why their truck had not moved, or 2) that their carrier had changed their logs.

The evidence in this survey research does not support concluding that harassment occurs due to being in a situation where HOS are logged using ELDs.

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APPENDIX A: LITERATURE REVIEW

INTRODUCTION

Statutory Context for the Literature Review

FMCSA was created by Congress in the passage of the Motor Carrier Safety Improvement Act (MCSIA) of 1999. The core mission of FMCSA is defined in this statement:

> *In carrying out its duties, the [FMCSA] shall consider the assignment and maintenance of safety as the highest priority, recognizing the clear intent, encouragement, and dedication of Congress to the furtherance of the highest degree of safety in motor carrier transportation.*(9)

FMCSA is researching mandating the use of EOBRs for the purpose of maintaining records of duty status (RODS). The RODS is also known as a log (or a logbook, if in paper form) and is required of all commercial vehicle operators who are subject to the HOS regulations but are not eligible for either of the short-haul exceptions under 49 CFR 395.1(e).

The specific statutory authority for the FMCSA to enable the use of EOBRs to keep track of the RODS required to be maintained by commercial vehicle drivers is derived from a number of sources.[5] For the purposes of the present study, the relevant point is that this authority is modified by 49 U.S.C. Section 31137(a), which (after amendments due to the 2012 passage of MAP-21, Public Law 112-141, 126 Statute 405) provides the following:

> *Use of electronic logging devices. Not later than 1 year after the date of enactment of the Commercial Motor Vehicle Safety Enhancement Act of 2012 [enacted July 6, 2012], the Secretary of Transportation shall prescribe regulations—*
>
> *(1) requiring a commercial motor vehicle involved in interstate commerce and operated by a driver subject to the hours of service and the record of duty status requirements under part 395 of title 49, Code of Federal Regulations, be equipped with an electronic logging device to improve compliance by an operator of a vehicle with hours of service regulations prescribed by the Secretary; and*
>
> *(2) ensuring that an electronic logging device is not used to harass a vehicle operator.*

This wording, along with the court decision referenced above explains why it is necessary to analyze literature related to how the potential for the harassment of drivers may be affected by EOBRs, in the context of the primary statutory mission of FMCSA. The demand for monitoring technology is closely associated with how hours of work affect truck driver productivity, so as a

[5] All rulemakings are published in several stages, from the Advanced Notice of Proposed Rulemaking (ANPRM) to the Final Rule; each contains an early section detailing the relevant legal basis for the rulemaking (see, for example, Section II, FMCSA 2010).

corollary the researchers also address how the relevant scientific literature analyzes the role of EOBRs and related technologies in monitoring productivity of truckers for productivity management.[6]

Plan of the Literature Review

The literature review begins with a scientific discussion of the issues at hand through a review of the relevant research literature, as found in scientific journals in economics and other relevant parts of social science.[7] There is a modest amount of published work related to productivity monitoring in trucking. Three sources were found that relate to the general question of how to analyze productivity in trucking. While this is not directly relevant to the context of this report, it is potentially useful for the purpose of refreshing an understanding of the economic concept of productivity; so this literature is summarized in Appendix B. More directly relevant is a small literature review on the issues involved in the monitoring of truck drivers by motor carriers. This is discussed in the section entitled "EOBRs and Productivity Monitoring," which reviews three journal sources that analyze the economic incentives facing dispatchers and drivers and the resulting economic foundations of the demand for monitoring, along with some early empirical analyses of the distribution of that demand across industry segments. The section entitled "Industry-sponsored EOBR Research" summarizes early findings from an important industry-sponsored study about the distribution of EOBR use and initial industry reactions to EOBRs.

There is almost no published work on the topic of truck driver harassment, let alone research on how EOBRs might affect such harassment. However, there are two well-developed streams of scientific literature on harassment as it arises in workplace-related contexts: research on workplace bullying and research on sexual harassment, with a focus on workplace instances. The genesis and main points in the literature on workplace bullying are discussed in the section entitled "Related Literature: Workplace Bullying," while the literature on sexual harassment is reviewed in the following section. Relevancy to the general issue of truck driver harassment from these related sources is summarized toward the end of each respective section.

A general point that arises in research on workplace bullying and sexual harassment is that there are two approaches to defining these concepts: One is based primarily on the subjective experience of the targets, and the other is based upon some more objective evaluation (such as that from a third-party observer). The social scientific literature establishes that both of these approaches may be relevant. In the case of sexual harassment—which is legally prohibited—there is a precise legal definition (in addition to broader definitions used by social scientists) which has both subjective and objective components. Since there is essentially no social scientific work directly related to the issue of the harassment of truck drivers, in the one synthetic section of this literature review, the authors try to integrate the main points from the

[6] In fact, before the amendment mentioned above that was provided by MAP-21 to the language of 49 U.S.C. Section 31137(a), this section of the U.S.C. stated that the use of EOBRs for productivity monitoring was permitted.

[7] A key characteristic of published articles in scientific journals is the use of anonymous referees who are professional scientific peers to determine which articles, and with what revisions, are accepted for publication. This does not, of course, imply that results so vetted are necessarily free from error, as scientific knowledge develops through a process of iterative discovery and challenge. However, it does imply that articles from reputable anonymously refereed journals—that provide results not currently being challenged from within the relevant scientific research community—represent our best current scientific evidence. It is for this reason that we look first for this kind of evidence in the present document.

two literatures discussed and provide more general conceptual guidance about how harassment might be defined as a social scientific concept in the trucking case.

Thus, the authors apply the developed causal framework, along with the legal context of FMCSA's safety mandate and relevant dictionary sources, to develop a conceptual framework that provides one way to distinguish productivity monitoring from harassment of a truck driver by a dispatcher. This is done by incorporating both subjective and objective elements that are specific to the trucking safety context. The authors also discuss whether there may be a place for an analogy to the "hostile work environment" case that arises in the sexual harassment literature. This section is intended to be neither definitive nor exhaustive, but to provide provisional examples of how one might integrate the insights from the social scientific literature with the institutional and legal context of the driver harassment case.

The second major topic area of this review is the experience of countries in the European Union and Australia regarding the issue of harassment of truck drivers as it may be connected to the use of mechanical and electronic devices for the recording of the work hours. There is little or no formal scientific literature directly related to these topics, so the primary sources in this section are documents published by the relevant governmental authorities, and some personal communication received by the research team/report co-author in response to queries about whether and how the topic of driver harassment has arisen in these settings.

EOBRS AND PRODUCTIVITY MONITORING

As noted above, there is essentially no scientific literature directly related to the topic of how the potential for driver harassment might be affected by the use of electronic logging devices. However, the use of EOBRs and related technologies to monitor productivity is relevant, and some research has been conducted on productivity in trucking. One part of this work may be useful in providing a foundation for the concept of productivity and an analysis of how it is measured over time in trucking as an industry as compared to other parts of the economy; however, since this material is not directly relevant to the topic of the current study, it is reviewed in Appendix B.

More directly connected to the current topic are three scientific studies that address the use of monitoring technology and productivity in trucks. In 2000, Hubbard discussed an economic model for the relationship between carrier and driver, which identifies potential areas of conflict and analyzed the relative value of different types of on-board monitoring technologies for different market segments.[(10)] In 2003, Hubbard extended the previous analysis by assessing productivity gains for enclosed van fleets that install electronic vehicle management systems (EVMSs), which are fleet management systems that include real-time communication functions.[(11)] Finally, in 2001, Chakraborty and Kazorosian asked what types of carriers are adopting fleet management technologies and concluded that carriers that market as "on-time performers" are more likely to adopt fleet management technologies than carriers that market as "least cost" service providers.[(12)] The authors conclude by assessing the salience of this literature to the question of potential driver harassment.

While most of the analysis of on-board information technology in trucks does distinguish between different levels of functionality, none of the formal scientific literature directly separates the role of EOBRs from other aspects of onboard technology. This distinction is drawn more carefully when considering the relationship between EOBRs and fleet management systems (FMSs) in the development of the social scientific definition of driver harassment.

The Use of Monitoring Technology in Trucks

As far as studies that specifically relate to driver monitoring are concerned, there is a small but extremely useful body of literature in relevant journals. The seminal study is Hubbard's "The Demand for Monitoring Technology."[13] The author applies the standard microeconomic theoretical framework to analyze the causal factors at play in the relationship between supervisors/dispatchers and drivers. He then uses data from the 1992 Vehicle Inventory and Use Survey (VIUS, part of the quinquennial economic census until 2002) to analyze the way in which the demand for information gathering and monitoring systems in trucks may vary across types of trucking operations. In this sub-section, the authors summarize the causal analysis and then summarize the main empirical findings relevant to the present context.

Hubbard points out that the relationship between dispatcher and driver is an instance of the principal-agent relationship[8] in which the objectives of the principal and the agent are at least partially in conflict, and the knowledge the principal has about the agent's choices is costly to obtain and incomplete.[9] More specifically, the firm aims for the highest profit by maximizing the difference between freight revenue and the costs of moving freight, while the agent balances a subjective cost of effort that increases the harder he works against the desire for income and any non-monetary perquisites of the job. Thus, the principal's control over the agent's behavior is incomplete, and the principal incurs an "agency cost" of some kind (for example, somewhat reduced productivity) by employing the agent. That is, the principal cannot generate as much net benefit from production carried out by the agent as he or she would if labor resources were perfectly applied to necessary tasks at the lowest market cost.

Although Hubbard does not emphasize it, the relevant literature establishes that this mismatch of objectives is corrected, to a reasonable first approximation, by the piece rate payment system[14,15] under which almost all road drivers in the United States work—mileage pay for standardized trip miles.[16],[10] However, as Hubbard emphasizes, differences remain. For example, carriers would generally prefer that drivers operate their trucks at a consistent and not excessive speed, use up available work hours before stopping for a break, and always make pickups or

[8] The model of principal and agent, an application of the theory of asymmetric information, is one of the explanatory work-horses of modern microeconomics. Summaries and reviews appear in Eisenhardt (1989) and Stiglitz(2008). Stiglitz was among the three Nobel laureates of 2001, which was awarded for the foundational work on asymmetric information, in part because of his contributions to one of the first principal-agent models.

[9] It is initially assumed, for simplicity, that the dispatcher's actions are perfectly aligned with the objectives of the firm. This assumption can, of course, be relaxed, and the relationship of CEO to supervisor, and between owners and CEO (if they are different people), can be analyzed in the same way, as relationships between principal and agent. .

[10] This incentive effect is the fundamental reason for mileage pay. Normally the payment system isn't actually by the number of miles driven, but by the standard number of miles attached to each trip or trip segment (Burks, Belzer, et al. 2010). But paid miles are accumulated by completing trip segments or trips, so other things held equal, more miles are better. Some motor carriers go further in making the incentives of firm and driver compatible by having a second set of smaller incentives, such as a bonus system for meeting fuel mileage objectives. In some cases, firms utilize owner-operators, who are residual claimants on their truck's income after all expenses, and therefore have even higher-powered incentives than do employee drivers on piece rates.

deliveries at the times requested by customers. Insofar as doing these things provides the best chance of completing more paid miles, drivers have similar motivations.

However, to a potentially significant extent, "drivers' objectives differ from carriers' because arriving on time requires effort, the cost of which they bear privately. Also, driving consistently means that they forgo the opportunity to work at their own pace."[17] Thus, he continues,

> *[A]lthough performance incentives reduce agency costs, they do not eliminate them. One reason is that basing incentives on arrival times forces drivers to bear risk associated with factors outside their control, such as traffic and equipment malfunctions. The other is that they do not address the issue of driving variability within a haul . . . Assuming that performance incentives are set optimally, drivers drive more variably, bear more risk, and have weaker incentives to arrive on time than they would under a "first-best" contract.*

(i.e., under a contract that removed all agency costs by perfectly aligning a driver's job performance with the firm's desired behavior without raising wage costs).[18]

Hubbard points out that in the 1992 VIUS data, one can distinguish between two types of onboard computer systems (OBCs): (1) trip recorders (TRs), which keep track of driver and truck performance for later examination, and (2) EVMSs, which additionally track vehicle location in real or near-real time and provide a two-way communication link between firm and driver. From the standpoint of the economic factors, which affect the costs and benefits of adoption, both types of OBCs provide the ability for the firm to increase the accuracy and intensity of incentives offered to the driver to meet the firm's job performance objectives and hence to reduce agency costs. Based upon the data collected by OBCs (of either type), the dispatcher can evaluate the driver's performance and adjust the firm's response: "Poor-performing drivers are paid less, receive less-desirable job assignments, and in extreme cases, are fired."[19]

However, more advanced EVMSs also provide a second "coordination" benefit, which is an increase in the ability of dispatchers to correctly allocate the firm's resources (drivers and trucks distributed in a partially random manner across time and space) to varying customer demands (loads that also have a partially random distribution across time and space, one that is likely different from that of trucks). The basis for Hubbard's empirical analysis, which the authors will briefly summarize, is the identification of motor carrier and load characteristics that make the incentive effect more or less valuable as compared to the coordination effect. From the standpoint of current concerns with EOBRs, either type of OBC could include the ability to create an electronic RODS. However, in the timeframe investigated by this study, it was relatively unlikely for either type to include such an electronic HOS logging function, so the causal analysis is more important than are the empirical results of this paper for the present regulatory purpose.

In the 1992 data, only 7.5 percent of all truck tractors had TRs and a further 10.5 percent had EVMSs; so penetration was as yet very low. The results from the econometric models of the study suggest that TRs are used primarily where monitoring—but not near-real time communication and coordination—is most important, such as when the trucks in question make

longer runs and have fewer stops, and when accidents are potentially more costly, other things being equal. By contrast, other things again held equal, EVMSs are used where both functions are important so that the relative importance of near-real time communication and coordination is large enough to outweigh the higher costs of EVMSs, such as in for-hire as compared to private fleets. EVMSs are also used when equipment is general purpose, permitting its (the equipment's) allocation to many different loads, as opposed to special purpose, which limits its uses.

Hubbard returns to the topic of OBCs in a second paper which utilizes both the 1992 and 1997 VIUS data.[20] In this paper, however, he focuses primarily on the coordination-improving aspects of EVMSs. He again focuses on truck tractors and finds that penetration into the fleet of OBCs has increased: TRs are used by 8.4 percent and EVMSs by 24.9 percent of all truck tractors in 1997, and the percentages are somewhat higher for units used at least 48 weeks during the reporting year. The econometric results are stronger in the later data year. In a cross-sectional analysis of truck tractors in use in 1997, Hubbard finds that EVMS use is associated with approximately 3.3 percent higher miles per truck per year, and that the increases are concentrated in the 15 percent of the fleet that pulls standard enclosed vans (which can be used for a variety of loads) across long distances. Trucks that pulled standard enclosed vans realized a gain of about 13 percent in miles per year in 1997 if they adopted EVMSs.

A final journal article that directly examines the use of onboard computers is a study by Chakraborty and Kazorosian that addresses how the marketing characteristics, in addition to other more standard segment and service-type differences, affect the level of adoption across firms of communications and fleet management technology.[21] These authors distinguish between three levels of truck-based information-gathering technology: (1) none, (2) two-way radios, pagers, or cell phones, and (3) higher level information technology such as an automatic vehicle locating system, an onboard computer, or a satellite link. (Thus they collapse Hubbard's two OBC categories of TRs and EVMSs into a single "higher technology" category.) Their data source is a survey of member firms sponsored by the American Trucking Associations (ATA), along with data from public sources about the operations and financial situation of many of the firms in the sample. The main conclusion of this study is that the likelihood of adopting higher level OBCs is dependent on the marketing strategy of the firm, in addition to the more standard market segment and service-type differences. Specifically, firms focusing on low cost are less likely to use OBCs, while those focusing on on-time-performance are more likely to use them, controlling for other relevant factors, including the level of complementary "back office" information processing capacity.

Conclusions from the Literature on Monitoring Trucking Productivity

There are two potentially important insights to be gained from the scientific literature on trucking productivity discussed above. A relevant point gleaned from the analysis of monitoring is that the importance of productivity management sharply varies across different segments of trucking, depending a great deal on the type of equipment utilized and the type of customer demands being served.[22,23] However, by business standards these studies are relatively dated, the level of market penetration is now much higher, and the pattern of monitoring devices across segments of the trucking industry, while surely driven by similar factors to those analyzed, may well be quite different. So perhaps the most useful insight from these papers is the analysis by Hubbard of the

way in which piece rates (mileage pay) do not fully align the incentives of motor carriers and their drivers.[24] The authors will refer to this approach when considering how to provisionally synthesize the insights from the social scientific literature in defining harassment in the context of supervisor-driver interactions.

INDUSTRY-SPONSORED EOBR RESEARCH

Before proceeding to the related social scientific literature, this section will consider industry-sponsored research that may be of interest. Some of the most important research on the question of how EOBRs are used in the industry that does not fall into the anonymously-peer-reviewed category is work by the American Transportation Research Institute (ATRI), a non-profit research institution sponsored by the ATA. ATRI performs a great deal of applied research aimed at better understanding current or future industry concerns, such as the costs and benefits of onboard safety systems, the costs and benefits of simulators in training truckers, highway congestion that affects trucks, and FMCSA's Compliance, Safety, Accountability (CSA) carrier safety regulation and management system.

In response to the 2004 initiation of EOBR-related rulemaking procedures by FMCSA, in 2006 ATRI conducted a study of then-current industry usage patterns and the issues that might attend widespread industry adoption of EOBRs.[25] ATRI's industry association affiliation gives it excellent access to trucking company personnel and data, and for this study ATRI not only analyzed the docket entries in the ANPRM, but it also surveyed 12 EOBR vendors, 29 EOBR-using motor carriers, and 122 motor carriers not then using EOBRs.

This study was not focused on the issue of driver harassment and does not offer much that is of direct use on this specific topic. However, it is worth noting that ATRI reports that the ATA's Technology and Maintenance Council (TMC) estimated that about 100,000 total EOBR units were in use at the time of the study, and that in ATRI's survey of carriers utilizing them, 54 percent identified the HOS compliance functions of EOBRs as the primary reason for which they were purchased, and all were using them for this purpose. Vendors, on the other hand, tended to cite the fleet management functions, especially near-real-time communications to drivers, as important in their sales efforts. Of perhaps greater direct relevance, ATRI's study of the 2004 ANPRM docket produced similar findings to some of the citations noted below, in which some drivers expressed concerns about both being halted when they wanted to run and "pressured" to run when they wanted to halt, in association with EOBRs when combined with a near-real-time communications capability for management.

RELATED LITERATURE: WORKPLACE BULLYING

There are two areas of the social scientific literature that address specific types of harassment which may have some relevance to the issue of on-the-job harassment of drivers. This section discusses the literature on workplace bullying. The literature on sexual harassment is covered in the subsequent section.

Genesis of This Literature

Harassment and bullying are closely related—though not identical—concepts. There is substantial social scientific and academic literature on the topic of workplace bullying. This literature is historically connected to related work on aggression and bullying among school children.[26,27,28] The earliest important work specifically on the occupational setting is from Caroll Brodsky, who was Independent Medical Examiner for the California Workers Compensation Appeals Board in the 1970s, and was involved with the issue of psychological stress in cases where workers appealed the denial of compensation for on-the-job injuries.[29] Despite this early U.S. interest in the occupational setting, the topic of workplace bullying first gained relatively wide interest among public policy makers in the Scandinavian countries. National laws were passed against workplace bullying in Sweden in 1993 and in Norway in 1994, while there is as yet no national legislation on this topic in the United States.[30]

Bullying among schoolchildren is frequently a group activity, and some of the relevant literature refers to bullying as "mobbing."[31] However, whether in schools or in workplaces, bullying appears to be a group activity among peers more commonly in the Scandinavian countries than in the United Kingdom or the United States.[32] The group and individual cases involve different social processes,[33] and the group version is not likely to be relevant to the trucking case, since individual road drivers generally work alone, so the authors concentrate on what is known about the individual category.

In defining bullying, the early literature generally focused on two features: the frequency of bullying actions and an asymmetry of power between the bully and the victim. Brodsky, who uses the label "harassment," defined bullying as "repeated and persistent attempts by one person to torment, wear down, frustrate, or get a reaction from another. It is treatment which persistently provokes, pressures, frightens, intimidates or otherwise discomforts another person."[34] A Swedish rule of thumb has been a minimum frequency of once per week for six months in order for negative interactions to constitute bullying.[35] However, an asymmetry of power is not a necessary condition for Rayner and Hoel, as bullying actions can take place between employees who are nominally peers, as well as between someone higher up in the corporate hierarchy and someone subordinate to them.

Incidence of Workplace Bullying

A fundamental question about workplace bullying is how prevalent it might be in a specific country, or in a particular industry or occupation. In two privately commissioned questionnaire surveys[11] of different representative samples of the U.S. population in August, 2010, the Workplace Bullying Institute reports that 35 percent (plus or minus 1.5 percent) of the U.S. adult population reports having been or currently being bullied at work. The definition used by one of these surveys was: "repeated, health harming abusive conduct committed by bosses and co-workers."[36] However, authors working in this area note that there are inherent definitional issues involved in measuring incidence, because workplace organization and workplace culture vary widely, even within a single country, and so the definitional parameters must be broad.[37]

[11] That is, these studies were not published in anonymously-peer-reviewed scientific journals.

In fact, investigators who have conducted reviews of the scientific literature in this area agree that a clear consensus definition on which replicable incidence statistics can be based does not exist.[38,39,40] One overview article reports distinct estimates from specific papers of overall incidence (i.e., the proportion of employees who report being victims) in specific working populations that vary from 5.9 percent to 50 percent,[41] while in another review article the reported incidences from different studies range from 8.3 percent to 97 percent.[42] One study specifically on the topic of measurement methods reports incidence levels that differ by a factor of three, depending on the method utilized.[43]

Generalizability from This Literature

This leads to a general point about the large amount of literature on workplace bullying: its scientific value—in the sense of providing clear, convincing, and replicable evidence about the phenomenon—that can be generalized beyond the specific settings studied in specific papers is modest. For instance, in order to estimate the incidence of workplace bullying in a scientifically defensible manner, one should follow the methodological and statistical principles established by epidemiologists to estimate the prevalence of diseases. Moayed et al.[44] utilized the Epidemiological Appraisal Instrument (EAI)[45] to evaluate the extent to which the existing literature meets this criterion. The EAI provides a framework for evaluating each study based upon how it deals with "design, objectives, sample and population size, methodology, statistical analysis, reliability and validity of measurements, input variable or exposures, covariates and confounders, outcomes and adjustments."[46]

These authors examined 37 studies published in English, but upon inspection, only 7 met the initial standards required to apply the EAI. The EAI scores the different components of a research report mentioned on a scale of 0 to 2 and then provides an overall evaluation on the same scale. Moayed et al. created a "risk factors – bullying behaviors – outcomes" conceptual model of workplace bullying based on the content of the seven papers subject to evaluation, and applied the EAI to the design and other components of each study.[47] The highest overall score was .94 (that is, less than halfway on the 0–2 point scale), and some work by well-known investigators in this area had lower scores (e.g., .64 for Mikkelsen and Einarsen, and .45 for Zapf).[48,49] Moayed et al. conclude that while specific studies can provide interesting and potentially useful analysis of individual settings, it is difficult to generalize from the existing literature. Of course, it may not be appropriate to judge studies that did not attempt to estimate incidence by the standards of the EAI, but since many attempt to do so, these results suggest that one should be cautious in trying to generalize from this literature to the case of truckers.

However, despite these limitations, there are a number of specific points emphasized in the existing workplace bullying literature that are of potential interest because of their analogies to the trucking case. These fall in four areas:

1. The identification of several types of actions that could constitute bullying.
2. Objective versus subjective definitions of bullying.
3. The role of organizational setting and leadership.

4. Evidence about outcomes for individual targets of bullying that are either similar to trucking outcomes or that would be of potential regulatory concern if they appeared in the trucking case.

These points from the literature are addressed in order.

Types of Actions That May Be Bullying

First, several authors identify specific bullying actions by supervisors with respect to subordinates that are potentially similar to the trucking case. Rayner and Hoel identify "overwork" as a major category encompassing a number of diverse bullying actions.[50] More specifically, Jennifer, Cowie et al. identify assigning an excessively heavy workload as a bullying action,[51] while Fox and Stallworth specify setting "unrealistic goals" for a subordinate.[52] Moayed, Daraiseh et al. identify three work-related types of bullying actions in the conceptual model of bullying they develop from their review of the literature—work overload, setting unrealistic targets, and excessive monitoring.[53] They point out that time pressure on the job is identified by Zapf[54] as a factor that co-varies with bullying incidence across workplaces, with the caveat that the methodology of this study is weak because responses but not response rates were reported, and variations in job characteristics across two populations were not described or accounted for.[55]

One can observe similarities between these categories of actions from the bullying literature and some of the public comments that provide examples of harassment in the trucking context. The example of the driver who worked all day doing paperwork or startup tasks, only to be directed to then drive all night,[56] might naturally fit in the general category of "overwork," and under the more specific category of "setting unrealistic expectations." Drivers who are contacted when they have stopped to take a break[57] might fit under "excessive monitoring." This suggests that there are some regularities across the settings of different occupations and across different jobs within an occupation with regard to what employees will perceive as hostile behavior on the part of their supervisors.

Subjective Versus Objective Bullying

Some authors address the problems raised by the varying definitions of bullying in the literature by proposing a distinction between bullying as subjectively experienced by the target, and bullying actions that could be objectively identified by a third-party observer.[58,59] The central idea is that the sets of events identified by these two conceptions are overlapping, but not identical. Most of the literature, however, focuses primarily on the subjective definition, as it uses self-reports of one kind or another to identify victims of bullying. There is some work based on third-party evaluations of harassment from surveys in the literature, but since almost all studies reviewed herein ask the same individuals if, in their workplace, they have ever been harassed and also if they have ever observed harassment, these cannot be considered evidence about reports that would be made by neutral third parties.

A further complication with the subjective identification of harassment events is that several authors find that potential target individuals may vary in their susceptibility to harassment, as defined subjectively. For instance, Zapf finds that bullying victims are more likely to be low in assertiveness and high in trying to avoid conflict.[60] Coyne, Seigne et al.([61]) use the five-factor

ICES personality framework[62] to compare bullying victims with matching controls, and conclude that victims tend to be higher in conscientiousness, and lower in independence, extroversion, and stability. Similar results are reported by Glasø, Berge Matthiesen et al.[63] If there is a causal connection between personality traits and perceived victimhood, it is not clear to what extent these variations are due to the fact that bullies prefer targets with particular traits, versus being due to the fact that the same actions by a supervisor would be perceived as bullying by those with these traits and not perceived as bullying by those with different traits.

These issues present a serious complication when trying to analyze workplace bullying in general, and undoubtedly the same would be true if one were trying to analyze harassment in the workplace in general. However, in the trucking case there is enough theoretical, legal, institutional, and regulatory context that some progress in identifying harassment events can be made, as will be proposed later in this review. The authors will use the principal-agent framework, the function of mileage pay in aligning economic incentives, and the role of HOS and related safety regulations in specifying when a particular kind of disagreement between manager and driver would constitute productivity monitoring that could be legitimate, and when it might, in contrast, constitute safety-related harassment.

Organizational Leadership

Several authors identify aspects of corporate culture and leadership as factors which can enable, facilitate, or even lead directly to the bullying of employees by their supervisors. Zapf finds that targets of and observers of bullying believe that organizational problems are a key causal factor.[64] Brodsky, whose work is based on more than 1,000 cases, notes that in some organizations, harassment may be institutionalized as part of management practice, and this view recurs in other parts of the literature.[65,66] This suggests that it is appropriate to ask whether relevant variations in organizational culture or leadership—ones which affect the incidence of harassment that can affect safety performance—occur across trucking firms.

Individual Outcomes from Being Bullied and Safety Performance

Finally, several authors find specific effects of bullying upon victims that could be of regulatory relevance, if they were to carry over to the trucking case, due to potential safety implications. One common effect is that employee job attachment is reduced, and employee turnover is increased by workplace bullying (see references 67, 68, 69, 70, and 71). High rates of driver turnover are a safety issue, if perhaps indirectly. Inexperienced drivers are likely to have a higher incidence of driving accidents than experienced drivers.[72] In addition, Staplin and Gish found that drivers who change jobs more frequently have a higher crash risk, by as much as double for drivers who held three different driving jobs per year over 2 years, as compared to those with a single employer.[73] Since the largest single component of for-hire motor freight—by employment, the truckload (TL) segment—has historically had turnover rates of more than 100 percent per year,[74,75] the likelihood that workplace bullying, and thus correspondingly, driver harassment, affects driver retention may be indirectly of potential interest to safety regulators. (The ATA surveys their member firms on turnover quarterly, and large TL firms had never reported levels less than 100 percent until the deep recession in 2008; the low point was 39 percent per year in the first quarter of 2010, and the rates have been rising since.)[76]

Of more direct safety relevance is a suite of further outcomes for victims that would be important if they were to carry over to trucking. Several studies report outcomes that could directly affect job performance and potentially increase the risk of an accident on the job for employees driving heavy commercial vehicles, a job in which constant attention and vigilance are required. Several authors report increased stress among victims of bullying, and some find evidence that this can rise to the level of post-traumatic stress disorder,[77,78] and several report that victims experience a loss of concentration and an increase in job performance errors.[79,80,81,82] Another study finds that victims not only become upset and impatient, but can become easily exhausted.[83] Perhaps most directly related to the specific context of EOBRs in trucking, the issue of providing the opportunity for sufficient restful sleep, a large scale representative sample of the French population finds a strong correlation of workplace bullying with sleep disorders.[84] One would expect sleep disturbances to lead to fatigue in drivers; however, Howard and Joint also show a connection between stress and fatigue,[85] suggesting that fatigue may be an additional outcome for drivers who are bullied, among the other stress-related symptoms seen in bullying victims.

A Study of Legal Cases Involving Workplace Bullying

Martin and LaVan used the LexisNexis legal indexing service to find a total of 273 legal cases that were litigated during the period 2003 to 2007 which involved some kind of bullying in a workplace setting.[86] They then randomly selected 45 of these for a closer analysis of case characteristics. These cases have some points of similarity with the trucking setting, but some features of their results suggest that most of the existing litigation is in situations that are not particularly similar to the trucking setting.

Among characteristics that appear similar to key trucking situations, 71 percent of the cases involved a single perpetrator, and in 56 percent, that person was a supervisor of the affected employee. In addition, 84 percent of the cases involved a perceived power imbalance between the perpetrator and the victim. In 64 percent of cases verbal aggression was involved, and the victim perceived that there was little cost to the perpetrator and no policy against such behavior.

On the other hand, substantial points of difference included the fact that 67 percent of the cases occurred in public sector jobs, with 27 percent being in schools. In addition, the legal basis for the case was racial discrimination in 36 percent and gender-oriented discrimination in another 29 percent, with 7 percent each for discrimination based upon age and national origin. Neither safety issues nor safety-related regulatory compliance were mentioned as distinguishing characteristics of any cases.

Martin and LaVan point out that their survey shows that there are legal grounds upon which workplace bullying complaints can be litigated in the United States, even in the absence of national legislation in this area (such as exists in some Scandinavian countries).[87] The authors of the current study note, however, that 73 percent of the cases they examined were found in favor of the employer as the defendant.

Related Topic to Workplace Bullying: Abusive Supervision

There is a partially overlapping stream of anonymously-peer-reviewed research by investigators in the discipline of organizational behavior (a branch of social psychology), which has primarily been published in management journals, about the topic of “abusive supervision.” Researchers in

organizational behavior who work in the general area of leadership have been interested since the 1990s in the general concept of "hierarchical abuse" (the mistreatment of subordinates within a hierarchy by one or more superiors), but the current literature on abusive supervision was primarily triggered by a seminal paper on its organizational and individual consequences by Tepper.[88]

Tepper defines abusive supervision as "subordinates' perceptions of the extent to which supervisors engage in the sustained display of hostile verbal and non-verbal behaviors, excluding physical contact."[89] This definition makes abusive supervision phenomenon with a purely subjective definition, unlike the jointly subjective and objective approaches of much of the workplace bullying literature, which will turn out to be potentially relevant in trucking. However, it also rules out physical abuse, which is probably better aligned with the issues in truck driver harassment as connected with EOBRs than some parts of the bullying literature. And it focuses on purposive behavior of supervisors, without specifying the purpose (so the purpose could be purely aggressive—i.e., to cause harm—or instrumental, in order to elicit specific job performances),[90] which is also potentially connected to the trucking harassment case.

From the latter two points, and the fact that this work is only about negative hierarchical relationships (from immediate supervisors to their direct reports) unlike the branch of the bullying literature on bullying by peers, it may appear that this research would be of considerable interest for the topic of truck driver harassment. However, in practice, the disciplinary interests of the researchers working on this topic have led it in directions that are not as directly useful for the concerns of the current report as are some parts of the workplace bullying literature. For instance, some of this work focuses on why supervisors might be abusive, with two psychological explanations offered. One is that some supervisors were abused by their superiors, and they displace their natural response downward in aggression toward those over whom they have power. The second explanation is that some supervisors were provoked by subordinates who are difficult to supervise.[91] Another significant focus of this work is on the individual psychological characteristics that moderate (i.e., weaken or intensify) the behavior of supervisors and the responses of targets.[92] A third focus of this work is on how one might distinguish between two subjective dimensions of perceived stress due to supervisor behavior: demands for excessive workload and directly hostile actions.[93] Further, where there are conclusions in this literature that may offer analogies to the issue of truck driver harassment, they are not distinctively different from those found in the workplace bullying literature. As a result, the authors call attention to this strand of research in passing, but do not differentiate its findings from that of the workplace bullying literature in terms of results that are of interest to the case of truck driver harassment.

Relevance of Workplace Bullying Literature

In summary, the extensive literature on workplace bullying (and the related material on abusive supervision, where relevant) is of modest value in the discussion of driver harassment due to limitations in the methodologies used and the difficulty in generalizing from the many particular and partial results it contains. However, there are several opportunities for analogy between the empirical settings and conceptual models used by these researchers and the case of harassment of commercial drivers by their supervisors. As detailed above, these points of similarity mean that

the results in this literature, despite not being directly applicable, offer several types of suggestive evidence that may be of use in considering the trucking case.

In particular, three potentially relevant findings from this literature are as follows: first, the role of managerial leadership may be important in the likelihood and incidence of workplace bullying, and hence, by analogy, of driver harassment. This suggests that the ethical direction and corporate culture of trucking firms could be relevant to the likelihood that safety-related harassment will occur in any particular case. Second, the workplace bullying literature establishes that both subjective and objective characteristics may be important in defining the concept of bullying and in identifying cases in which it does or does not occur. Last, bullying is robustly associated with a number of outcomes for bullied individuals that would potentially be of regulatory concern for FMCSA if they (the outcomes) occurred in victims of driver harassment, because they are plausibly associated with an increase in accident risk for individuals who experience them. Some specific examples are higher turnover, higher job stress, related poorer job performance, and sleep disruption and disorders.

RELATED LITERATURE: SEXUAL HARASSMENT

There are two motivations in considering the literature on sexual harassment. First, one can presume that the trucking industry is not immune to incidents of sexual harassment, so it is necessary to examine the prevalence of sexual harassment and any safety-related hazards it may involve, in addition to the potential for the adoption of EOBR technology to affect these. Second, the relative maturity of the social scientific study of this area, which began to gain momentum in the 1970s (following the passage of the 1964 Civil Rights Act, which made sexual harassment in the workplace illegal), may provide some transferrable insights into how to understand more generally harassment and its risk factors, as well as its outcomes and prevention strategies, from the reasonably well-developed scientific literature.

Initial Usage of "Sexual Harassment" in the Social Science Literature

This section will examine the definition of sexual harassment from the perspective of legal liability, but first it considers how the issue is addressed by social scientists. A meta-analysis by Gruber infers from published studies that an estimated 44 percent of U.S. working women experience sexual harassment sometime during their careers.[(94)] This is a small fraction of the cases reported formally to the Equal Employment Opportunity Commission (EEOC). The antecedents and outcomes reviewed below are developed in association with broader definitions of sexual harassment than those that appear in relevant law and they apply to this overall population. These expanded definitions highlight some specific aspects of the victim's experience that may bear on the EOBR case.

The literature on sexual harassment specifically, as distinct from general gender- or sex-based workplace issues, began to appear in the 1970s and continues to expand. A search of the peer-reviewed literature using the American Psychological Association's PsychInfo bibliographic

database for the phrase "sexual harassment"[12] identified 5 papers published in the 1970s (the decade following the Civil Rights Act of 1964), 94 papers published in the 1980s, 600 papers published in the 1990s, and 850 papers published between 2000 and 2009 (the most recent complete decade). As the field of study has developed, the expression of what constitutes sexual harassment has evolved and has been refined.

Early discussions of sexual harassment "focused on whether or not sexual harassment was a social problem worthy of study, and on descriptive analyses of its prevalence."(95) The behavioral models proposed tended toward social control mechanisms and power differential models(96) similar to those described in the workplace bullying discussion. One early work(97) illustrates its definition of sexual harassment with a description of a woman's interview for the position of doctor's stenographer, taken from a letter published in *Harper's Bazaar* in 1908. The interview had gone well, and

> *[a]s I was leaving his office, feeling that at last I was launched safely upon the road to a good living, he said casually, 'I have an auto; and as my wife doesn't care for that sort of thing, I shall expect you to accompany me frequently on pleasure trips.' After that experience I was ill for two weeks; a result of my hard work, suffering and discouragement.*

This experience would likely not rise to meet the modern legal definition of sexual harassment; however, the experience clearly had undesirable consequences, both in the failure to retain a desirable applicant by the employer and in the health impact on the applicant.

Another early work examining the experiences of policewomen defines sexual harassment as occurring "when a man in a position to control, hamper or affect the job or career of a woman who refuses his offer, uses his authority or power to coerce the woman into sexual relations or punishes her rejection."(98) This study gives examples that illustrate the challenges of identifying situations that represent coercion when disguised as something more benign. The policewomen described how they might be punished for resisting harassment or sexual coercion, saying "A new woman can be assigned [either] to a scout car with a friendly partner or to a foot beat with one who will teach her nothing; she can be protected from minor disciplinary action or face full enforcement of the rules. When there is no relationship she can be embarrassed by the appearance of one . . ."(99)

As the availability of data improved, research methods became more sophisticated and empirical, aiming to ascertain the causes and consequences of sexual harassment.(100) A more recent model of sexual harassment in organizations, formulated by Fitzgerald, Hulin, and Drasgow, defines sexual harassment rather broadly, as encompassing gender harassment, unwanted sexual attention, and sexual coercion.(101)

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[12] The exact search string used was *all ("sexual harassment" AND (work OR workplace) NOT homosexuality NOT macaque NOT rhesus)* in peer-reviewed scholarly journals.

These examples point to an aspect of the definition of sexual harassment that parallels the discussion of workplace bullying: the issue of subjective versus objective definitions. Individuals may perceive and/or label the same experience differently.[102,103] However, outcomes for individual targets do not appear to depend as much, as this might suggest, on whether an event is labeled by the victim as sexual harassment. In 2005, Munson, et al. "revealed that self-labeling as a victim had little association with negative outcomes, whereas scores on a behavioral checklist (such as the Sexual Experiences Questionnaire [SEQ]) showed a strong linkage with them" (as described by Chan, Chun Bun et al., 2008).[104] Magley, Hulin et al. reported that "experiences with unwanted sex-related behavior on the job consistently led to negative outcomes; labeling these experiences as sexual harassment had no effect on the degree of the negative outcome."[105] This suggests that, at least in the sexual harassment setting, asking participants to self-identify as victims is less effective in identifying harassment than an approach that asks participants to select from a list of multiple behaviors the ones they have experienced.

Incidence of Sexual Harassment Overall and in the Trucking Industry

Estimates of the likelihood of experiencing workplace sexual harassment within a working lifetime vary widely depending on factors including the particulars of how the question is asked and what population is studied. In a review of the literature on gender and sexual harassment, Welsh quotes results ranging from 12 percent up to 90 percent or more for female respondents,[106] but cites a meta-analysis of 18 surveys that yields a median value of 44 percent.[107] One conservative way to quantify the prevalence of sexual harassment for comparison across populations is to examine receipts filed with the EEOC citing Title VII sexual harassment.[13] In the year 2011, there were 11,364 receipts filed and resolved regarding Title VII with sexual harassment as an issue, with 16.3 percent from men and 83.7 percent from women.[108] Note that 11,364 resolved cases in a workforce of roughly 150 million represents a rate of approximately 0.0076 percent. This rate, much lower than the estimates in the social scientific studies, is in part due to the fact that most workers who experience behavior that could either subjectively or objectively be classified as sexual harassment do not report their experiences to the EEOC.[109]

In the trucking industry, the class action suit of EEOC vs. CRST Van United (ongoing as of 2013), in which female driver trainees allege sexual harassment by their senior partners in a team driving setting, indicates that at least some drivers perceive that sexual harassment is occurring in industry settings.[110] Hersch examined industry classification codes for individual sexual harassment filings with the EEOC and corresponding State or local agencies (2000–2004) and calculated estimates of the risk of sexual harassment by industry, gender, and age.[111] The risk for females in the transportation and utilities industry was 17.24 per 100,000, or 0.017 percent—at least twice the average risk for the general workforce. The population within the industries of transportation and utilities (North American Industry Classification System [NAICS] 22 & 48–49) was 25.5 percent female, while for-hire trucking (NAICS 484, Truck Transportation) is 12.5 percent female;[112] however, this includes all employees in all occupations, including

[13] When a charge of sexual harassment is filed with the EEOC, the EEOC issues a receipt, which is an acknowledgement of the filing sent to the filer and the employer. The number of receipts issued is therefore a tally of the number of charges filed.

occupations that are female-dominated (e.g., some types of office work). Sources more specifically analyzing heavy and long-distance truckers suggest the percentage of females in this occupational category is on the order of 5–6 percent.[113] Hersch's analysis indicates women are generally at greater risk of sexual harassment in male-dominated industries, which suggests the rate in heavy and long-distance trucking is likely to be higher than even the increased rate in the broader industry categories of transportation and utilities, relative to the much lower rate in the U.S. workforce as a whole.

Outcomes Linked to Sexual Harassment, and Their Safety Implications

The evidence thus suggests that this form of harassment does occur in the trucking industry and at a rate well above the national average. What connection, if any, exists between sexual harassment and safety-related aspects of a driver's job performance and well-being? As the trucking-specific literature on sexual harassment is limited, the authors report on the sexual harassment literature overall, noting when results are relevant to the trucking industry.

O'Donohue, Downs, et al.[114] and McDonald [115] present reviews of the literature that compile the case for a set of tangible and negative outcomes for victims of sexual harassment. Documented outcomes of sexual harassment include anxiety and depression,[116] symptoms of posttraumatic stress disorder,[117] harmful drinking,[118] elevated blood pressure,[119] neck pain,[120] sleep disturbances, headaches, nausea, gastrointestinal disorders, and increased distraction.[121,122] Sexual harassment and gender-based discrimination are also correlated with job dissatisfaction and absenteeism,[123] and reduced productivity and increased turnover.[124] A study of New Zealand police officers found that sexual harassment is correlated with lack of social support, which is correlated with turnover intentions.[125] A 2008 meta-analysis of 70 studies of sexual harassment effects on workers found negative correlation between sexual harassment experiences and job satisfaction, job commitment, job performance, psychological well-being, and physical health.[126]

Interestingly, Hesson-Mcinnis and Fitzgerald [127] and others have found that these undesirable outcomes are actually increased for victims who engage in some aggressive coping strategies, such as reporting incidents to supervisors or filing formal complaints. These authors suggest that reducing organizational tolerance for undesirable interactions may be the most expedient way to reduce rates of sexual harassment, a suggestion which parallels the discussion of organizational leadership in the literature on workplace bullying.

What are the implications for accident risk if these outcomes were to occur among truckers? The story is similar to that for workplace bullying. The link between fatigue and increased crash rates for truck drivers is well-documented.[128,129] One would expect sleep disturbances to lead to fatigue in drivers; however, Howard and Joint also show a connection between stress and fatigue, suggesting that fatigue may be an additional outcome for drivers who are sexually harassed, among the many stress-related symptoms seen in sexual harassment victims.[130] Alcohol consumption is another obvious safety concern, and the positive correlation with commercial truck accidents is well documented.[131] High rates of driver turnover are a subtler safety issue. Turnover has historically been relatively high in specific parts of the trucking industry, specifically the long-distance truckload segment.[132] Turnover can affect the proportion of inexperienced drivers in the workforce who historically have a higher accident rate until they gain experience. It can also affect the level of job-hopping between firms; Staplin found that the

risk of crash involvement increases for drivers who "job-hop," slowly at first but more rapidly as the job change rate increases.[133] Thus, several of these outcomes have safety implications for drivers subjected to sexual harassment.

Sexual Harassment and EOBR Adoption

Thus far, the literature review has described the evidence that sexual harassment is a measurable concern in the trucking industry, both due to incidence rates and outcomes that represent potential safety risks. The next question to address, in considering the sexual harassment literature in relation to the goals of this literature review, is whether and how the introduction of EOBR equipment could have any impact on a driver's sexual harassment risk or experience. It is clearly difficult to imagine a rationale for such a correlation, although unobvious does not always mean non-existent. To evaluate this, the authors examine the set of factors identified in the social science literature as enhancing the likelihood of sexual harassment and ask if any of these risk factors could be measurably affected by replacing the autonomous and potentially flexible paper-based logging of HOS with an EOBR system that automatically and more inflexibly documents driving start and stop times and forces contemporaneous recording of other duty status changes.

Antecedents correlated with elevated levels of sexual harassment include being single or divorced; being female, independently or in conjunction with trainee status; having a blue-collar occupation, a high education level, and/or a high pay grade;[134] numerical and/or normative dominance of one gender in the organization or occupation, termed "double dominance" when occurring simultaneously;[135] high levels of power differentials in the workplace;[136] organizational tolerance of harassing behaviors;[137] and irregular, contingent or precarious employment contracts.[138] Das finds a correlation suggesting that sexual harassment is more likely when perpetrators perceive a fairly low cost-to-benefit ratio; that is, when it seems they are relatively unlikely to be caught or punished, compared to the perceived benefit of engaging in harassment.[139] While most reported sexual harassment occurs when there is physical proximity between the aggressor and the victim, studies of occasions where email has been used to sexually harass people indicate that the lack of situational cues and the perceived ephemerality of email result in communications that are "more likely to be irresponsible," and hence, more likely to cross the boundary into harassment.[140] Das also shows strong correlation between sexual harassment-related outcomes and "routine activities" in the workplace.[141]

In thinking about application to trucking, one can identify several trucking work situations which would represent risk factors for sexual harassment according to the reviewed literature. These might include drivers interacting with customers at loading and delivery sites, where low cost-to-benefit expectations might arise for potential harassers when the driver is alone and responsible for satisfying the demands of the customer with regard to how shipments are picked up or delivered. Electronic interactions between drivers and dispatchers through fleet management systems might introduce an environment conducive to email-like irresponsibility. Drivers working with other drivers in team driving arrangements, which keeps driving partners confined in the close quarters of the same truck cab for periods extending to 3 or 4 weeks at a time, might be associated with the physical proximity risk factor. However, as noted above, nothing in the literature suggests any clear way that these risks would be measurably affected by the change EOBRs will bring to the recording of duty status. A possible exception could be changes in communication functions that may accompany EOBRs that are implemented as part of fleet

management systems. Such a change in communication functions, though not intrinsically part of an embedded EOBR *per se*, is perhaps one channel through which the use EOBRs and their related technology could affect the likelihood of the sexual harassment of drivers.

Legal Definitions of Sexual Harassment

In contrast to workplace bullying, which is not currently prohibited in the United States, sexual harassment is a form of sex discrimination that has been illegal in the United States since the passage of Title VII of the Civil Rights Act of 1964. Thus, in addition to the range of broader definitions found in the social science literature, there is a distinct and specific legal definition. Because this legal definition is connected to its context in employment discrimination law, it will not necessarily translate easily to EOBR-based harassment scenarios governed by a safety mandate; however, a discussion of what types of interactions rise to the level of legal concern may help in forming a general picture of how the courts might approach EOBR-based harassment. The U.S. EEOC definition of sexual harassment says:

> *Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when submission to or rejection of this conduct explicitly or implicitly affects an individual's employment, unreasonably interferes with an individual's work performance or creates an intimidating, hostile or offensive work environment.*(142)

The first point to note is that as it has been applied in practice, this definition offers two separable conceptions of harassing behaviors. The first is commonly known as "*quid pro quo*," in which the victim's employment status is directly conditioned on submitting to some specific demand for sexual activity and so the demand in and of itself constitutes harassment. The second is known as the "hostile workplace" scenario, in which the accumulated effect of recurring incidents, which do not in themselves individually constitute *quid pro quo* events, is deemed sufficiently significant to be actionable (i.e., the pattern constitutes harassment).[14] A charge of *quid pro quo* sexual harassment might be prosecutable on the basis of a single egregious incident, while the demonstration of a hostile environment normally requires "more than a few isolated incidents."(143)(Although in at least one sexual harassment attorney's opinion, "[a] single 'severe' act of harassment can render an environment permanently hostile, such as a rape by a supervisor.")(144)

Note that "Title VII does not proscribe all conduct of a sexual nature in the workplace….[O]nly unwelcome sexual conduct that is a term or condition of employment constitutes a violation."(145) Nor does it proscribe hostile work environments *per se*; it is only concerned with work environments that are hostile in a sex-discriminatory manner. In the context of EEOC vs. CRST Van Expedited,(146) the 8th U.S. Circuit Court of Appeals gave some blunt guidance on the limits of the Title VII conception of prohibited workplace sexual harassment, saying:

[14] One should note that, as with all laws and regulations, the meaning of such a definition depends not only on the wording of the legal text but also on the history of its interpretation through adjudicated cases. Since this literature review is not intended to address legal issues in depth, the authors focus primarily on how the definition has been discussed by social scientists.

[T]he women complained of harassment that was neither sufficiently severe nor pervasive [to survive summary judgment]. The record reveals complaints about their Lead Drivers' poor personal hygiene, boasting about past sexual exploits, sporadic remarks of sexual vulgarity, and highly offensive but isolated instances of propositioning for sex. None of the relevant factors listed above, including the women's "physical proximity to [their] harasser[s] and the presence or absence of other people," meet the applicable standard that the alleged harassment was so severe or pervasive that it "alter[ed] the conditions of the [women's] employment." Regarding the Lead Drivers' poor hygienic practices, we have noted that "Title VII . is not a general civility code for the American workplace." Although a Lead Driver's poor hygiene undoubtedly made for an unpleasant work environment, this "[m]erely rude or unpleasant conduct is insufficient to support a claim" for hostile work environment. As for the boasting about past sexual exploits and sporadic, sexually vulgar remarks, a de novo review reveals that they mostly constituted "mere offensive utterance[s]," and we have cautioned that "[s]poradic or casual comments are unlikely to support a hostile environment claim." With respect to the isolated propositioning, this court and the Supreme Court have stated that "[m]ore than a few isolated incidents are required" to support a hostile work-environment claim. (Internal quotations and citations omitted.)

From this background one can draw some inferences with potential relevance to EOBR-based harassment. One might reasonably expect situations classified as 'EOBR-related harassment' to meet a high legal bar for (a) intensity, or (b) pervasiveness in frequency, or both. In the section below, the authors explore to what extent these definitional distinctions might have analogies in the case of EOBR-related harassment of a driver, given that the legal definition of sexual harassment arises in the legal context of employment discrimination, while FMCSA's concern with EOBRs is in a different legal context, that of highway safety (as noted above).

Relevance of Sexual Harassment Literature

The scientific literature on sexual harassment is relatively well developed, and there is also a relatively clear legal definition of what constitutes sexual harassment. It is clear that sexual harassment does exist in trucking and may occur at a higher rate than in some other occupations. However, no direct links have been found by which the potential for the harassment of drivers by supervisors could be affected by the introduction of EOBRs (though it is possible that changes in communication functions sometimes associated with EOBRs could have some impact).

On the other hand, one can draw some guidance from the sexual harassment literature on approaches to identifying EOBR-based harassment, and one can infer some potential consequences of EOBR-based harassment on metrics of interest in the trucking context, such as job performance, turnover rates and other safety-related issues. In particular, three potentially relevant findings parallel conclusions drawn from the literature on workplace bullying. First, organizational structures and attitudes affect the incidence of sexual harassment (similar to findings on organizational leadership in the case of workplace bullying). Second, both subjective and objective characteristics may be important in defining the concept and measuring the incidence of sexual harassment. However, it appears that negative outcomes do not depend as

much on what is subjectively perceived as sexual harassment by targets as they might in the case of workplace bullying, except that victims who both perceive themselves as such and fight back may have worse outcomes. Finally, sexual harassment is robustly associated with a number of outcomes for bullied individuals that would potentially be of regulatory concern for FMCSA if they occurred in victims of driver harassment, because they are plausibly associated with an increase in accident risk for drivers who experience them. Some specific examples are higher turnover (potentially of concern to the degree it raises the incidence of inexperienced drivers in the fleet), higher job stress, related poorer job performance, and sleep disruption and disorders.

DRIVER MONITORING AND DRIVER HARASSMENT IN THE TRUCK DRIVER CASE

There is no formal scientific research that attempts to directly define or study the concept of driver harassment. The authors have, however, accumulated some insights from the literature on two related areas—workplace bullying and sexual harassment, and they have reviewed the analysis of the economic motivations of drivers and firms in connection with the demand for technology to monitor and coordinate drivers. The next question is, how might one integrate these insights in addressing the question of how to define "driver harassment" as a social scientific concept relevant to FMCSA's regulatory interests? And how would one distinguish it from the ordinary business practices of productivity monitoring and vehicle coordination, which together form the context in which many EOBRs have been introduced?

The social scientific literature has established that both subjective and objective characteristics are plausibly involved in defining harassment in any particular context. In addition, a legal template that may find analogies for truck drivers does exist in the case of sexual harassment. This section begins with dictionary definitions and asks how they could be scientifically relevant in the specific institutional and economic context at hand. It then applies the causal framework provided by the economic analysis reviewed above and attempts to illustrate how both subjective and objective elements might be joined in distinguishing harassment from driver monitoring related to productivity and coordination in at least one central type of case, in a manner that turns out to be analogous to the "*quid pro quo*" criterion in the case of sexual harassment. This section also briefly examines a potential further analogy to the "hostile workplace" version of the definition of sexual harassment, in which smaller incidents that do not individually cross the threshold and count separately as harassment might accumulate into a pattern that could be said to constitute harassment.

Initial definitions

The current online edition of the *Oxford English Dictionary*[147] offers these two definitions of "harass," a verb [with object]:

> *(1) subject to aggressive pressure or intimidation:*
>
> *if someone is being harassed at work because of their sexuality they should contact the police*
>
> *(2) make repeated small-scale attacks on (an enemy):*

the squadron's task was to harass the retreating enemy forces

Origin: early 17th century: from French harasser, from harer 'set a dog on', from Germanic hare, a cry urging a dog to attack

An early edition of *Black's Law Dictionary* provides an expansive definition:

> *Used in a variety of legal contexts to describe words, gestures and actions which tend to annoy, alarm and abuse (verbally) another person. A person commits a petty misdemeanor if, with purpose to harass another, he: (1) makes a telephone call without purpose of legitimate communication; or (2) insults, taunts or challenges another in a manner likely to provoke violent or disorderly response; or (3) makes repeated communications anonymously or at extremely inconvenient hours, or in offensively coarse language; or (4) subjects another to an offensive touching; or (5) engages in any other course of alarming conduct serving no legitimate purpose of the actor.*[148]

A later edition provides a more concise definition: "Words, conduct, or action (usually repeated or persistent) that, being directed at a specific person, annoys, alarms, or causes substantial emotional distress in that person and serves no legitimate purpose."[149]

Truck drivers generally work alone in a truck cab (with an exception for the small fraction of over-the-road drivers who work in teams). So while harassment can, in principle, involve gestures, touching, or even other more aggressive physical contact, in the truck driver case the most common circumstance will be when a dispatcher is communicating with a driver, possibly face-to face, but more likely by telephone, cell phone, or direct-to-the-truck satellite uplink. In this case, the four key points that define a harassing interaction appear to be:

1. That the communication is perceived as negative, as an attack (a specifically subjective component).
2. Implicitly it is not a "major" attack (whatever that might be in a specific context).
3. It may be, though need not necessarily be, repeated.
4. The communication serves no legitimate purpose (this is, at least potentially, an objective component).

We next consider how these components might play out in the trucking case, given the insights we have accumulated to this point from different parts of the scientific literature.

Subjective and Objective Components of Harassment in the Trucking Context

In order to understand these definitional components in application to the current setting, that is, the switch from a paper logbook RODS for truckers to an electronic one, we start by considering the subjective component to these definitions—that the communication in question must be perceived as hostile or attacking or pressuring by the recipient. When is a communication from a dispatcher to a driver likely to be perceived in this manner? Refer to the analysis provided by the principal-agent model and its application by Hubbard, above.[150,151] The first thing to recall is that much of the time the economic motivations of dispatchers and drivers are aligned by the

piece-rate payment system for road drivers. When this alignment is not disturbed by other factors, both drivers and dispatchers agree that the driver's best current choice is to operate the truck more miles now (or do whatever other further work action is appropriate at the present moment). Communications with the driver are likely to concern operational matters, and when economic goals are aligned, such communications are likely to be perceived either as neutral, or as beneficial by the driver if they involve information exchanges that aid in better coordinating drivers and loads.

However, as Hubbard noted, despite the fact that the mileage pay system mostly aligns firm and driver incentives, there is still substantial scope for disagreements about the details and pace of the driver's work.(152) This general theoretical point is reinforced anecdotally by some of the public comments entered into the Docket for the various parts of the EOBR rulemaking process by individual drivers.(153) As noted by one driver, "many [drivers] became truckers to be able to do a job without constant supervision,"(154) and this expectation can increase the potential for such disagreements. Thus, there are many circumstances under which a dispatcher and a driver might disagree about the best current action for the driver.

This analysis allows for categorization of the subjective components of the communication setting. The authors present a simplified version in the two-by-two typology in Figure 1, in which messages from the dispatcher to the driver come in two forms, one urging further driving or other work to be undertaken now, and the other instructing driving or other work to stop now. In the two boxes numbered 1 and 4, there is no current conflict of interest between firm and driver, because both agree on the current best action for the driver, and so there the subjective component of harassment—the perception of an "attack"—is not present.[15] By contrast, in boxes 2 and 3, the driver and the supervisor disagree on the current best action for the driver, and so the subjective component of harassment is present.

[15] It is worth noting that box 1 describes a situation in which the driver and the firm have an economic incentive to collude in breaking safety regulations, should those regulations create a binding constraint on achieving the joint goal.

		Message Content From Supervisor	
		Continue Work	**Stop Work**
Driver's Behavioral Preference	**Continue Work**	1. No subjective component. Communications perceived as neutral or beneficial.	2. Subjective component present; objective component probably not present (a "legitimate purpose" may be served if represents enforcement of safety regulations by carrier).
	Stop Work	3. Subjective component present: a. Objective component present IF "go" violates any safety regulations. b. Objective component probably not present IF "go" does not violate any safety regulation; may be productivity monitoring (a "legitimate purpose").	4. No subjective component. Communications perceived as neutral or beneficial.

Figure 1. Simplified typology of the incidence of subjective and objective components of harassment in dispatcher/driver communication situations.

Now a second feature of the institutional setting is needed—the fact that the legal context for FMCSA regulation is a primary concern with highway safety. This provides the reader with a clear criterion, specific to the regulatory context, as to when a message that might be subjectively perceived as an attack is nonetheless not harassment because the communication serves a "legitimate purpose," for the case in box 2 of Figure 1. In this box, the driver and firm disagree on the driver's best current action, but the nature of the disagreement is that the firm is restraining the driver when the driver prefers to work further. Thus, the subjective component of harassment, the perception of an attack, is present. However, because of the firm's economic incentives, this is unlikely to occur in any systematic way unless the firm is taking action to enforce HOS or other safety-related regulations. To the extent that this is the case, a message that the driver perceives as hostile or negative would lack the relevant objective component (i.e., it would not meet the last requirement of the earlier stated definition of harassment ["failing to serve a legitimate purpose"] because enforcing safety regulations is clearly a legally permissible purpose [and hence a "legitimate purpose"] that could be served by a message in the box 2 context.) An example that approximately exemplifies this category (an objection to speed monitoring) is offered by several comments by Gaskill on a recent FMCSA EOBR-related rulemaking.(155)

The most relevant and problematic cases come in the box numbered 3 (in Figure 1), in which the driver and the firm disagree on the driver's best current action, and the firm is asking the driver to work more than the driver prefers to work. Thus the subjective component—the perception of an attack—is present. But when is the objective component present? Here, in addition to the

primary safety mission of FMCSA, it is possible to utilize the earlier established understanding of the economic origins of the demand for monitoring and coordination for the purposes of improving productivity, in order to suggest when the objective component is present.

There are two extreme sub-cases that are possible. In Figure 1, box 3, sub-case (a), messages are identified that might also meet the objective standard: they cannot be in aid of any legitimate purpose because they direct or imply violating a safety regulation applicable to commercial motor vehicle drivers. These messages meet both the subjective standard and also objective ones appropriate to the context, and might reasonably be construed as harassment. By contrast, in box 3, sub-case (b), messages are placed that meet the subjective standard in that they are perceived as hostile, but which fail to also meet the objective standard, because they implement what is ordinarily a legitimate business purpose in the absence of an implied safety violation—that of monitoring drivers for the purposes of increasing their productivity or coordinating their work. These cases would not be construed as harassment, according to the authors' suggested approach. This way of categorizing cases provides, in principle, a fairly clear distinction.

So far this discussion has revolved around messages. How does this conceptual classification relate to HOS and EOBRs? There are likely to be some box 3 messages which clearly fall into sub-case (a)—messages that one might conjecture would be classified as harassment because they meet both the subjective and objective tests and are related to EOBR use. This would require that the dispatcher uses HOS information collected by an EOBR to put pressure on a driver to act against the driver's preferences, and also that this action would be illegal under the FMCSRs. For instance, suppose the driver has stopped because of believing him or herself to be too fatigued to continue.[156] A demand by the supervisor to continue driving would meet the subjective test (i.e., it would be perceived as hostile) and would also meet the objective one, by being in violation of the "ill or fatigued driver" rule in the regulations.[157] Or, suppose the driver were asked to log on-duty-not-driving time as off-duty when the driver preferred to log accurately.[158] This would meet the subjective test (i.e., it would be perceived as hostile) and would also meet the objective test, in violating the "prohibition of false reports of duty status."[159] If the driver were asked to run when a correct rendering of the RODS would show the driver out of hours, and the driver preferred to stop,[160] this would meet the subject test (i.e., it would be perceived as hostile) and would also meet the objective one by contravening the prohibition on either "permitting or requiring a driver to violate the hours of service regulations."[161] All of these would clearly be in box 3, sub-case (a) of Figure 1.

There are also likely to be some cell 3 cases which clearly fall into sub-case (b), in which the subjective test is met, in that the driver may perceive the message as hostile (because he or she prefers to stop), but the objective test is not, as the firm is carrying out the monitoring of driver behavior for the purposes of increasing productivity or coordinating drivers in a manner that does not threaten safety. More carefully, as long as there is not a violation of the safety regulations explicit or implicit in the message content, a single instance of such an interaction would fall in sub-case (b). (For a driver's opinion that both types of scenarios will occur, see the public comments of Edens.)[162]

Finally, it may be hard to decide how to categorize many messages in which the subjective test is met in that the driver and the supervisor are in disagreement about the driver's best current action. In many cases the correct categorization may depend on specific details of the context

which determine whether it is plausible that the objective test is met. However, for the purpose of this review, these do not need to be settled; it is sufficient to clearly define the conceptual categories.

Analogies with Sexual Harassment

It is worth noting that the synthesis of insights from related literature and the trucking safety context offered in the preceding sub-section embodies a partial parallel with the case of sexual harassment. In particular, in integrating subjective and objective characteristics into a typology of communication situations (Figure 1) that encompasses both harassment and productivity monitoring/coordination, the authors suggested that the violation of a safety regulation is a natural objective criterion that identifies the subset of cases in box 3 of Figure 1 in which harassment has occurred, even in a single instance. This is parallel to a legal criterion in the sexual harassment setting: a demand for a sexual *quid pro quo* related to the victim's employment is objectively sufficient to classify an individual instance of this specific behavior as harassment. Sexual harassment is defined in the context of employment law, so it is the relationship to discrimination in the terms or conditions of employment that matters. In trucking safety regulation it is vehicle (and driver) safety that is paramount; so it is reasonable to suggest that the violation of a safety regulation is what should matter.[16]

This raises a further question: is there also a partial analogy in the trucking case to the legal criterion in the sexual harassment setting under which the creation of a "hostile workplace" can also suffice to identify harassment, even though no *quid pro quo* demand has been made? If the answer were to be in the affirmative, it would be founded on the potential safety effects of repeated and persistent interactions that the driver perceived as subjectively hostile. In the scientific research on sexual harassment reviewed above, the authors noted that persistent interactions identified as harassment were associated with outcomes for the target that could reduce vehicle safety, such as fatigue due to stress, sleep disturbances, and alcohol consumption. In the literature on workplace bullying reviewed above, similar results were found. Thus, it is possible that there would be conceptual grounds, based upon existing social scientific research, to explore whether repeated instances of communications perceived as hostile by a driver might constitute safety-relevant harassment, even though none of these communications fell into box 3, sub-case (a) of Figure 1, in which the objective criterion was met in that the violation of a safety regulation was at issue.

A Significant Caveat: EOBRs versus FMSs

Before concluding the definitional section, a further issue must be considered: the scope of the current regulatory process. The basic point here is simple: one can use the discussion in the social scientific literature to understand the causal factors at work in the economics of the dispatcher-driver relationship, and then one can use this understanding plus a conceptual analysis to understand when communications from a dispatcher to a driver might constitute harassment, in that both the proposed subjective and objective tests are met. However, the scope of the

[16] Thus, the second component of the legal definition of harassment (that implicitly the attack is not major), and the third (that the attacks are repeated), are specifically dropped in this case. One event, a safety violation demand in a trucking safety context, is conjectured to be major enough to qualify as harassment, in analogy with a *quid pro quo* sexual demand in the employment law setting.

present regulatory process is quite limited—it is about the technical standards and legal conditions for the use of electronic systems (EOBRs) for reporting RODS.

It is not clear to what extent the regulation of the use by the motor carrier of any particular communication method with the driver is within the scope of this process. Also, the technology which keeps track of vehicle location, speed, or other characteristics is only a limited part of the current regulatory process (to the specific extent that one of the technical requirements for an EOBR is that it has to record the location of the vehicle, to the nearest city, at each change of duty status). The features around communications and more precise location information generally fall under the heading of FMSs in industry parlance (or EVMSs in the language of the VIUS and the principal-agent analysis).

EOBRs are often implemented as part of a larger fleet management system, but they need not be, and as a result it is not automatically the case that issues regarding these broader functions fall within the scope of the present regulatory process. Therefore, while one can with reasonable clarity offer a provisional scientifically-based analysis of when a message to a driver constitutes harassment, it does not necessarily follow that the cases that have been identified as likely to be classified as "driver harassment," with regard to communications between dispatcher and driver, fall within the scope of the regulations specifically governing EOBRs. The kind of harassment identified in Figure 1, box 3, sub-case (a), does not depend on the existence of an EOBR, and could take place with a paper logbook and a telephone, if a manager pressured a driver to work further when the driver wanted to stop, and the context made the manager's request a request to violate a safety regulation.

Here is a more precise description: there are two primary differences between a paper log record and an EOBR record. First, with an EOBR, the driver is constrained to record the time the vehicle is in motion as driving time, which prevents shifting the occurrence of driving work to hours before or after it actually occurred, and also prevents showing very slow trip segments as being driven faster and taking less time than they actually did. The second is that the driver has to enter changes of duty status manually at the time he or she wants to show them as taking place, and not at a later time when the starting and ending times could be advantageously adjusted. Both of these increase, to some degree, the accuracy with which the RODS is kept.

But, based on the analysis presented earlier, there is no *a priori* argument that will show that this increase in the accuracy of the RODS must, by itself, either increase or decrease driver harassment by managers. This is because the greater flexibility of paper logbooks can, in principle, cut in both directions. With a paper log, a dispatcher can pressure a driver to work longer hours when work time is not currently exhausted, or even pressure the driver to rewrite a paper log inaccurately to make more work appear legal. By the same token, a driver can write a logbook so as to show himself or herself out of hours when desired, even though an accurate recording would permit more work. Removing some of the flexibility in recording work hours could make it harder for a dispatcher to demand more work when the driver is accurately out of hours, but make it easier when the driver wishes to stop short of exhausting allowed work time. So the net effect is an empirical question that cannot be settled by a conceptual or logical analysis alone.

On the other hand, it is clear from earlier analysis that the use of specific FMS functions—specifically the increase in near-real time knowledge by management of driver location and RODS information, along with the ability to send messages to drivers wherever their trucks happen to be located—could potentially result in an increase the opportunities for driver harassment as defined above to occur. This is particularly true to the extent that one considers not just single events in which a safety violation is demanded, but also the potential for a series of small communication events to add up to a pattern that constitutes harassment. However, since these functions are not inherently part of EOBRs, the authors cannot herein define the extent to which the statutory requirement to ensure that EOBRs are not used for driver harassment bears upon the role of communications functions in facilitating harassment.

Summary of the Synthesis: What Is Harassment in the Truck Driver Case?

There is no definition of the concept of harassment of employees by managers specific to the truck driver case in the social scientific literature. Nor is there an existing legal definition that precisely fits this case. However, some foundational resources do exist. The authors have utilized the causal framework provided by the microeconomic model of the principal-agent relationship, as developed by Hubbard[163,164] and reviewed in application to the trucking case, along with standard definitional reference sources reviewed earlier in the literature review.[165,166,167] From these resources, the authors have synthesized a reasonable provisional conceptual interpretation of some key circumstances under which communications from managers to drivers might possess both the subjective and objective characteristics to be harassment, and under what circumstances they might be subjectively harassment but not objectively so described. The approach herein hinges on the difference between the ordinary business practice of monitoring driver behavior for productivity and coordination purposes and the implied or explicit demand to violate one of the safety regulations governing commercial driver behavior. The authors also speculated that an analogy to the case of a "hostile workplace" in the sexual harassment setting could arise in the trucking safety case even when the objective criterion proposed (that there be an explicit or implicit demand for the driver to violate a safety rule) is not met, but in which a series of smaller events adds up to a pattern that qualifies as harassment. A significant caveat to this provisional literature-based interpretive framework is that it categorizes communications, and EOBRs—despite frequently being implemented in the context of FMSs that have communications functions—are not in and of themselves communication devices.

EUROPEAN EXPERIENCE

The quest for monitoring technologies in the trucking industry is not unique to the United States. The European Union has been using devices to measure HOS since the 1970s. There is essentially no peer-reviewed, scientific literature related to driver harassment in connection to HOS recording in Europe; so here the authors review some relevant government documents and responses by government officials to queries about the relevance of driver harassment to the situation in Europe. This section begins with a review of the regulations enacted by the European Commission (EC) in order to understand the evolution of tachograph use in Europe.

Hours of Service Regulations in Europe

The current regulations governing the HOS of commercial vehicle drivers in the European Union are specified in Regulation (EC) No. 561/2006.[168] The rules are somewhat more restrictive than the analogous rules in the United States. For instance, the maximum total accumulated driving time over the course of 2 weeks (14 calendar days) is 90 hours, and most U.S. drivers would be permitted a higher total accumulation; thus, a driver using a 60-hour, 7-day log over a 2 week period who drove 9.5 hours per workday could accumulate 114 hours in the 12 working days encompassed; using an 8-day log or a 34-hour restart would permit more. A second example is that European drivers are limited to 9 hours of driving in a normal workday, though they can extend that to 10 hours twice each week if they still observe the weekly and bi-weekly maxima.[169,170] This regulation shares a key feature with the newest regulations governing Australian HOS, in that drivers are not the only individuals responsible for HOS compliance.

> *According to the new regulation, road transport undertakings can be made liable for infringements committed by drivers. Neglecting regulatory constraints when scheduling driving and working hours of drivers may lead to infringements and/or delayed arrival times due to required breaks and rest periods which have not been scheduled. Consequently, road transport undertakings must ensure that truck driver schedules comply with regulation (EC) No 561/2006.*[171]

(See also the discussion of the Australian "chain of responsibility," below.)

Use of Tachographs in Europe

In 1970, the EC required (in Regulation No. 1463/70) the use of an analog disk tachograph for keeping the RODS (as well as average speeds and other related items) for trucks that were involved in international transport.[172] The analog disk tachograph recorded data on circular paper cards. It used ink or a stylus that could make an image on a pressure sensitive medium like carbon paper, and was used to record the HOS of a driver and the speeds of the truck.[173] In 1985, the EC updated the rules about the tachograph in Regulation 3821/85.[174] This regulation prescribed the vehicles required to use tachographs as those weighing more than 3.5 metric tons or being used to carry 10 or more people, with a few exceptions for utility companies, etc. The regulation included rules on HOS and directions for construction, testing, and inspection of the analog disk tachograph.

The EC revisited the issues again in a new program for road safety for 1997–2001, in which it required that all new commercial motor vehicles be equipped with digital tachographs.[175] The goal was to create a device that was harder to manipulate than the older analog models.

> *The forthcoming introduction of the electronic tachograph at the end of 2002 represents a significant step forward in improving the effectiveness of the enforcement measures. Such electronic recording equipment is bound to improve considerably the level of compliance with the rules, in particular, by ensuring better protection of recorded data and by enabling a large number of checks to be carried out in a short period of time.*[176]

The digital tachographs are different from the analog tachographs in the way that they record and save the data. The European Union now defines a tachograph in the following way:

> *A digital tachograph is a control device for road transport. The digital tachograph is composed of a Vehicle Unit (VU) essentially containing a printer, two slots for the cards and a display. It is connected to the gearbox via a secured sensor. The VU is the brain of the system. It is able to hold data in the mass memory on drivers and their periods of driving and duty for about a 12 month period. It also and among others holds data relating to faults, attempts to tamper with the system, over speeding, calibration details, and when data has been accessed, for example, by the Police. It functions with smart cards. Drivers, companies (operators), workshops (tachograph calibration centers) and enforcement officers (Police for example) have each smart cards according to their specific needs. These enable them to use and/or give access to the data in the VU.*[(177)]

The most recent government action in regard to digital tachographs was a Proposal for Regulation in 2011, which has not yet resulted in a final regulation.[(178)] The EC plans to improve upon the digital tachograph by improving protections against manipulation and giving the devices a wireless capability in order to make enforcement less intrusive.[(179)] Digital tachographs as specified in Europe have many similarities with EOBRs in the United States, as specified in the FMCSA EOBR regulations. However, one significant difference is that in the EOBR specification there is not a separate card holding driver information, as there is with a digital tachograph.[(180)]

Problems with Tachographs

The EC's proposed regulatory change was accompanied by an impact assessment document that discussed concerns about the shortcomings of existing tachographs in some detail.[(181)] The European Union continues to look for ways to improve upon HOS compliance. The report found that at any point in time there are several thousand heavy-duty vehicles driving on the European network with a manipulated tachograph or a non-valid driver identification card. Nine percent of all controlled vehicles were found to be in violation of HOS, and of those a quarter of them were in direct violation of the laws requiring them to have a working digital tachograph. A big factor in non-compliance was suggested to be the incentive for transport firms to cheat. Employee costs are as estimated to be about 30–40 percent of the operating costs of trucking companies. If a subset of firms are able to employ fewer drivers and have them drive more by breaking the rules, then such firms can reduce their costs, potentially creating an unfair advantage for those who do not cheat and an unfair burden on those companies that follow the social rules.[(182)]

In addition to some of the more blatant violations mentioned above, there is concern that tachographs are still vulnerable to manipulation in various ways, despite the switch from analog to digital models. One specific issue is that drivers are, under some circumstances, able to utilize a second driver card if they have used up the permitted work hours on their primary card. The European Union has proposed changes to rules in order to combat these manipulations, including making the "driver's card" and a driver's license the same physical card, promoting wireless capabilities of a tachograph to speed up traffic stops, and increasing the strength of seals which keep the tachograph unit from being opened.[(183)] The seals have not been uniformly regulated, so

some countries have seals that are easy to break open, and then replace, making the tachograph easier to manipulate. There have also been reports of manipulation using “magnets” or “exotic devices” by European Union police and authority officials.

Workshops in which drivers have their tachographs calibrated have also been called into question. Authorities estimate that 30 percent of all workshops have conducted some sort of fraud in the past.(184) Also, there are questions about the uniformity and effectiveness of controls and sanctions. Of the 29 countries that were to train enforcement officials, only 20 had actually trained officials by 2009, and those that did train officials had varying degrees of training. The harmonization of enforcement approaches is important in that uniformity gives no specific geographic area an advantage in business competition. But participating countries have greatly varied penalties for a violation. In Malta, a relevant fine is 53.23 euros, while fines for similar offenses can exceed 5,000 euros in Germany, Austria, Ireland, and Cyprus. The discrepancy in penalties can give an unfair advantage to those who work in more highly penalized areas.(185)

Driver Harassment and Digital Tachographs

Documentation relating the digital tachograph and driver harassment is limited and inconclusive. In the assessment of impact report on digital tachographs, the EC states that since there are strong incentives for companies to lower payroll costs, employers may pressure drivers to drive past their HOS limits.(186) As long as the digital tachograph can be manipulated, or the costs of getting caught outweigh the increase in productivity, there will be pressure from companies on drivers to manipulate the digital tachograph.(187) Because there is little or no literature directly addressing the topic of driver harassment, one member of the research team sent e-mail enquiries about this issue to several relevant stakeholders in the European trucking industry. A response from Damian Viccars of the International Road Transport Union, which is an association of vehicle operators worldwide, said he is not aware of anyone raising this issue:

> *Concerning your enquiry on behalf of the FMSCA, as you know in Europe we now have quite some experience with EOBRs or as we call them here, digital tachographs. The reality is we have never heard of driver harassment being raised as an issue anywhere at all in the EU. As such I can't point you in the direction of any literature or studies on the subject.*(188)

A response from Ewa Ptaszynska of the EC allowed that harassment of drivers by managers “is possible,” but stated that no complaints along this line were currently known:

> *Only driving activity is recorded by the tachograph automatically. For other activities: 'other work', 'availability', 'break' / 'rest' a driver must push an appropriate button. It is theoretically possible that a driver is forced by his employer to record an obligatory 'break' after 4.5 hours of driving whilst he was doing 'other work' (e.g.: unloading). After this working activity (falsely recorded as 'break') a driver could recommence driving and be in line with the provisions on the obligatory breaks after every 4.5 hours of driving. At the roadside check it would be difficult to prove that the break is falsely recorded as a driver may say that others were doing unloading while he was having a break. This is a theory. I am, in fact, not aware (since 2007) of any complaints or petitions on this issue.*(189)

There have been a number of social scientific papers on the related topic of workplace bullying that utilize European data; these are discussed as part of the overall literature on this topic above. However, none focus specifically on truckers.

Summary of the European Experience

The European Union has been using automatic devices for generating part or all of the RODS used to track compliance with the HOS regulations in Europe for drivers of commercial vehicles since the 1970s. Originally, these devices were analog tachographs, and since 2002 these units have been digital in nature. European digital tachographs are closely related to the EOBRs specified for use in the United States by FMCSA. However, there is little or no scientific literature on the topic of driver harassment in association with tachograph use in Europe. Inquiries sent to relevant stakeholders produced the view that driver harassment associated with how the RODS is maintained could in theory be an issue, but the uniform response was that it had not been so in practice.

AUSTRALIAN EXPERIENCE

Australia has also begun to move toward electronic monitoring technologies for recording the work hours of drivers in the trucking industry, with the development of "electronic work diaries" (EWD). There is essentially no peer-reviewed scientific literature related to driver harassment in connection to HOS recording in Australia, so this section reviews some relevant government documents and responses by government officials to queries about the relevance of driver harassment to the situation in Australia.

Australian Safety-related Fatigue Regulation

In 2008, Australia reformed its heavy vehicle speed and fatigue compliance laws.[(190)] One of the key aims was to change driver speed and fatigue enforcement from an exclusive focus on drivers to a broader focus, in order to ensure that all parties associated with the transport of freight are held responsible for its safe movement. The new laws now provide a chain of responsibility which includes not only the vehicle's driver, but also the employer of the vehicle's driver, the prime contractor for the vehicle's driver, the scheduler or dispatcher of the vehicle, the shippers and the consignees of goods in the vehicle, loading and unloading managers of goods in the vehicle, and loaders and unloaders of goods in the vehicle.[(191)] (See also the discussion of a similar approach in Europe, above.) The new approach requires everyone in the supply chain whose actions have a potential impact on driver speeding or driver fatigue to take 'all reasonable steps' to prevent drivers from speeding in their trucks or operating them while fatigued. More specifically for fatigue, "Employers and customers will be held accountable for dangerous work schedules and long truck queues, which are known to be major causes of fatigue. If poor business practices endanger the lives of other road users, there will be severe penalties for those responsible."[(192)] The potential fines range from a few thousand Australian dollars for more minor infractions to as much as 50 thousand Australian dollars for a serious violation.

The 2008 reform also altered the focus of what in the United States would be called the HOS regulations, from the regulation and control of driving hours to the management of driver fatigue. There are now three levels of certification for the employers of heavy vehicle operators, which

detail how this management will take place.[193] The default option is Standard Hours, or STM, which has no accreditation requirements and defines a set of HOS limits analogous to the U.S. approach. Operators who acquire additional certification in fatigue risk management strategies can qualify for either of two alternatives: Basic Fatigue Management accreditation (BFM) loosens the HOS restrictions slightly while maintaining the same regulatory structure, while the more demanding Advanced Fatigue Management accreditation (AFM) allows the creation of a customized safety management system and work hours policy in return for the operator taking on greater accountability for managing fatigue risks. "The reform changes the focus from regulating hours to managing fatigue. Working long hours and fighting your body clock at night is widely recognized as high risk. Operators and drivers who 'do the right thing' by managing those risks through accreditation schemes will have a greater say in when they can work and rest."[194] The accreditation process includes meeting standards in all areas of fatigue management, including employee knowledge, awareness, job responsibilities, work scheduling, driver health, how fitness for duty is ensured, how internal review processes work, and record keeping.

In-vehicle Telematics

In addition to the changes with regard to heavy vehicle speed and operator fatigue management, Australia has developed a national policy towards several aspects of vehicle telematics (the long-distance transmission of computerized information).[195] In parallel with the domestic situation, industry practice in Australia includes a number of different aspects of what would be termed "fleet management systems" in the United States under this label. The new national policy for telematics was approved in July, 2011, and calls for the cooperation of industry and regulatory bodies to encourage the use of in-vehicle telematics for both productivity- and safety-enhancing reasons, including satellite-based location tracking, real-time or near-real-time information transmission from vehicles to dispatchers and managers (and vice versa) on-vehicle weight sensors with in-cab readouts, on-vehicle speed monitoring, and the recording and monitoring of HOS, which is called an EWD in Australia. Interestingly, the Australian regulators considered electronic tachographs and decided not to use existing technology of this type but to proceed to develop their own Australian approach to EWDs.[196] To date, a performance-based specification for the regulatory use of most of the work-recording functions of EWDs has been developed, but approvals of specific devices for general use have not yet occurred.

Electronic Work Diaries

The policy issues involved and the process to be undertaken to generate specific standards for EWDs were addressed as part of the consideration of the overall telematics topic area,[197] and so in Australia, standards for the analog of EOBRs appear to be connected, as a matter of regulatory policy, to standards for communications of managers with drivers. The 2008 changes in the regulations governing speed and fatigue management made the switch from a paper work diary (analogous to a paper logbook in the United States) to an electronic version permissible. However, the government initially failed to provide a standardized minimum specification such a device would need to meet in order to be approved for regulatory compliance. As a result, commercial operators in the trucking industry were reluctant to use EWDs in place of paper logs, even when they have already installed EWDs and associated telematics functions in their vehicles for fleet management purposes.[198] This led to the development of a set of "performance-based" specifications that was released in July 2011.[199] A pilot study of the

operational impact is currently underway, with an initial phase complete and a second phase nearly so.[200]

Driver Harassment and EWDs

As in the U.S.-based discussion, there is a range of stakeholders, and not all are in complete agreement as to the goals of EWD implementation for regulatory purposes. Most agree that improving compliance with current regulations is a goal that would help to "level the playing field," thus there is reasonable support for a legal process that allows monitoring of "persistent speed and fatigue offenders" via in-vehicle telematics generally, and EWDs more specifically (see the parallel discussion in the European case, above). But, while regulators would like to see EWDs address some of the current "loopholes" associated with paper logs, and some industry representatives agreed, others cited this as a reason to maintain their paper log approach. A related concern for drivers is the problem of increased measurement precision. With paper logs, under current enforcement practices, the smallest time measurement increment is 15 minutes, so breaches of the work hours limits that are smaller than this are not captured nor penalized. Drivers are concerned that the precision of electronic records could result in many minor infractions and/or repeated citations for the same violation, and the National Transport Commission discussed this issue in its 2011 policy paper on EWD adoption, in the context of how to ensure fair enforcement practices.[201]

However, despite extensive discussion in the regulatory documents and reports related to the EWD issue, the authors did not find any specific discussion of the issue of driver harassment by managers or by employing firms connected to the use of EWDs. There has been a significant discussion in Australia about the economic pressures generated by a piece-rate pay system (pay by mileage or by trips), which may be exacerbated for drivers by pressure from management related to working long hours to complete trips, including a major "enquiry" formally commissioned from academic researchers by the government.[202] But this discussion has not focused on EWD, or even very much on the role of telematics ("fleet management systems"). Rather, it has been focused in two other directions. One is the aforementioned concept of chain of responsibility, which is designed to address the potential for third parties (e.g., shippers or consignees), as well as motor carrier managers, to put pressure on drivers to speed or run fatigued to complete more trips. The second approach has been to focus on the issue of compensation levels and forms. This second approach has led to a new initiative in Australia to require minimum levels of driver pay that are designed to moderate the economic pressures on drivers.[203]

In addition, in order to verify our understanding that driver harassment has not emerged as a distinct issue with respect to electronic work diaries in the Australian motor freight industry, one of the authors contacted several officials in Australia to ask what had come about this topic in their understanding. One, an official of the National Heavy Vehicle Regulator Project Office, specifically mentioned the chain of responsibility approach as a fundamental response to the issues underlying the potential for harassment.[204] The second, an official working on the Operational Pilot Study of EWD at Australia's National Transport Commission, responded to the enquiry about driver harassment issues by saying, "This has not to this stage been raised as a major concern in the Australian pilot…"[205]

Summary of the Australian Experience

The Australian government and motor freight industry have argued that there is an underlying fundamental economic relationship between the commercial pressures facing the industry and the safety performance of heavy freight vehicles. The government has moved to address this in a different historical and institutional setting from that in the United States, and it has attempted to develop reforms focused on these underlying economic issues. There have been two basic approaches: one through defining a chain of responsibility for driver fatigue and driver speeding behavior which places on all in the supply chain the legal obligation to take "all reasonable steps" to remove pressures on drivers to drive when fatigued and/or to speed, and in fact, to ensure that they do not speed. The second is through a newer initiative to require minimum pay rates for drivers to moderate the economic pressures on drivers to engage in unsafe behaviors. In the context of the chain of responsibility applied to driver fatigue issues, the Australians have updated their working hours regulations and moved toward the use of EWDs, which are very similar to EOBRs in the U.S. context. At the same time, they have given motor carriers the opportunity to have greater flexibility in how the limits on driver's hours are set if they are willing to affirmatively take on the legal responsibility of managing driver fatigue in an effective manner.

However, possibly because of the focus on these more fundamental economic issues, the specific topic of the harassment of drivers by motor carrier management has not emerged as a significant issue in Australian context. The authors conclude that given the very different historical and institutional context in the United States, which makes the chain of responsibility approach unlikely as a regulatory option here, at least in the short run, there is not a great deal that can be learned from the Australian experience about the topic of the present research (i.e., the specific role of EOBRs in the potential for the harassment of heavy vehicle drivers).

SUMMARY OF THE LITERATURE REVIEW

The authors began with a short description of the legal context of the literature review. FMCSA is considering a regulation on the use of EOBRs on the duty status of drivers for the purposes of tracking driver compliance with the HOS rules. A court decision has required attention to the statutory necessity for FMCSA to deal with a specific issue in devising regulations governing EOBR use: driver harassment due to the introduction and use of such devices should be prevented.

Looking initially at the context for most EOBR use, the ordinary business practice of monitoring drivers for improved coordination and productivity, the authors found a modest social scientific literature on measuring productivity overall in trucking (covered in Appendix B), and another on the topic of the economics of productivity monitoring among individual truckers. The latter is reviewed in some detail, as it turns out to be important for later sections. Specifically, an analysis of the economic motivations of firms and drivers using the principal-agent model[206] suggests that while the incentives of firms and drivers are aligned to a first approximation by the piece-rate pay system used for almost all road drivers,[207,208] the possibility of economically significant incentive conflicts still exists.[209] Along with coordination benefits (improved matching of trucks and loads), the ability to monitor drivers to ensure high productivity due to this potential conflict is part of what drives the demand for communication and HOS functions embodied in

"fleet management systems" and other electronic monitoring devices.[210,211] The authors also briefly review some industry-sponsored research on the incidence of EOBR use and the issues the industry sees with that use,[212] and it surveys the currently available EOBR devices in Appendix C.

Turning more directly to the topic of driver harassment, there is no social scientific literature precisely on this topic, let alone on the issue of how EOBRs might affect such harassment. However, there are two related bodies of research that are potentially relevant, one on workplace bullying and a second on sexual harassment. The literature on workplace bullying provides several potentially transferrable insights. Among them are that organizational leadership may be important in the incidence of bullying, that both subjective and objective components may be relevant to identifying bullying, and that several individual outcomes are associated with bullying that may be of relevance to vehicle safety, such as increased stress, sleep disruptions and disorders, and reduced job attachment.

The second body of related research is on the issue of sexual harassment. Sexual harassment of truck drivers may occur, and sexual harassment of female truckers may occur more frequently than among other occupations, but there is no evidence of any direct link to EOBRs. However, the legal definition of sexual harassment, which distinguishes two cases—a single event that crosses a specific threshold versus a sufficient number of less intense events that together create a hostile climate—offers some potential analogies. There are also potentially transferrable insights from this literature that parallel those from studies of workplace bullying: the role of institutional attitudes, the relevance of both subjective and objective components, and the existence of negative outcomes for victims that have some potential relevance to vehicle safety, such as stress, sleep disruption and disorders, alcohol use, and reduced job attachment.

The authors offer a synthesis of the elements from the statutory context, the economic analysis of the demand for driver monitoring, and the insights from the two related social scientific literatures. The authors suggest a provisional approach to integrating both subjective and objective elements in a typology that allows communications between managers and drivers to be categorized as the ordinary business practice of productivity monitoring versus statutorily prohibited harassment (see Figure 1 and the related discussion, above). There are two key insights. One is that the statutory setting for FMCSA rulemaking, a primary concern with highway safety, defines the objective components, much in the way a primary concern for employment discrimination provides an objective definitional component in the sexual harassment setting. The second insight, from principal-agent theory,[213] is that the subjective element occurs when there is an incentive clash between the firm and drivers, and so the manager and the driver disagree about the current best work action of the driver. However, some cases which have the subjective element present are irrelevant in a safety context, as they objectively constitute enforcement of safe work practices and regulations by the firm (box 2 in Figure 1). When such an incentive clash is potentially relevant, there are two subcases: one is still not to be classified as harassment because it objectively represents the ordinary business practice of productivity monitoring (box 3, sub-case (b) in Figure 1), and a second that clearly is to be classified as harassment because objectively the driver is pressured by the manager to commit a violation of a safety regulation (box 3, sub-case (a) in Figure 1).

In comparing the driver harassment case with the sexual harassment case, the authors suggest that this provisional conceptual map defines driver harassment cases that are analogous to the sexual harassment case in which a single act crosses a specific threshold and thus counts as harassment. There may be a further analogy to be found in trucking to the distinct sexual harassment case of a "hostile work environment," when there exists a series of actions in which the subjective component is present, but the objective component is not, and the sum of the actions adds up so as to have safety consequences for the target's job performance.

Finally, the authors note a very important caveat: the conceptual synthesis offered directly addresses how to categorize communications, and EOBRs are not inherently communication devices, though they may be installed in systems with accompanying communication functions. Thus, while the conceptual synthesis can provisionally clarify what kind of communication events constitute driver harassment, it is not automatically clear to what extent harassment so defined is relevant to a rulemaking about EOBRs.

In a separate section, the authors review the experience in Europe with analog and electronic recording devices for HOS compliance. There is no scientific literature directly on this topic, so the authors review relevant government documents and report results of inquiries to stakeholders. In the penultimate section, the same is done for the Australian experience. Both cases exhibit distinct institutional and historical patterns that differ from those in the United States and which may be of some independent interest (for example, including other actors in the supply chain, such as shippers and consignees, in the "chain of responsibility" for driver safety behavior, along with the driver and the motor carrier). However, in neither case is there evidence that the topic of driver harassment has been a substantial issue in connection with the specifics of the use of automatic recording devices for work hours and duty status.

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APPENDIX B (TO THE LITERATURE REVIEW): MEASURING OVERALL PRODUCTIVITY GROWTH IN TRUCKING

We begin with a conceptual introduction to the topic of productivity measurement from two technical reports by an economist at the Bureau of Transportation Statistics.[214,215] As economists use the terminology, "productivity refers to the efficiency with which output—of a factory, company, industry, etc.—is produced with the available inputs used to produce the output—e.g., labor, capital, etc." There are two common approaches to measuring productivity: labor productivity and "multifactor productivity" (MFP) (sometimes called "total factor productivity").

> *"Labor productivity is defined as output per unit of labor, and is calculated by dividing output produced by a measure of the labor input used to produce the output (number of employees or labor hours) . . . Multifactor productivity refers to the productivity of all the inputs used in the production process. These include: labor, capital, land, and intermediate inputs (e.g., energy inputs and purchased services)."*[216]

Labor productivity is conceptually straightforward, but the measurement of MFP is a little more complex, a point which will be addressed later. For present purposes, the relevant point is that both kinds of productivity measurement can produce results that potentially reflect the impact on productivity of the use of various types of information technology by firms, including the use of EOBRs.

Apostolides studied the trends in MFP in for-hire trucking from 1987–2003.[217] He used the standard procedure, which essentially calculates MFP as a growth rate residual, or the part of the growth of output per unit of time (whether positive or negative) that cannot be attributed to growth per unit of time in the three basic categories of inputs (labor, capital, including land, and intermediate goods). This residual is thought of by economists as a measure of the effects of technological change in the broad sense of all the factors, other than the changes in the level of inputs, which affect the amount of output. In addition to things such as changes in the organization of production, the use of information technology (such as FMSs for dispatching drivers, and EOBRs for tracking their HOS) could be a source of an observed increase (or decline) in MFP. Apostolides found that MFP grew in trucking at an average annual rate of 2.7 percent from 1987 through 1994, fell at an average annual rate of 1.0 percent from 1995 through 2001, and began to rise again at a rate of 1.1 percent in 2002 and 2003.[218]

FMSs began to be introduced in the late eighties (see discussion below), and the first EOBRs also appeared then, generally as add-ons to fleet management tools. One could conjecture that some part of the relatively high MFP growth in 1987–1994 found by Apostolides was due to the first effects of the diffusion of FMSs, but if this were correct it is not obvious why there should have been a slowdown until 2001 (also, see the discussion of Hubbard, below). In any event, EOBRs were much rarer than FMSs until near the end of Apostolides's study period, so it would be hard to attribute any aggregate effects to EOBRs in particular. Apostolides does not propose an explanation of his findings, even after his comparison to the MFP growth for the entire U.S.

private business sector shows trucking MFP grew faster during 1987–94, more slowly from 1995–2001, and then faster again in 2002–03, the last 2 years of the comparison.

A major strength of the Apostolides approach is that it accounts (at least at an aggregated level) for all the different types of inputs to production. One significant limitation is that it only covers the for-hire motor freight industry, thus missing the very large part of the total production of trucking services that is carried out by private carriers. A second is that in order to compare such disparate inputs as capital and labor, this approach uses financial measures of inputs and output (costs for each input and the dollar value of output, deflated with price indices), thus implicitly assuming that deflated costs accurately capture quantities used in a form that can be compared over time, which the next study argues may not be fully accurate for trucking.

An alternative approach to measuring the long term growth of productivity in trucking is taken by Boyer and Burks.[(219)] These authors use data from the VIUS to analyze changes in trucking productivity from 1982 through 1997. The analysis is technically of truck productivity, but given the limited substitutability of capital for labor in the task of driving a truck, the authors argue that their analysis should be understood as one of labor productivity for driving labor. "At the lowest level trucking is transparently simple. A truck requires a single driver. Without the driver, there is no production. A second driver never operates the vehicle simultaneously with the first, and one driver never operates two trucks at the same time. In order for labor productivity to increase in trucking, then, trucks and their drivers must either travel farther in a year while loaded, or carry more tons in their loads."[(220)] The final output measure used is physical (ton-miles) and the authors separately calculate the effects of changes in miles per truck, tons per loaded truck, and the probability of being loaded to generate their results for ton-miles. A major focus of this study is a counterfactual exercise which shows how the measured increases in ton-miles over the period of study have been partially confounded by a change in the output mix of trucking towards longer and heavier hauls.

The conclusion of this study is that measured physical productivity growth in trucking during the 1982–1997 period appeared on the surface to match the 1.8 percent annual labor productivity growth of the U.S. economy over the same time, but that this was misleading. Instead, a correct analysis shows that the annual growth rate in trucking was significantly slower, at only 1.3 percent. The authors argue that this is because changes in the output mix (toward longer and heavier hauls) made the nominal measure of ton-miles per truck per year misleading, in the absence of the counterfactual correction offered in the paper. They also suggest that the increases in miles and ton-miles observed were driven most directly by the one-time drop of labor costs and profits from deregulation, plus a secular downward trend in fuel costs, and they counterpose this explanation to the more usual story that better information technology increased productivity and lowered costs, driving prices down and truck use up. This study also quantified the changes in physical productivity due to longer trailers, estimating that it explained about a third of the productivity growth over this period, and suggested that while information technology may have affected product quality, it did not affect physical productivity in a substantial way.[(221)]

A strength of this study is that it uses specific disaggregated physical measures of inputs and outputs, thus allowing the counterfactual exercise undertaken by the authors, and avoiding the potential measurement problems inherent in the kind of financially-based approach used in MFP calculations. A second strength is that it included both for-hire and private carriage, thus

covering both of the important parts of trucking services production. A significant limitation is that direct account could not be taken of changes in the quantity of labor inputs other than changes in the number of drivers, nor or of changes in the quantity of capital used other than changes in the number of trucks; thus inferences about the role of information technology, such as FMSs or EOBRs, from this work (as from the study of MFP) are indirect. For the present study, the point of these three analyses is somewhat indirect. They review the foundational ideas in the measurement of productivity, albeit at the industry level, and they suggest that both miles per truck and load indicators, such as the percentage of empty miles and the fraction of trailer capacity used, are important productivity indicators.

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APPENDIX C (TO LITERATURE REVIEW): FUNCTIONAL CHARACTERISTICS OF COMMERCIALLY AVAILABLE EOBRS

This section offers a short survey of the functional characteristics of EOBR units that are currently on the market (as of August, 2012). There are extensive similarities across the EOBRs available commercially, with some key differences. In many cases, the EOBR function is embedded within a FMS offering a variety of services. All of the EOBR units on the market perform automated logging of HOS, conforming to the 395.15 regulation. Most provide wireless connectivity to the fleet office. Most vendors also provide alerts and warnings to drivers who are in danger of violating HOS rules. Another feature, available in some units, calculates available driving times and duty status. The ability to certify or correct driver logs is offered by some vendors.

The display of HOS data when requested by law enforcement authorities is done in several ways: through an in-cab device or screen, via a smartphone screen, or paper printouts.

Information specific to individual vendors is shown in Table 59.

Table 59. EOBR vendor comparison.

Vendor	Wireless	395.15 Compliant	Automated HOS	Calculate Available Driving Times and Duty Status	HOS Violation Alert/Warn	Certify/ Correct Driving Log	Means to Show Log to Law Enforcement	Fleet Manager Real-Time Access to HOS Data	Non-HOS Features Bundled-in to "EOBR"
Inthinc	Yes	Yes	Yes	No	Yes	No	Yes (in-cab display)	Yes	• GPS tracking and trip reporting • Automated IFTA fuel tax • Real-time in-cab verbal alerts for speeding, seat belt use • Emergency global sitcom connectivity • Crash detection/accident reconstruction
People-Net	Yes	Yes	Yes	No	Not specifically stated	Entered through electronic forms	Yes (in-cab device)	Yes	(Separate packages: Vehicle Management, Fleet Manager)
Qual-comm	Yes	Yes	Yes	Yes	Yes	Entered through electronic forms	No	Yes	(Separate packages for Analytics, CSA Performance, Critical Event Reporting, In-cab Navigation, Performance Monitoring, Fleet Management (messaging, vehicle tracking, mapping)

Vendor	Wireless	395.15 Compliant	Automated HOS	Calculate Available Driving Times and Duty Status	HOS Violation Alert/Warn	Certify/ Correct Driving Log	Means to Show Log to Law Enforcement	Fleet Manager Real-Time Access to HOS Data	Non-HOS Features Bundled-in to "EOBR"
Rand-McNally	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	• Fleet communications/ messaging • Text-to-speech email playback • Driver monitoring • Performance monitoring • Navigation • Fuel reporting • Engine diagnostics
TeleTrac	Yes	Yes	Yes	No	Yes	No	Yes (handheld device)	Yes	
VDO	Future	Yes	Yes	No	Yes	No	Yes (print-out)	Yes	• Vehicle Events Data Recording • Vehicle Tracking Data Recording • Driver Vehicle Inspection Reports • Log in/Log off (track vehicle use by more than one driver) • Track vehicle speed, harsh braking, idling, tire pressure • Track seat belt use • Vehicle Diagnostics Reporting

Vendor	Wireless	395.15 Compliant	Automated HOS	Calculate Available Driving Times and Duty Status	HOS Violation Alert/Warn	Certify/ Correct Driving Log	Means to Show Log to Law Enforcement	Fleet Manager Real-Time Access to HOS Data	Non-HOS Features Bundled-in to "EOBR"
Xata	Yes	Yes	Yes	No	Yes	No	Yes (smartphone display)	Yes	• Alerts • IFTA and state mileage • Actual miles driven • Electronic DVIR • Driver & vehicle performance reporting • Asset tracking • Driver scorecards • Diagnostic warnings • Online mapping

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APPENDIX D: DETAILED METHODOLOGY

This is a technical section which details the procedures used in selecting the sample and compensating weighting procedures.

SAMPLING DESIGN AND WEIGHTING – DRIVERS

Sampling Design

The sample for the survey was based on two frames of truck stops.

Sampling Frame 1: 2008 Listing from NIOSH

As discussed in Section 1 of this report, a representative from NIOSH provided the research team with an Excel file—used in the National Survey of U.S. Long-Haul Truck Driver Health and Injury[222]—containing 6,169 truck stop entries. After geocoding, linking a stop to the nearest MSA, and filtering by proximity (i.e., within 20 miles of an MSA with a population of 500,000 or more and within 0.5 miles of the nearest interstate exit in the FAF3 model database), there were 1,465 entries eligible for the study. These entries were distributed into 21 strata based on 13 broadly defined geographies and 3 levels of traffic volume, with some collapsing to equate (roughly) the population sizes. Table 60 shows the 21 strata used in the study.

Table 60. Strata for truck stops listed in the first sampling frame, based on geography and traffic volume.

Stratum	Geography	Traffic Volume	Stops on the Frame	Stops Sampled	Probability of Selection of a Vehicle
A	California Southwest (NM, AZ)	15,000+ 10,000+	46	2	< 17:315,000
B	South Atlantic (NC, SC, GA, FL)	15,000+	38	2	< 17:285,000
C	South (LA, MS, AL), Texas	15,000+	44	2	< 17:330,000
D	I-95 NE corridor (CT, DE, MA, MD, NY, NJ, RI, VA)	15,000+	30	1	< 17:450,000
E	Steel corridor (PA, OH, MI, WV)	15,000+	24	1	<17:360,000
F	Memphis hub (TN, AK)	15,000+	22	1	<17:330,000
G	Upper Midwest (IN, IL, WI, KY)	15,000+	32	1	<17:480,000
H	Mountains and Pacific NW (CO, ID, NV, ND, SD, UT, WY, OR, WA)	10,000+	26	1	<17:300,000
I	California Mountains and Pacific NW (CO, ID, NV, ND, SD, UT, WY, OR, WA)	5,000–15,000 5,000–10,000	72	1	17:790,000–17:430,000
J	Great Plains (MN, IA, MO, KS, NE, OK)	10,000+	37	1	<17:435,000
K	I-95 NE corridor (CT, DE, MA, MD, NY, NJ, RI, VA), Steel corridor (PA, OH, MI, WV)	10,000–15,000	79	1	17:1,185,000–17:790,000
L	Memphis hub (TN, AK)	10,000–15,000	45	1	17:675,000–17:450,000
M	South Atlantic (NC, SC, GA, FL)	10,000–15,000	75	1	17:1,125,000–17:750,000
N	Upper Midwest (IN, IL, WI, KY)	10,000–15,000	58	1	17:870,000–17:580,000
O	South (LA, MS, AL), Texas	10,000–15,000	62	1	17:930,000–17:620,000
P	Texas	5,000–10,000	75	1	17:750,000–17:375,000
Q	Steel corridor (PA, OH, MI, WV); Upper Midwest (IN, IL, WI, KY)	5,000–10,000	216	2	17:1,080,000–17:504,000
R	Great Plains (MN, IA, MO, KS, NE, OK)	5,000–10,000	101	1	17:1,010,000–17:505,000
S	I-95 NE corridor (CT, DE, MA, MD, NY, NJ, RI, VA); Other Northeast (ME, NH, VT)	5,000–10,000	99	1	17:990,000–17:495,000
T	Memphis hub (TN, AK), South (LA, MS, AL), Southwest (NM, AZ)	5,000–10,000	92	1	17:940,000–17:480,000
U	South Atlantic (NC, SC, GA, FL)	5,000–10,000	154	1	17:1,540,000–17:770,000
	Total		6,168		
	Within 20 miles of MSA population 500,000+		2,900		
	Within 20 miles of MSA population 500,000+ and 0.5 miles from a high ADDTT highway segment	5,000–10,000 10,000–15,000 15,000+ Total	834 379 252 1,465	 25	 17:1,540,000–17:330,000

The initial sample of truck stops was drawn according to this design. However, as project staff started to verify contact information, it became apparent that there were obsolescence issues with the frame: contact information was out of date; the truck stop may have been out of business; the business found at the location was not a truck stop (but instead a regular gas station with little truck traffic and no parking, a convenience store, or a repair shop); the stop could not be located using an online Web mapping service application; more recent images found using an online Web mapping service application would show that the lot had been razed, etc. Thus, it was decided that a supplementary frame should be used.

However, the truck stops that had already been recruited into the survey during this process were retained. Namely, eight markets (shown in Table 61) appear in the ultimate sample:

Table 61. Truck stops recruited using the first sampling frame.

City	ST	Zone Improvement Plan (ZIP) Code	Original Stratum	Census Division
Geneva	OH	44041	K	3
West Greenwich	RI	02817	S	1
Wheat Ridge	CO	80033	H	8
Sacramento	CA	95833	I	9
Chandler	AZ	85226	A	8
Baltimore	MD	21224	D	5
Vero Beach	FL	32966	U	5
Haw River	NC	27258	B	5

Sampling Frame 2: The National Truck Stop Directory – The Trucker's Friend (Hard Copy)

To overcome the issues of overcoverage (truck stops no longer in business), and possibly undercoverage (new truck stops that had opened since them) encountered with the 2008 frame, project staff acquired hard copies of *The 2014 National Truck Stop Directory: The Trucker's Friend*.[(223)] A 1:21.1 systematic sample of truck stops was taken from the interstate portion of the directory, producing 302 entries. After conducting geocoding and proximity filtering identical to that conducted on the 2008 frame, there were 66 eligible stops left.

To ensure adequate geographic coverage, the subset was further stratified by Census division to make an approximately proportional sample (i.e., omitting stratification by traffic volume, as done previously). The estimated count (as shown in Table 62) is the estimate of the total number of truck stops in the 2014 directory, based on the State-specific geocoded eligibility rates as determined in working with the 2008 frame. Had the sample of 25 stops been drawn using the directory, the following design would have been used:

Table 62. Strata for truck stops listed in the second sampling frame, based on Census division and geography.

Census Division	Geographic Location	Estimated Count	Sample Size	Weight
1	New England	42.96	1	42.96
2	Mid Atlantic	206.49	2	103.24
3	East North Central	462.17	4	115.54
4	West North Central	166.15	2	83.08
5	South Atlantic	498.09	5	99.62
6	East South Central	251.33	2	125.66
7	West South Central	548.47	5	109.69
8	Mountain	160.70	2	80.35
9	Pacific	151.99	2	75.99
	Total	**2488.35**	**25**	**99.53**

In practice, the second frame was used to supplement the balance of the truck stops drawn from the first sampling frame. Sixteen stops from the second frame (shown in Table 63) appear in the final sample.

Table 63. Markets with truck stops recruited using the second sampling frame.

City	ST	ZIP Code	Original Stratum	Census Division
Houston	TX	77009	C	7
Kingsland	GA	31548	U	5
Council Bluffs	IA	51501	R	4
East St. Louis	IL	62201	N	3
Gary	IN	46406	G	3
Marshall	MI	49068	Q	3
Lincoln	AL	35096	O	6
Anna	TX	75409	P	7
Oklahoma City	OK	73153	J	7
Tulsa (East)	OK	74108	R	7
North Little Rock	AR	72117	T	7
Kingston Springs	TN	37082	L	6
Bentleyville	PA	15314	Q	2
Braselton	GA	30517	M	5
Carney's Point	NJ	08069	S	2
Ontario	CA	91761	A	9

One truck stop (in Omaha, NE) refused to cooperate at the last minute, after the subcontracts had already been distributed to field agencies. To compensate, data collection was done in 2 days at the nearest truck stop in the sample (Council Bluffs, IA).

Sampling of Truck Drivers at the Truck Stops

The study aimed at balancing (approximately) the sample sizes of ELD-user and non-user drivers to maximize the power of the comparisons between the groups. Given the initial estimate of ELD prevalence (14 percent), the second stage sampling at the truck stop was designed to sample 100 percent of ELD users and a comparable number of non-users. Since the approximate interview length was 20 minutes, it was estimated that the field interviewing team could complete 17 interviews per day. A screener card was offered to truck drivers exiting the truck stop, asking whether they were required to report HOS and whether their truck was equipped certain electronic devices (including ELDs). One-hundred percent of ELD users and up to10 non-users per site per day were sampled. In this case-control sampling setting, the effective sampling rate of non-users varies by site, and is computed post-hoc based on the counts of ELD users and non-users.

Given a much higher incidence of ELD users than initially expected (the original estimate used for the sampling design was 14 percent, while the survey estimate based on final weights was 48.7 percent, with a standard error [SE] of 4.3 percent), the sampling rate for ELD users was adjusted for the last four truck stops to create a better balance of ELD users and non-users in the ultimate sample. Sampling rates for both groups were computed post-hoc for these sites.

Truck Stop and Truck Driver Weights

The final weights for the truck stops include the following components:

5. Unequal probability of selection from the 21 strata of the 2008 frame (sampling frame 1).
6. Unequal probability of selection from the 9 strata of the 2014 frame (sampling frame 2).
7. Frame integration by single frame method.
8. Adjustment for non-response at truck stop level.
9. Differential selection probabilities of ELD and non-ELD truck drivers.
10. Adjustments for non-response at the driver level.
11. Adjustments for different field duration at different sites.

The first two weighting components in this list are described in Table 60 and Table 62, above. The third weighting component (Step 3, shown below in Figure 2) integrates the weights according to the single frame method: [224]

$$w_i = \begin{cases} w_i^{2008}, & \text{the } i^{\text{th}} \text{ truck stop can only be found in 2008 frame} \\ w_i^{2014} & \text{the } i^{\text{th}} \text{ truck stop can only be found in 2014 frame} \\ \left(\frac{1}{w_i^{2008}} + \frac{1}{w_i^{2014}}\right)^{-1}, & \text{the } i^{\text{th}} \text{ truck stop can be found in both frames} \end{cases}$$

Figure 2. Formula. Single frame method, used to integrate truck stop weight components 1 and 2.

Of the 24 truck stops in the final sample, only truck stop (ID=106, “Pilot Travel Center #497”) was not found in the 2008 directory. All other stops were present in both frames. Since several sample replicates

taken from the 2008 frame with the corresponding stratification design were eventually used to find contactable truck stops, the weights for the 2008 frame were adjusted for multiplicity (i.e., the number of times a stop was sampled across the donor replicates).

For the fourth weighting component (Step 4), the non-response adjustment at truck stop level was a simple proportionality factor based on the number of responding and non-responding truck stops (see Table 64).

Table 64. Final counts for responding and non-responding truck stops.

Status	Count	Note
1.1 Complete	24	Field interviewing was conducted at the truck stop.
2.11 Refusal	3	The truck stop or chain manager refused to participate.
2.12 Break-off	16	Correspondence regarding survey participation was initiated, but no definitive answer was obtained from the truck stop or chain manager.
Total Eligible	43	N/A
4.1 Ineligible	14	Entry deemed unusable.
Total Truck Stops, Eligible or Ineligible	57	N/A

Thus the non-response adjustment ratio is 43/24=1.79.

The components of differential selection probabilities and non-response adjustments for the truck drivers (i.e., secondary sampling units [SSUs]) for Steps 5 and 6, respectively, are given in Table 65. This table also lists the duration of the field period at the sampled stops. While most of the stops had 9-hour field periods (e.g., from 8 a.m. to 6 p.m. with a 1-hour lunch break), at some stops it had to be reduced due to logistic or sub-contractual reasons. A simple proportionality adjustment at Step 7 increased the weights for the stops with shorter periods to match the effective length of 9 hours.

Table 65. Within-site weights of truck drivers weight components.

Truck Stop Market	Date	Field Duration (Hours)	Completes		Known Eligible		Truck Count	SSU Non-response Adjusted Weight	
			ELD	Non-ELD	ELD	Non-ELD		ELD	Non-ELD
Houston, TX	5-May	9	16	4	16	18	440	12.94	58.24
Houston, TX	6-May	9	15	10	17	15	438	15.51	20.53
Kingsland, GA	8-May	9	24	4	33	16	159	4.46	12.98
Kingsland, GA	9-May	8	22	3	34	8	104	3.83	6.60
Council Bluffs, IA	12-May	9	11	11	14	11	394	20.06	15.76
Council Bluffs, IA	13-May	9	13	9	16	16	383	14.73	21.28
East St. Louis, IL	15-May	8	24	0	29	2	432	18.00	14.90
Gary, IN	16-May	9	17	6	22	16	416	14.17	29.19
Marshall, MI	12-May	9	4	9	9	44	79	3.35	7.29
Marshall, MI	13-May	9	14	9	19	26	68	2.05	4.37
Lincoln, AL	15-May	9	17	13	43	29	389	13.67	12.05
Lincoln, AL	16-May	8.5	18	12	55	42	334	10.52	12.05
Anna, TX	5-May	9	11	5	12	5	312	20.02	18.35
Oklahoma City, OK	6-May	9	11	6	20	12	211	11.99	13.19
Tulsa (East), OK	7-May	7	9	4	9	4	305	23.46	23.46
North Little Rock, AR	9-May	8	11	6	16	11	350	18.86	23.77
Kingston Springs, TN	19-May	8.5	6	17	10	20	143	7.94	5.61
Geneva, OH	20-May	7	3	16	13	33	126	11.87	5.65
Bentleyville, PA	19-May	9	6	14	23	51	304	15.75	14.97
Braselton, GA	20-May	8	5	16	16	22	518	43.62	18.74
West Greenwich, RI	28-Apr	9	10	7	10	13	202	8.78	16.31
Carney’s Point, NJ	1-May	9	6	10	11	65	105	2.53	8.98
Carney’s Point, NJ	2-May	9	13	8	14	45	115	2.10	10.96
Wheat Ridge, CO	9-May	9	15	7	15	8	328	14.26	16.30
Sacramento, CA	12-May	9	18	9	18	9	481	17.81	17.81
Ontario, CA	14-May	8	7	11	7	73	849	10.61	70.43
Chandler, AZ	16-May	5.65	8	14	10	14	222	11.56	9.25
Baltimore, MD	20-May	7.5	4	4	4	8	383	31.92	63.83
Vero Beach, FL	19-May	9	9	14	9	18	529	19.59	25.19
Haw River, NC	20-May	8	5	18	28	18	490	59.65	10.65

Weight Diagnostics

A series of checks have been applied to the weights to gauge how well they represent the population and to determine how analysis should be conducted, taking the complex survey designs into account.

Sum of Weights

The sum of weights of the 628 completes is 778,865. This is the estimate of the population size (number of truck drivers) that the study covers. As this is a total for the unknown population size, a standard error is appropriate for it. Using the truck stop weights and treating the sample of truck stops as an unequal probability sample without replacement, the standard error accompanying this estimate is 112,269; the associated 95-percent confidence interval is 549,000–1,008,000 people.

This figure needs to be related to other existing estimates of the number of people employed in the trucking industry. Two estimates of the total number of individuals employed in the trucking industry are available from the Federal Statistical System. Both are based on North American Industry Classification System (NAICS) Code 484,[17] defined as follows:

> *Industries in the Truck Transportation subsector provide over-the-road transportation of cargo using motor vehicles, such as trucks and tractor trailers. The subsector is subdivided into general freight trucking and specialized freight trucking. This distinction reflects differences in equipment used, type of load carried, scheduling, terminal, and other networking services. General freight transportation establishments handle a wide variety of general commodities, generally palletized, and transported in a container or van trailer. Specialized freight transportation is the transportation of cargo that, because of size, weight, shape, or other inherent characteristics require specialized equipment for transportation.*

The employer-based data are available from Bureau of Labor Statistics (BLS).(225) As of June 2014, BLS reports the following figures, shown in Table 66:

Table 66. BLS-reported employer-based data on the number of truck drivers employed in the trucking industry.

Data Series	2013	Feb. 2014	Mar. 2014	Apr. 2014	May 2014
Employment, all employees (seasonally adjusted, in thousands)	1,379.45 (average across all months)	1,390.4	1,394.0	1,399.4 (preliminary)	1,400.9 (preliminary)
Employment, production, and nonsupervisory employees (in thousands)	1,218.4	1,193.4	1,205.2	1,221.3 (preliminary)	N/A
Truck drivers, heavy and tractor-trailer	804,680	N/A	N/A	N/A	N/A

Sources: **Employment, all employees** and **Employment, production, and non-supervisory employees**: Current Employment and Statistics Survey, BLS, June 2014. **Truck drivers, heavy and tractor-trailer**: Occupational Employment Statistics, BLS, June 2014.
Note: No standard errors are reported by the BLS.

An alternative microdata-based estimate can be made using the American Community Survey (ACS) data. The latest available dataset at the time this report was written was ACS 2012. The estimate for total employment for the NAICS Code 484 is 2,141,000 (SE 21,000). This is an overestimate of the number of truck drivers, as the full NAICS 484 figure includes other occupations such as management,

[17] This code does not capture drivers for private motor carriers who are classified under the primary business activity of the business.

maintenance and repairs, etc. The BLS figures (which only report employees, unlike ACS which includes owner-operators who may not consider themselves employees) suggest that truck drivers constitute 88.3 percent of total industry employment, translating the initial ACS estimate into 1.891 million (no standard error can be provided).

Comparing the estimate based on the current survey with these conflicting figures, we see that the estimated population size is in good agreement with the BLS population figure, and an underestimate of the ACS population figure. Underestimation can easily be understood from undercoverage of the sampling design, as well as natural difficulties in contacting the target population of truck drivers:

- Only truck stops near large MSAs were sampled.
- Only truck stops near major traffic arteries were sampled.
- The field period only covered a portion of the day.
- Truck drivers may be off work on a given day.

Unequal Weighting Design Effect

The overall design effect of the survey is primarily due to two sampling design features: unequal weights (stemming from unequal probabilities of selection of truck stops, unequal probabilities of selection of ELD users and non-users, and non-response adjustments) and cluster samples, with clusters being the 30 truck-stop-by-day periods.

Unequal weighting is known to negatively impact precision of the survey estimates:[(226)]

$$\text{UWE DEFF} = 1 + \text{CV}_\text{w}^2 = \frac{(\sum_i w_i)^2}{n \sum_i w_i^2}$$

Figure 3. Formula. Impact of unequal weighting on precision of survey estimates.

where CV_w is the coefficient of variation (CV) of weights (standard deviation divided by the mean). These statistics for the final weights are as follows:

- Mean = 1240.23
- Standard deviation = 893.25
- Unequal weighting design effect (UWE DEFF) = 1.519

Thus the standard errors are increased by about 23 percent, on average, compared to the simple random sample of the same size. The actual increase may be greater or smaller depending on whether the characteristic of interest is correlated with weights. The strongest correlation with weights is demonstrated by the ELD usage variable, and thus it would be reasonably expected to have high design effects. On the other hand, variables that are not strongly related to either ELD use or geography (which drives the selection probabilities of the truck stops) may have lower design effects.

Clustering Design Effect

Another important driver of the increase of the design effect, and corresponding decrease in the survey estimates precision, is effect of clustering. If units in the same primary sampling unit (PSU) are more similar to one another than to the rest of the population, then they provide relatively less information for sample estimates. The effect is captured mathematically by the clustering design effect,[227] as shown in Figure 4:

$$\text{Clustering DEFF} = 1 + \rho(\bar{m} - 1)$$

Figure 4. Formula. Clustering design effect.

where ρ is the intra-class correlation coefficient (ICC), or the portion of the total variance due to cluster membership, and $\bar{m}$ is the average number of interviews per cluster (which was 20.93 in the survey).

The ICCs were computed for several outcome variables using a weighted linear mixed (multilevel) model with effective sample size weight scaling [228] without any covariates. As shown in Figure 5, using such a mixed model, the ICC can be found as:

$$\rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2}$$

Figure 5. Formula. Weighted linear mixed model with effective sample size weight scaling.

where σ_u^2 is the variance of the random effects at the PSU level and σ_e^2 is the variance of the residuals. A summary of the findings is presented in Table 67. For variables with multiple categories, ICC was computed for each category using a 0/1 indicator of that category as the dependent variable in the mixed model regression. For these variables, a range of the category-specific ICCs and the coefficients of variation of the ICC (ratio of the standard error to the estimate) are given.

Table 67. ICC, CV of ICC, and clustering design effect for specific outcome variables.

Variable	ICC	CV of ICC	Clustering Design Effect (DEFF)
Q9_S (ELD used for HOS)	0.130	0.472	3.59
Q2 Job satisfaction	0.013–0.015	1.11–1.23	1.26–1.30
Q11 Satisfied with ELD	0–0.056	0.68–1.18	1–2.12
Q16 Harassment because of ELD	0.006–0.049	0.33–2.94	1.12–1.98
Any Q16	0.145	0.39	3.89
Q29 Opinions regarding ELD	0.007–0.064	0.45–4.51	1.14–2.28
Q30 ELD use for enforcement	0.203	1.93	5.05
Q32 Effective regulations against coercion	0.033–0.045	0.58–0.75	1.66–1.90
Q33 Ideas to prevent harassment	0–0.075	0.12–0.52	1–2.49
Q35 FMCSA definition of harassment	0.001–0.021	0.93–6.35	1.02–1.42
Q36 FMCSA definition of coercion	0.016–0.064	0.53–0.72	1.32–2.28

For most items, ICCs are in single digit percentage points. Since ELD usage is one of the design variables generating the differences in weights (see Table 65), it has a high ICC of 0.130 leading to design effect of clustering of 3.59. For some items related specifically to ELDs, their use, and awareness, there is a similarly high ICC of the use of ELDs by enforcement officers (Q30: Have you ever had a problem producing your electronic HOS records for a law enforcement officer? ICC = 0.203, DEFF = 5.05) and its potential for harassment (Q16: Which [of the above actions by management] do you see result from management's use of information about your HOS from EOBR/ELD? ICC=0.145, DEFF=3.89).

As is typical in cluster surveys, none of the ICCs is precisely estimated. The standard errors are often about as large as the ICC estimates themselves, as evidenced by the CVs (mean = 1.21, median = 0.84). This indicates that ICC per se is too unstable to be used to characterize design effects.

Total Design Effect

The concept of the design effect does not provide for a single number that is applicable to every variable and every analysis. Even different categories of a single variable may have different design effects. Thus it is prudent to analyze the design effects for some specific important variables, to gauge the extent to which precision of the estimates based on the survey is being affected. Statistical software packages that support complex survey estimation can produce design effect for most estimates associated with complex survey data tabulations.

Table 68. Design effects for specific variables.

Variable	Clustering DEFF	Unequal Weighting DEFF	Total Final DEFF
Q9_S (ELD used for HOS)	3.59	1.519	4.64
Q2 Job satisfaction	1.26–1.30	1.519	1.01–1.97
Q11 Satisfied with ELD	1–2.12	1.519	1.67–2.33
Q16 Harassment because of ELD	1.12–1.98	1.519	1.33–3.57
Any Q16	3.89	1.519	3.27
Q29 Opinions regarding ELD	1.14–2.28	1.519	0.81–3.22
Q30 ELD use for enforcement	5.05	1.519	2.63
Q32 Effective regulations against coercion	1.66–1.90	1.519	1.48–3.55
Q33 Ideas to prevent harassment	1–2.49	1.519	0.82–3.28
Q35 FMCSA definition of harassment	1.02–1.42	1.519	1.20–1.74
Q36 FMCSA definition of coercion	1.32–2.28	1.519	1.71–2.52

It could be reasonably expected that the clustering design effect and unequal weighting design effect might act multiplicatively. However, the final design effect is often smaller than the product of the design effects in the two specific columns, indicating a somewhat weaker dependence of the result on the design variables. Since ELD use is one of the main drivers of the design effect, this dampening of the total design effect can be considered indirect evidence that the outcome variables in this table are not very strongly associated with ELD use.

Analytical Guidelines

As shown above, estimates based on the survey demonstrate appreciable and widely varying design effects. Since the design of the survey includes both unequal weighting and clustering, these features need to be incorporated using the appropriate statistical packages. The following design variables need to be provided to the statistical software to compute appropriate point estimates and standard errors:

- Final weights: final_trucker_weight
- Primary sampling unit: psu

These design variables can be specified as follows:

- Stata: svyset psu [pweight= final_trucker_weight]
- SAS: PROC SURVEYFREQ ; CLUSTER psu; WEIGHT final_trucker_weight; TABLES … ;

SAMPLING DESIGN AND WEIGHTING—CARRIERS

Sampling Design

The sample of freight carriers for the survey was based on the census file in the MCMIS database. The MCMIS census file includes information such as fleet size, number of employed drivers, cargo carried, interstate, intrastate, and hazardous materials operations. The criteria for a company to be eligible for the study were as follows:

- Total number of vehicles: 50 or more.
- The main business address is in the United States (versus Mexico, Canada, or the U.S. territories, all of which are also present in MCMIS).
- Entity type is carrier (versus shippers, registrants, brokers, and intermodal equipment providers).
- Carrier operation is interstate or hazardous materials intrastate (thus excluding a portion of intrastate carriers that were not expected to utilize ELDs extensively).
- The company carries freight (versus passengers only)
- The company does not have flags indicating undeliverable mailing or physical addresses.

At the study design stage, it was expected that ELD usage was positively correlated with the company size, in the sense that larger companies were more likely to utilize ELDs. Hence the sampling design included only carriers with 50 or more vehicles. The relationship between fleet size and HOS logging methods is discussed in Section 3 of this report.

Carriers with 200 or more power units were sampled with 100 percent probability. Carriers with 50–199 power units were sampled at the rate of 50 percent, to ensure the total sample size of 4,200 carriers. Out of these, a subsample of 200 was used for the pilot portion of the survey. The pilot sample was selected as a systematic 1:21 subsample of the initial sample, with the full sample being ordered on the size

stratum (50–199 versus 200 or more), number of different types of cargo carried, geography (ZIP codes), total number of vehicles, and total number of drivers. The results of the pilot study were used to ensure that the expected 10 percent response rate was met; the pilot response rate surpassed the expectation, and mailings to the remaining 4,000 began.

The protocol for the full study was as follows:

- An initial letter, addressed to the "Manager of Trucking and Truck Drivers" at the firm, was sent to the selected truck stops. The letter was printed on FMCSA letterhead and was enclosed in a window envelope bearing the Abt SRBI logo and return address. The letter, which discussed the reason for the survey, provided a Web address for the Web survey and a personal identification number (PIN) for survey participants to enter in order to complete the survey.
- A reminder postcard was sent to all recipients 1 week later.
- Two weeks following the first letter, those who had yet to respond were sent a second letter, again printed on FMCSA letterhead and enclosed in a window envelope bearing the Abt SRBI logo and return address. This second letter reminded recipients of the first letter and the purpose of the survey, again providing the Web address for the survey and their PIN. In addition, it provided a Web address(229) (hosted on the FMCSA Web site) and contact information for the survey project manager at FMCSA, should they be interested in further information.

Carrier Weights

To compensate for carrier non-response, non-response adjusted weights were created in the following manner. First, inverse probability of selection (i.e., 1 for companies with more than 200 vehicles, and 1/0.396=2.53 for companies with 50–199 vehicles) was used as the base weight. Second, a response propensity model was used to calculate predicted response probabilities, and the non-response adjusted weights were calculated as the ratio of the base weights over the response propensities. Finally, the final carrier weights were post-stratified so that the total weights matched the number of companies in the three size groups of 50–199 vehicles, 200–999 vehicles, and more than 1000 vehicles. These final weights have the mean of 9.92, min of 3.01 and max of 20.65, with a modest apparent design effect ($DEFF = 1 + CV^2 = 1.17$). Distribution of the raked weights[18] is plotted in Figure 6, below. The two modes around 5 (approximately) and 12 (approximately) roughly correspond to larger and smaller companies, respectively, with the latter being undersampled. To analyze the data from the carrier portion of the study, analytical weights (carrier_nra_weight) need to be specified for all the analyses. Since non-response adjustments cut across strata, efficiency gains from stratification cannot be materialized, and sampling strata should not be specified for analysis.

[18] Raking is a weighting procedure conducted to ensure a sample's representativeness. For more information see Lavrakas, Paul, *Encyclopedia of Survey Research Methods* (Sage Publications, 2008).

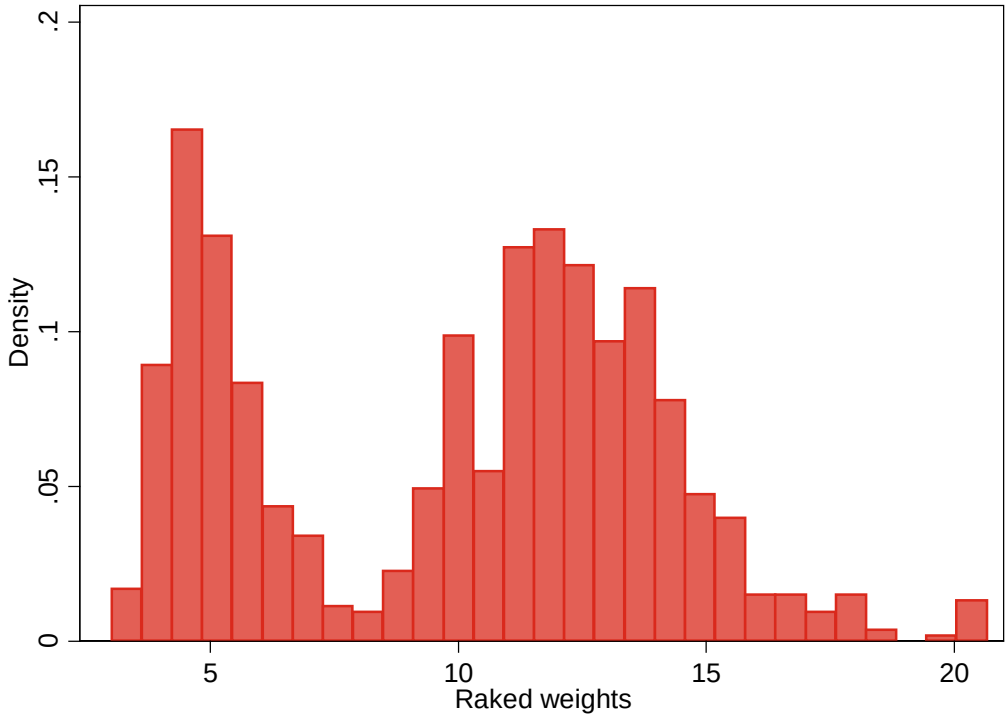

Figure 6. Distribution of the analysis weights.

APPENDIX E: RESPONSE RATES AND NON-RESPONSE FOLLOW-UP SURVEYS

DRIVERS

Drivers' Survey Response Rate Calculations

Response rate, or the proportion of eligible respondents who were eventually interviewed, is a commonly used, although imperfect, measure of the success of a survey. Calculation and reporting of response rates is guided by the Standard Definitions of the American Association for Public Opinion Research (AAPOR).[230] These standard definitions categorize the survey dispositions into four broad categories:

- Interviews.
- Eligible cases that are not interviewed (non-respondents).
- Cases of unknown eligibility.
- Cases that are not eligible.

However, these standard definitions do not provide guidelines for the intercept surveys that additionally require establishment of the sampled person's eligibility (done in the field with Question A [QA] in the main survey and Question 2 [NR2] in the non-response follow-up survey: "Are you required to keep a record of your hours to comply with the Federal hours of service regulations?"). For the purposes of this study, the categorization shown in Table 69 was adapted from the general AAPOR guidelines.

Table 69. Final disposition codes for the survey of truck drivers.

Disposition	AAPOR Code	Description
Interview	1.0	The driver agreed to participate in the survey, was screened as eligible on QA (is required to record HOS), and answered some or all of survey questions.
Complete	1.1	The driver agreed to participate in the survey, was screened as eligible on QA (is required to record HOS), and finished the survey.
Partial	1.2	The driver agreed to participate in the survey, was screened as eligible on QA (is required to record HOS), and did not finish the survey.
Eligible, non-interview	2.0	The driver agreed to participate in the main survey, was screened as eligible on QA (is required to record HOS), but did not complete enough questions to qualify as Complete (1.1) or Partial (1.2), OR The driver did not agree to participate in the main survey, but agreed to participate in the short NRFU version of the survey, and was screened as eligible on NR2 (is required to record HOS).
Refusal	2.1	The driver did not agree to participate in the main survey, but agreed to participate in the short NRFU version of the survey, and was screened as eligible on NR2 (is required to record HOS).
Unknown eligibility, non-interview	3.0	The field staff was unable to determine if the driver is eligible for the survey (is required to record HOS).
Unknown if eligible	3.1	The driver refused to respond to either the main survey or the NRFU. Since neither QA nor NR2 were asked, eligibility for the survey is unknown.
Not eligible	4.0	The driver was determined to be ineligible.
Out of sample	4.1	The driver agreed to participate in the main survey, but was screened as ineligible on QA (is not required to record HOS), OR The driver did not agree to participate in the main survey, agreed to participate in the short NRFU version of the survey, and was screened as ineligible on NR2 (is not required to record HOS).
Over quota	4.8	The drivers agreed to participate in the main survey, but the quota for the ELD/non-ELD (determined from Q1D) had been filled for the field period.

Field staff additionally counted the trucks at the beginning and the end of every field period (i.e., as they entered the truck stop in the morning; between the morning and mid-day field periods; between mid-day and evening field periods; and in the end of evening field period). No contact with drivers in these vehicles was attempted. These counts of trucks are not used in response rate calculations.

Table 70 reports the components of the response rate calculations, by truck stop. Proportion of eligible drivers was computed separately by site, as it was expected that eligibility may vary geographically. Based on these counts, the most commonly reported response rate (RR3) can be calculated as shown in Figure 7:

$$\mathrm{RR3} = \frac{\#\ \mathrm{Complete}\ (1.1)}{\#\ \mathrm{Interviews}\ (1.0) + \#\ \mathrm{Eligible\ non\text{-}interviews}\ (2.0) + \#\ \mathrm{Estimated\ eligible}} = 30.5\%$$

Figure 7. Formula. Response rate calculation, AAPOR response rate 3.

The total number of estimated eligible drivers was computed as follows. For each site, the total number of drivers known to be eligible was calculated as the sum of counts in codes (1.1), (1.2), (2.1) and (4.8). Likewise, the total number of drivers known to be ineligible was calculated as the total number in code (4.1), reported as two separate counts as they were coming either from the main survey (QA) or the NRFU survey (NR2). The percent of drivers eligible for each truck stop was then determined as the ratio of the known eligible to the total number of drivers with known eligibility status. The number estimated eligible in a given truck stop was calculated as the product of the computed percent eligible and the count of truck drivers with unknown eligibility (3.0) (i.e., refusals who did not participate in the NRFU survey).

Finally, the most commonly reported response rate (shown in Figure 7) was calculated from the totals shown in the bottom row of Table 70.

Table 70. Truck stop counts in AAPOR dispositions.

Truck Stop Market	Date	AAPOR Detailed Categories (see Table 53)							Percent Eligible	AAPOR Broad Categories				Estimated Eligible	Response Rate 3 (%)
		1.1	1.2	2.1	3.1	4.8	4.1 (QA)	4.1 (NR2)		1.0	2.0	3.0	4.0		
Houston, TX	May 5	20	0	10	198	4	25	2	55.7%	20	10	198	31	110	14.3
Houston, TX	May 6	25	0	6	71	1	0	3	91.4%	25	6	71	4	65	26.1
Kingsland, GA	May 8	24	0	22	38	0	0	1	97.9%	24	22	38	1	37	32.1
Kingsland, GA	May 9	29	0	17	6	0	0	0	100.0%	29	17	6	0	6	52.1
Council Bluffs, IA	May 12	22	0	3	34	0	1	0	96.2%	22	3	34	1	33	38.1
Council Bluffs, IA	May 13	22	0	6	48	4	3	0	91.4%	22	6	48	7	44	30.6
East St. Louis, IL	May 15	24	0	7	55	0	0	0	100.0%	24	7	55	0	55	27.9
Gary, IN	May 16	23	0	15	50	0	0	1	97.4%	23	15	50	1	49	26.5
Marshall, MI	May 12	13	0	20	5	21	10	3	80.6%	13	20	5	34	4	35.1
Marshall, MI	May 13	23	0	16	9	6	4	0	91.8%	23	16	9	10	8	48.7
Lincoln, AL	May 15	30	0	42	47	0	0	3	96.0%	30	42	47	3	45	25.6
Lincoln, AL	May 16	29	0	68	50	0	0	4	96.0%	29	68	50	4	48	20.5
Anna, TX	May 5	16	1	0	88	0	0	0	100.0%	17	0	88	0	88	15.2
Oklahoma City, OK	May 6	16	1	15	7	0	0	5	86.5%	17	15	7	5	6	43.5
Tulsa, OK	May 7	13	0	0	36	0	0	0	100.0%	13	0	36	0	36	26.5
North Little Rock, AR	May 9	17	0	10	21	0	0	1	96.4%	17	10	21	1	20	36.0
Kingston Springs, TN	May 19	23	0	4	47	3	0	1	96.8%	23	4	47	4	45	31.7
Geneva, OH	May 20	20	0	9	32	18	0	1	97.9%	20	9	32	19	31	32.0
Bentleyville, PA	May 19	20	1	41	55	12	28	3	70.5%	21	41	55	43	39	19.9
Braselton, GA	May 20	21	0	2	14	15	1	0	97.4%	21	2	14	16	14	57.3
West Greenwich, RI	April 28	17	0	0	12	6	0	0	100.0%	17	0	12	6	12	58.6
Carney's Point, NJ	May 1	16	1	6	3	53	5	0	93.8%	17	6	3	58	3	62.0
Carney's Point, NJ	May 2	20	1	4	10	33	3	0	95.1%	21	4	10	36	10	59.1
Wheat Ridge, CO	May 9	22	1	0	40	0	0	0	100.0%	23	0	40	0	40	34.9
Sacramento, CA	May 12	27	0	0	14	0	0	0	100.0%	27	0	14	0	14	65.9
Ontario, CA	May 14	18	1	1	109	60	0	0	100.0%	19	1	109	60	109	14.0
Chandler, AZ	May 16	17	2	0	5	0	0	0	100.0%	19	0	5	0	5	75.9

Baltimore, MD	May 20	16	0	5	45	0	0	0	100.0%	16	5	45	0	45	13.8
Vero Beach, FL	May 19	23	0	4	28	2	0	0	100.0%	23	4	28	2	28	41.8
Haw River, NC	May 20	23	0	0	49	23	6	0	88.5%	23	0	49	29	43	34.7
Total		629								638	333	1226	375	1092	30.5

Drivers' Non-Response Analysis

Along with 628 main survey respondents, the field interviewing crews also collected 363 shortened NRFU interviews. While the number of the main completes varied from 13–30 between sites, the number of NRFU interviews varied from 0–72. Since non-respondents were sampled regardless of their ELD status, the subsequent analysis assumes a simple random sample of non-respondents and uses the base truck stop weights as well as truck-stop-by-day interaction as the PSU.

The shortened instrument had only seven questions. The first question asked for the reasons the drivers declined to participate in the full survey. Of the drivers who responded, 82.8 percent said that they did not have the time to do so; 3.2 percent did not believe the survey was confidential enough; 3.1 percent did not give a specific reason (i.e., said, "Don't know"); 2.4 percent gave other reasons; and 1.7 percent found the incentive to be insufficient.

Analysis of the remaining variables that were defined in the same way in the main survey and in the NRFU survey is provided in the Table 71. The "Don't know" and "Refused" categories were removed to make comparisons cleaner. The only statistically significant difference is on the unionization variable where the non-respondents were found to be more than twice as likely to be unionized. The method of keeping the HOS records is marginally significant at p=0.084, with non-respondents were somewhat more likely to keep records on paper, and somewhat less likely to have electronic devices.

Table 71. Non-response analysis for drivers.

Variable	Main Survey	NRFU Survey	Test for Independence
How do you keep HOS records?			F(2.08,60.28)=2.55 P = 0.0841
• Paper	• 43.6% (3.7%)	• 51.1% (4.8%)	
• Tachograph	• 0.7% (0.5%)	• 1.1% (0.7%)	
• Stand-alone EOBR/ELD	• 18.1% (1.1%)	• 10.9% (1.5%)	
• Part of a multifunction system	• 37.6% (3.5%)	• 36.9% (4.9%)	
Member of a union/covered by a collective bargaining contract?	4.3% (1.6%)	10.7% (3.4%)	F(1,29) = 5.57; P=0.0252
How many years have you had a commercial driver license?			F(2.44,70.67)=1.57 P=0.2113
• < 1 year	• 4.0% (1.0%)	• 3.0% (0.7%)	
• 1–2 years	• 6.5% (0.9%)	• 8.0% (1.7%)	
• 3–5 years	• 12.2% (1.8%)	• 13.7% (1.7%)	
• 6–10 years	• 17.9% (1.6%)	• 20.6% (2.8%)	
• 11–15 years	• 12.1% (1.9%)	• 14.9% (1.5%)	
• 15+ years	• 47.3% (3.3%)	• 39.7% (1.8%)	
How old are you?			F92.92, 84.61)=0.50 P=0.681
• 18–24	• 2.8% (0.7%)	• 1.6% (0.8%)	
• 25–34	• 13.9% (1.7%)	• 13.2% (1.5%)	
• 35–44	• 24.9% (2.4%)	• 25.4% (1.7%)	
• 45–54	• 31.1% (1.3%)	• 33.3% (2.7%)	
• 55+	• 27.5% (2.3%)	• 26.5% (2.2%)	

Note: Standard errors are in parentheses.

CARRIERS

Carriers' Survey Response Rate Calculations

Non-response in a sample survey is one of the major threats to the survey's validity and accuracy. High non-response rates create the potential for non-response bias if responding units are different from non-responding units, although it has been recognized that low response rates do not necessarily imply large non-response biases.(231)

Causes and channels of non-response in the survey study can be described as follows:

- Initial mail non-contact: the sampled establishment did not receive the initial packet, or did not open it.
- Refusal: the envelope was opened by a representative of the sampled establishment, but no further action was taken; or an informed respondent to whom the initial contact forwarded the mail failed to take further action.
- Qualified callback: an informed respondent within the sampled establishment was intending to complete the survey, but did not do it.
- Web break-off: a representative of the sampled establishment started the survey on the Web, but did not complete it because of the technical reasons, or because they did not have enough time in their daily tasks.
- Failed hand-offs: a representative of the sampled establishment who opened the mail was not informed about interactions with drivers, and failed to find an informed respondent within the sampled establishment, or failed to pass on the responsibility in completing the survey.

The non-response follow-up study shed some light on these reasons. Before describing the results of a non-response follow-up study in detail, the author provides the big picture of non-response and its correlates.

Logistic regression of the 0/1 response indicator was fit with the following explanatory variables:

- Inverse square root of fleet size (chosen as the optimal Box-Cox transformation towards normality[232]) and its square.
- Log of the number of the types of cargo carried (the raw number of cargo types is heavily skewed, range from 1–28; 1,631 missing values of the number of types of cargo had a separate indicator of the missing value).
- Carrier operation (interstate versus hazardous materials intrastate).
- U.S. Census division.

All of these variables were found to be statistically significant in the model, which means that non-response varied between companies that have differences in these characteristics. Predicted response probabilities were computed for the carriers in the original sample, and the summary of these predicted response probabilities are indicative of the following effects on the response rate:

- Fleet size: from 23.2 percent at 150 total vehicles to 0.8 percent at the sample maximum of 98,365 (the largest responding carrier had 11,899 total vehicles reported on the frame, and the predicted response probability of 5.6 percent).
- Log of the number of the types of cargo carried: 16.2 percent missing to 22.4 percent with a single reported cargo type to 49.2 percent at sample maximum of all 28 types being reported.
- Carrier operation: 22.5 percent for interstate versus 8.2 percent for hazardous materials intrastate.
- U.S. Census division: low of 12.6 percent in New England versus high of 29.4 percent in West North Central.

While it is difficult to conceptualize the differences due to other variables, the effect of the size of the carrier can be explained by failure to hand off the phone from the initial contact to the knowledgeable truck driver managers. Such hand-off is expected to happen in large companies, while smaller companies might have a single person that is in charge of the whole operation. Also, the fleet size is one of the few variables that have been collected in both the carrier and the driver samples, so studying its effects on survey outcomes is important. The response propensity with respect to this variable is visualized in Figure 8, below.

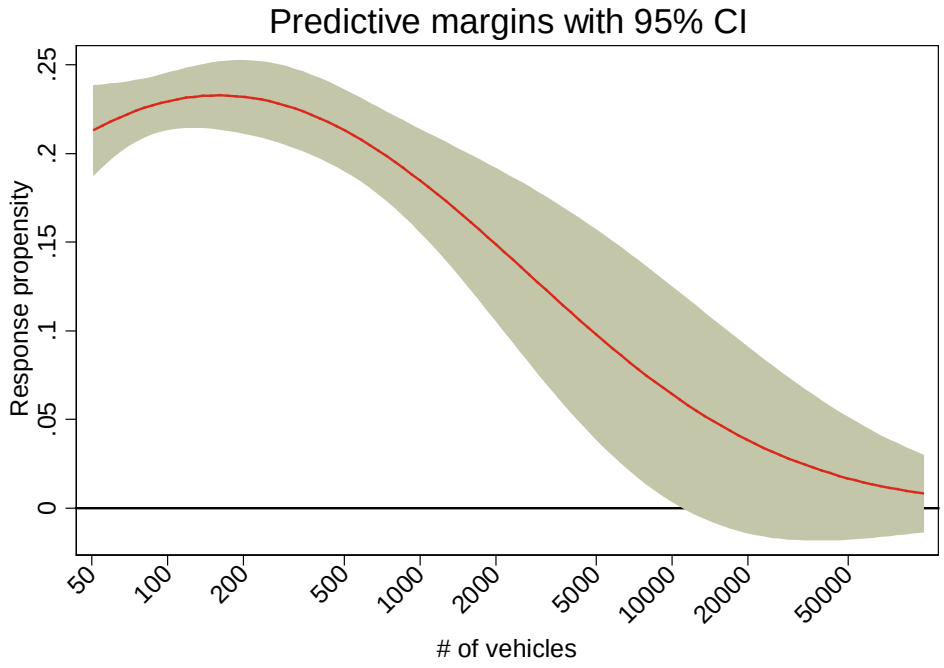

Figure 8. Carrier unit response propensity as a function of the fleet size.

Carriers' Non-response Analysis

Data collection for the full survey began on the date that the first letter was mailed (May 20, 2014); the survey was closed on June 16, 2014. By the time it was closed, 1,130 individuals had responded (resulting in a 28 percent response rate), with 865 completing the survey. Of the remainder, 76 were

screened out for one of two reasons: either their drivers were ineligible (because they were not subject to HOS reporting requirements), or the survey respondent did not manage the drivers. A total of 189 individuals began the survey but were not screened out and did not finish it.

Carriers who began the interview and did not finish it left at the following survey points:

- C-Q1, immediately after entering the PIN (without answering C-Q1, which asked if they were responsible for managing truck drivers): 23 percent.
- After answering the main basis of drivers' payment (C-Q6): 9 percent.
- After rating their satisfaction with the ELDs their company uses (C-Q13), as they saw the list of interactions to rate for frequency: 9 percent.
- When rating the frequency of the interactions the "average" driver might experience (C-Q14): 8 percent.
- After answering what percentage of the trucks in their fleet have ELDs (C-Q19b), and when asked costs of the units (C-Q19c): 6 percent.
- When identifying the transactions which drivers might consider harassment (C-Q15): 4 percent.
- After answering that their company's truck drivers are required to log HOS (C-Q2) and asked to rate their satisfaction with their job (C-Q3): 3 percent.
- No other point in the survey accounted for more than 2 percent of these respondents' abandonment.

To better understand the causes of non-response, a separate non-response follow-up study was done on carriers who either had not responded to the survey at all or began it and did not complete it. The study consisted of a brief, 4-minute interview (on average) which focused on determining why the survey was not completed and whether the carrier company used ELDs to log HOS. The goal was to reach 100 of these carriers; in that effort, calls were made to 366 before the quota was completed, with carriers randomly selected from the eligible pool. Callback appointments were scheduled when the appropriate manager was unavailable. Below are results from these interviews:

- Twenty-eight carriers remembered getting the letter, while 72 did not.
  - Of the 28 who remembered the letter, 27 of them said they had not forwarded it on to someone else.
  - Of those 28, the most common reason for not completing the survey was that they did not have the time (said by 16). Five said they tried to complete the survey, but that it had been closed.
  - No other single reason was given by more than 1 or 2 respondents.
- Of the 72 who did not remember the letter, 22 did not think it would have gone to anyone else. The remaining 50 did not know what might have happened to it.

- With respect to how these carriers' drivers record their HOS, 78 percent of the carriers use paper logs, and 28 percent use ELDs; 17 percent use ELDs as part of a fleet management system, and 12 percent use standalone ELDs.

APPENDIX F: DRIVERS' SURVEYS

DRIVERS: QUALITATIVE RECRUITMENT SURVEY

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

FMCSA-

A federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a current valid OMB Control Number. The OMB Control Number for this information collection is 2126-XXXX. Public reporting for this collection of information is estimated to be approximately 30 minutes per response, including the time for reviewing instructions, gathering the data needed, and completing and reviewing the collection of information. All responses to this collection of information are voluntary and confidentiality will be provided to the extent allowed by law. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to: Information Collection Clearance Officer, Federal Motor Carrier Safety Administration, MC-RRA, 1200 New Jersey Avenue, SE, Washington, D.C. 20590-0001.

Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Qualitative Discussion Guide
One-on-one In Depth Interview with Drivers

Recruitment Questionnaire

Introduction:

R1. Hello, my name is (**INTERVIEWER NAME**) and I'm calling from Abt SRBI, a national polling and survey company. We're conducting a very important research project about truck driving for the Federal Motor Carrier Safety Administration, and (**NAME ON SAMPLE**) was scientifically selected as one of the people we should include in the research project. May I please speak to (**NAME ON SAMPLE**)?

1	Speaking to person on list	**Skip to R4**
2	Person on phone asks what this is about	**Continue with R2**
3	Person on sample is coming to the phone	**Skip to R3**
4	Person on sample is unavailable	**Set up callback appointment**
5	No such person/refused	**Thank and terminate**

R2. The Federal Motor Carrier Safety Administration wants to include the opinions of people like (**NAME ON SAMPLE**) as part of its decisions about truck driving. This is only a research project. May I please speak to (**NAME ON SAMPLE**)?

1	Person on sample is coming to the phone	**Continue with R3**
2	Person on sample is unavailable	**Set up callback appointment**
3	No such person/refused	**Thank and terminate**

R3. Hello, my name is (**INTERVIEWER NAME**) and I'm calling on behalf of the Federal Motor Carrier Safety Administration. We're conducting a very important research project on truck driving, and your name was scientifically selected as one of the people we should include in the research project.

1	Continue	
2	Not a good time	**Set up callback appointment**
3	Refused	**Thank and terminate**

R4. The purpose of this discussion is to understand more about truck drivers and how they feel about their jobs. Before we proceed, this research project involves discussions of regulations and compliance, and management practices. But everything you say will be kept confidential, and what you say will never be connected to you or the company you work for. Your participation is voluntary; it is not mandatory. Do you understand and are you willing to continue?

1 Continue
2 Refused **Thank and terminate.**

R5. I have a few preliminary questions. Have you held a commercial drivers license at some point in the past 12 months? **(If so, continue. Otherwise terminate.)**

R6. And in the past 12 months did you drive a truck to transport freight? **(If so, continue. Otherwise terminate.)**

R7. During that time were you required to keep a record of your hours? **(If so, continue. Otherwise terminate.)**

R8. Hours records can be kept a variety of ways. Sometimes they are kept on paper logs. Sometimes they are automatically recorded when the truck starts or stops, or when the driver manually starts it logging. How were your hours logged?

1 On paper
2 Electronically
3 Both (company changes systems)
4 Both (driver worked for different companies)
5 Other (SPECIFY _____)

IF ELECTRONICALLY, ASK:

R9. Was it done with a stand-alone logging device that did nothing else, or was it part of a system which had other capabilities as well?

1 Stand-alone device
2 Part of a system with other capabilities
3 Both (at one job or at different companies)

REFER TO ANSWERS TO R8. IF 1, "ON PAPER," DRIVER QUALIFIES FOR NON-USER QUOTA. IF ANSWERS 2-4, DRIVER QUALIFIES FOR USER QUOTA.

CHECK QUOTAS TO SEE IF DRIVER'S QUOTA GROUP IS STILL OPEN. IF NOT OPEN, THANK AND TERMINATE. IF OPEN, CONTINUE WITH Q6.

6. I'd like to set up an appointment for someone to talk to you in greater depth about your job. The discussion will last about a half hour, but because your time is valuable we will send you a check for $25 to compensate you for your giving us your time.

SET UP APPOINTMENT FOR INTERVIEW.

DRIVERS: QUALITATIVE MAIN SURVEY

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

FMCSA-

Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Qualitative Discussion Guide
One-on-one In Depth Interview with Drivers

Main Questionnaire

I want to thank you again for your time, and remind you that this discussion is for research purposes only. And that as compensation for your time, we will send you a check for $25.

Before we begin, can you give me some background information about your job? **(Do not ask about how hours are recorded, that was obtained in the recruitment. Probe for information such as whether employed by carrier/independent owner operator/lease truck, paid by hour or by mileage, typical route [distance, other states, etc.], type of freight, size of truck], how many trucks in company fleet.)**

1. What, if anything, do you **like** about your job? **(Probe for additional aspects and specifics.)**

2. And what, if anything, do you **dislike** about your job? **(Probe for additional aspects and specifics.)**

3. How would you describe your relationship with management? **(Probe for additional aspects and specifics.)**

4. 4. Has management ever asked you to do anything which put your health or well-being at risk? **(Probe for additional aspects and specifics.)**

5. Has management ever asked you to do anything which could have led to you working more hours than the law allows? **(Probe for specifics.)**

6. Have you ever chosen, on your own, to work more hours than the law allows? **(Probe for specifics.)**

7. **If have worked more hours than allowed by law:** When you've been on duty for more hours than the law allowed, how was that handled with the record keeping? **(Probe for specifics.)**

8. Looking back at your dealings with management, have there been any occasions when you think they might have harassed you over your work? **(If respondent asks what meant by harassment, tell him it is as he interprets it.) (Probe for specifics.)** What did they say? What did they want you to do? How often does that occur?

9. **If experienced something they consider harassment:** In your view what about it constituted harassment? **(Probe:** Was it what they were asking? The frequency? Tone? Potential consequences?**)**

10. We're speaking to a number of drivers, and have heard a variety of opinions. I'm going to read you a list of driver experiences, and I'd like you to tell me which of them, if any, you would consider harassment if management asked them of you. Management…

Schedules:	
Ask you to meet a customer load schedule you viewed as unrealistic	1
Ask a customer to adjust a load schedule so it was realistic for you	2
Fatigue:	
Ask you to operate when you judged you were fatigued	3
Ask that you shut down if you felt fatigued	4
Logging and breaks:	
Ask you to log inaccurately to get more work time or delay a break	5
Ask you to log accurately when you could have had more work time or delayed a break by being inaccurate	6
Change your log record after it was made to give you more work time or delay a break	7
Ask you to take sufficient time off duty to recover from fatigue	8
Communications:	
Interrupt your off-duty time with a message that woke you up	9
Contact you promptly about a new job task so you didn't have to wait without pay	10
Paid and Unpaid Time:	
Pay you for customer delays in picking up or delivering freight	11
Require you to wait for customer delays for more than two hours without pay	12
Arrange your loads so you had little delay time between loads	13
Require you to wait between loads for more than two hours without pay.	14

11. In a typical month, do you, yourself, experience each of these? Management…

Schedules:	
Asks you to meet a customer load schedule you viewed as unrealistic	1
Asks a customer to adjust a load schedule so it was realistic for you	2
Fatigue:	
Asks you to operate when you judged you were fatigued	3
Asks that you shut down if you felt fatigued	4
Logging and breaks:	
Asks you to log inaccurately to get more work time or delay a break	5
Asks you to log accurately when you could have had more work time or delayed a break by being inaccurate	6
Changes your log record after it was made to give you more work time or delay a break	7
Asks you to take sufficient time off duty to recover from fatigue	8
Communications:	
Interrupts your off-duty time with a message that woke you up	9
Contacts you promptly about a new job task so you didn't have to wait without pay	10
Paid and Unpaid Time:	
Pays you for customer delays in picking up or delivering freight	11
Requires you to wait for customer delays for more than two hours without pay	12
Arranges your loads so you had little delay time between loads	13

Requires you to wait between loads for more than two hours without pay. 14

12. Are there other things they do to you which you consider harassment? (**Probe for specifics.**) Do they happen in a typical month?

13. If you haven't complied with management's requests or if you've pushed back, have there been any consequences? **(Probe for specific: make sure you get the request that was made, connected to the consequence.)**

14. Has management ever used your service logs or records to argue for you working longer hours or taking on additional work? **(Probe for specifics.)**

IF USER AND R9="PART OF A SYSTEM WITH OTHER CAPABILITIES," ASK Q15.

15. Did your company need to use anything in addition to just the logs in order to make that happen? **(Probe if doesn't come up:)** Did they need real time communications, or GPS, something of that nature? (What?)

16. Have their requests or consequences had any impact on other aspects of your life outside of your job? **(Probe for specifics.)**

17. Do you think that would be different if your hours of service were being recorded using some other method? (What kind of method? How would it be different?)

18. Some truck drivers are concerned that devices which automatically log their service hours electronically will allow management to harass its drivers. Can you think of anything which could be done to prevent that, either in the technology or the processes? **(Probe for specific harassing behavior and remedies.)**

If "USER", ASK 19.

19. Have you ever had any problem producing your electronic logs of your hours for a law enforcement agent or officer?

ASK ALL 20.

20. One of the objectives of our discussion is to understand the language and words that drivers like you use to refer to various systems used to track drivers' hours. When you think about the systems that automatically log hours when the truck starts or stops or when a driver forces it on manually, what do you call them?

IF THE RESPONDENT HAS NOT MENTIONED THE TERM "EOBR," ASK ABOUT FAMILIARITY WITH THE TERM AND USE. HAS (S)HE EVER HEARD THE TERM? KNOW WHAT IT IS? USE THE TERM?

Obtain information on who to make the check out to and where to send it. Thank and end interview.

DRIVERS: QUANTITATIVE SURVEY

The version of the survey which appears on the following pages is the Microsoft Word version, prior to its conversion to PDF for scanning.

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

MCSA-

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Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Intercept Survey with Drivers

APPROACH DRIVERS AS THEY LEAVE THE TRUCK STOP BUILDING.
Hi, my name is (NAME) and I'm conducting a research survey for the Federal Motor Carrier Safety Administration. We're very interested in talking to drivers at this stop and get information which will give the FMCSA information for policy decisions.

We know your time is limited, so we'll compensate you for your time with $10 if you qualify for the survey and answer the full survey. The whole survey takes about 15 minutes.

IF WILLING, HAND THE DRIVER THE PERMISSION CARD TO SIGN.

IF DRIVER IS WILLING TO PARTICIPATE SKIP TO "A". IF DRIVER IS NOT WILLING TO PARTICIPATE, SAY: Can I ask you just a few quick questions to help us better understand the answers that we do get? Of course, I can't give you the $10 since it's not the actual survey, but it will be very helpful. **IF DRIVER ACCEPTS, SWITCH TO NON-RESPONSE SURVEY AND SPEAK QUICKLY. IF DRIVER DOES NOT ACCEPT, HAND DRIVER THE POSTCARD SURVEY AND ASK HIM/HER TO FILL IT OUT ON OWN AND MAIL BACK.**

QUESTIONNAIRE FOR THOSE AGREEING TO PARTICIPATE BEGINS HERE.

A. We first have a few questions to see if you qualify to fill out the survey. Are you required to keep a record of your hours to comply with the Federal hours of service regulations?

Yes
No **Terminate**

HAND CARD 1.

1. Which of the items on this sheet are in your truck? Just read me the letters.

   A. Driver alertness monitoring system
   B. Forward collision warning systems
   C. Lane departure warning system
   D. An EOBR or ELD, a device which allows you to electronically log your duty status
   E. None of these

IF NOT "D. EOBR," CHECK QUOTAS. IF QUOTA FOR NON-EOBR HAS BEEN REACHED, TERMINATE. SAY: I'm sorry, but we've reached our quotas for trucks with the type of equipment you have.

2. Throughout this survey, we'll be talking about your job as a truck driver. Our first set of questions is about your satisfaction with your job and how you are paid. Overall, how satisfied are you with your job? **Read list, accept only one answer.**

   1 Very satisfied
   2 Somewhat satisfied
   3 Somewhat dissatisfied
   4 Very dissatisfied
   Do not read:
   5 Don't know/not sure
   6 Refused

3. How satisfied are you with your relationship with the people who manage you and your trips? **Read list. Accept only one answer**.

   1 Very satisfied
   2 Somewhat satisfied
   3 Somewhat dissatisfied
   4 Very dissatisfied
   Do not read:
   5 Don't know/not sure
   6 Refused

4. What is the **main** way you are paid? **Read list. Accept only one answer.**

   1 Miles
   2 Hourly
   3 Salary
   4 Percentage of revenue
   5 Fixed fees (e.g., flat payment per load/shipment)
   6 Some other way (**Specify:**_____)
   Do not read:
   7 Don't know/not sure
   8 Refused

5. Do you also get paid on some other basis at least some of the time? Do you also get paid for… **Read list. Accept all that apply.**

   Miles
   Hourly
   Salary
   Percentage of revenue
   Fixed fees (e.g., flat payment per load/shipment)
   Some other way (**Specify:**_____)
   Do not read:
   Don't know/not sure
   Refused

Hand Card 6/7

6. Please look at this sheet. What is the **main** way in which your supervisor evaluates your work? **Accept only one answer***.*

   Miles per week
   Loads per week
   Shipments per week
   Stop count (pickups and/or deliveries per week)
   Meeting customer service schedules
   Avoiding chargeable accidents
   Fuel mileage
   Avoiding freight damage claims
   Avoiding workers compensation claims
   Avoiding out-of-route miles
   Avoiding hard braking events
   Avoiding recorded hours of service violations
   Some other way (**Specify:**_____)
   Not on card:
   Not applicable
   Don't know/not sure
   Refused **Skip to Q9**

7. In what **other** ways (if any) does your supervisor evaluate your work? **Accept all that apply***.*

   Miles per week
   Loads per week
   Shipments per week
   Stop count (pickups and/or deliveries per week)
   Meeting customer service schedules
   Avoiding chargeable accidents
   Fuel mileage
   Avoiding freight damage claims
   Avoiding workers compensation claims
   Avoiding out-of-route miles
   Avoiding hard braking events

Avoiding recorded hours of service violations
Some other way (**Specify:**_____)
Not on card:
Not applicable
Don't know/not sure
Refused

8. How satisfied are you with having your performance measured in that way? **Read list. Accept only one answer.**

   Very satisfied
   Somewhat satisfied
   Somewhat dissatisfied
   Very dissatisfied
   Do not read:
   Don't know/not sure
   Refused

9. **Hand Card 9.** Let's talk now about the various ways which hours of service records are kept. There are paper logs which you fill out yourself. And there are tachographs, and more recently there have been loggers called EOBRs, which stands for Electronic On Board Recorders. You might have also heard them referred to as "ELDs", which stands for Electronic Logging Devices. EOBRs and ELDs automatically log hours when the truck starts or stops, as well as when you manually start it logging. Sometimes they are a stand-alone unit; sometimes they are integrated into a system with a variety of functionalities.

   We addressed part of this in an earlier question, but now we need more detail. How does your company track your "duty status" for compliance with the Federal hours of service regulations?

   Paper
   Tachographs
   Stand-alone EOBR/ELD
   EOBR/ELD in a system with other functionality
   Not on Card:
   Don't know/not sure
   Refused
   If Don't Know/Not Sure/Refused, explain: We can't continue the survey without this. **Terminate.**

If either of the "EOBR/ELD" answers in 9, ask 10. Otherwise skip to 14.

10. **Hand Card 10.** Which types of equipment on that list does your company have in the truck you usually drive? **Accept Only One Answer.**

    A smartphone synched to the engine, and logging the hours
    A laptop synched to the engine, and logging the hours
    A console/display that is not a smartphone or computer, branded with a manufacturer's name
    Another device (**Specify**_____)

Not on Card 10:
Don't know/not sure
Refused

11. How satisfied are you with having a device in your truck which automatically logs your duty status? **Read list. Accept only one answer**

    Very satisfied
    Somewhat satisfied
    Somewhat dissatisfied
    Very dissatisfied
    Do not read:
    Don't know/not sure
    Refused

If answer to 9= ("EOBR/ELD in a system with other functionality"), ask 12. Otherwise skip to 14.

12. Thinking about the EOBR/ELD in your truck which automatically logs your service status and has other functionality… Thinking only of its **service status logging functionality**, how satisfied are you with having a device in your truck which does that?

    Very satisfied
    Somewhat satisfied
    Somewhat dissatisfied
    Very dissatisfied
    Do not read:
    Don't know/not sure
    Refused

13. And, thinking about the system with its **other** functions, how satisfied are you with having a device in your truck that has those other functions?

    Very satisfied
    Somewhat satisfied
    Somewhat dissatisfied
    Very dissatisfied
    Do not read:
    Don't know/not sure
    Refused

ASK ALL.

14. **Hand Card 14/15/16/17.** The next questions are about your interactions with management. Please look at the sheet in front of you for this series.

In a typical month, how often does management do each of these to you, yourself? Read me the letter of the item and then tell me if the answer is Never, Once a month, or at least twice a month. **Circle the appropriate number in the grid. Ask each.**

	Never	Once a Month	2+/ Month	Don't know/ Ref.
Schedules:				
A. Ask you to meet a customer load schedule you viewed as unrealistic	1	2	3	4
B. Ask a customer to adjust a load schedule so it was realistic for you	1	2	3	4
Fatigue:				
C. Ask you to operate when you judged you were fatigued	1	2	3	4
D. Ask that you shut down if you felt fatigued	1	2	3	4
Logging and breaks:				
E. Ask you to log your hours inaccurately to get more work time or delay a break	1	2	3	4
F. Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate	1	2	3	4
G. Change your log record after it was made to give you more work time or delay a break	1	2	3	4
H. Ask you to take sufficient time off duty to recover from fatigue	1	2	3	4
Communications:				
I. Interrupt your off-duty time with a message at an inappropriate time	1	2	3	4
J. Contact you promptly about a new job task so you didn't have to wait without pay	1	2	3	4
Paid and Unpaid Time:				
K. Pay you for customer delays in picking up or delivering freight	1	2	3	4
L. Require you to wait for customer delays for more than two hours without pay	1	2	3	4
M. Arrange your loads so you had little delay time between loads	1	2	3	4
N. Require you to wait between loads for more than two hours without pay	1	2	3	4

15. Which of the items in that list, if any, do you consider harassment? Just read me the letter of the item. **(RECORD ALL THAT APPLY IN GRID BELOW UNDER Q.15, CHECKING THE BOXES THAT APPLY.)**

If EOBR in Q9 (Answer 3 or 4) Ask 16. Otherwise Skip to Q18a.

16. Which of these, if any, do you see result from management's use of information about your hours of service from your EOBR/ELD? **(RECORD ALL THAT APPLY IN GRID BELOW UNDER Q.16.)**

If EOBR with other functionality in Q9 (Answer 4) ask Q17. Otherwise skip to Q18a.

17. Which of these, if any, do you see resulting from management's use of other information from the device in your truck? **(RECORD ALL THAT APPLY IN GRID BELOW UNDER Q.17.)**

	Q15	Q16	Q17
Schedules:			
A. Ask you to meet a customer load schedule you viewed as unrealistic			
B. Ask a customer to adjust a load schedule so it was realistic for you			
Fatigue:			
C. Ask you to operate when you judged you were fatigued			
D. Ask that you shut down if you felt fatigued			
Logging and breaks:			
E. Ask you to log your hours inaccurately to get more work time or delay a break			
F. Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate			
G. Change your log record after it was made to give you more work time or delay a break			
H. Ask you to take sufficient time off duty to recover from fatigue			
Communications:			
I. Interrupt your off-duty time with a message at an inappropriate time			
J. Contact you promptly about a new job task so you didn't have to wait without pay			
Paid and Unpaid Time:			
K. Pay you for customer delays in picking up or delivering freight			
L. Require you to wait for customer delays for more than two hours without pay			
M. Arrange your loads so you had little delay time between loads			
N. Require you to wait between loads for more than two hours without pay.			
O. None of these			

18a. Are there any other interactions between you and your company that we haven't asked you about, where you feel as if they are harassing you? **(ACCEPT ONLY ONE ANSWER.)**

Yes
No
Don't know
Refused

If Yes in 18a, ask 18b. Otherwise skip to following instructions (after Q18b).

18b. Of those we haven't asked about, which **one** bothers you most? **(ONLY RECORD ONE.)**

_____
_____
_____

HAND CARD 19.

19. Which of these have happened to you while working at your current company? **(RECORD ALL THAT APPLY.)**

Told to record your loading/unloading hours as off-duty
Told to log your duty status as a fixed number of minutes on-duty, and the rest of the time as off duty while loading or unloading
Contacted by your carrier, to find out why your truck isn't moving
Your carrier changed your duty status in your logs
None of these
NOT ON CARD:
Don't know
Refused

If not an EOBR user (no EOBR in Q1), continue with Q20.
If an EOBR user (EOBR in Q1), skip to Q22.

20. Has your company ever punished you somehow for refusing to work more hours than the law allowed, or for refusing to drive when you were ill, fatigued, or when weather did not permit? **(ACCEPT ONLY ONE ANSWER.)**

Yes	**Continue with Q21**
No	**Skip to Q29**
Don't know/not sure	**Skip to Q29**
Refused	**Skip to Q29**

HAND CARD 21/27

21. Which of the items on this card happened in your life as a result of their actions? Just read me the letters of the items. **Record all that apply. AFTER Q21 TAKE BACK CARD AND SKIP TO Q29.**

    Fewer assignments
    Less favorable assignments
    Lower raises than deserved
    Considered looking for another job
    More arguments at home
    Didn't sleep as well
    Felt ashamed
    More isolated from co-workers
    Began smoking/drinking, or did so more often
    None of these

22. In dealing with your current company, have they ever asked you to drive or work more hours than federal regulations allow? **(ACCEPT ONLY ONE ANSWER.)**

    Yes
    No
    Don't know/not sure
    Refused

If 22=Yes, continue with Q23. All others skip to 29.

23. How often has that happened in the last year? **Do not read list. Ask for best guess if uncertain. Accept only one answer.**

    Once
    Twice
    Three to five times
    Six to ten times
    More than ten times
    Don't know
    Refused

24. How often have you rejected those requests, or told them that you didn't want to drive or work more hours than the federal regulations allow? **Do not read list. Ask for best guess if uncertain.**

Never	**Skip to Q27**
Once	**Continue with Q.25**
Twice	**Continue with Q.25**
Three to five times	**Continue with Q.25**
Six to ten times	**Continue with Q.25**
More than ten times	**Continue with Q.25**
Don't know	**Continue with Q.25**
Refused	**Continue with Q.25**

25. On those occasions, did they ever threaten you with fewer assignments or hours, or by threatening your job?

Yes	**Continue with Q26**
No	**Skip to Q27**
Don't know	**Skip to Q27**
Refused	**Skip to Q27**

26. How often have they made those threats in the past year? **Do not read list. Ask for best guess if uncertain.**

Once
Twice
Three to five times
Six to ten times
More than ten times
Don't know
Refused

Hand Card 21/27.

27. Aside from threats, which of the items on that card happened in your life as a result of their actions? Just read me the letters of the items. **Record all that apply.**

Fewer assignments
Less favorable assignments
Lower raises than deserved
Considered looking for another job
More arguments at home
Didn't sleep as well
Felt ashamed
More isolated from co-workers
Began smoking/drinking, or did so more often
None of these

28. Do you think their requests come as a result of having an EOBR/ELD in your truck?

    Yes
    No
    Don't know
    Refused

Hand Card 29.

29. We would like your opinion of devices which automatically log duty status regarding specific characteristics. Even if you do not have them in the trucks you drive, please base your answers on anything you might know or have heard. Please tell us whether you agree completely, agree somewhat, disagree somewhat, or disagree completely that each statement describes automatic duty status logging devices such as EOBRs or ELDs.

EOBRs and ELDs…	Agree Completely	Agree Somewhat	Disagree Somewhat	Disagree Completely
Protect me from management being overbearing	1	2	3	4
Prevent me from doing my job the way I want	1	2	3	4
Make me confident that other truck drivers are not overworking themselves	1	2	3	4
Improve decisions which my fleet manager and I make about driving and rest times, and management of loads	1	2	3	4
Make me feel less independent	1	2	3	4
Mean I have less paperwork to fill out	1	2	3	4
Enhance my relationship with my fleet managers to assure compliance and safe operations	1	2	3	4
Give management too much of an insight into my day	1	2	3	4
Save me time and makes it easier for me to comply with HOS logging	1	2	3	4
Make the roads safer for everyone	1	2	3	4

If not an EOBR user (no EOBR in Q1), skip to 32.

30. Have you ever had a problem producing your electronic hours of service records for a law enforcement officer?

Yes	**Continue with Q.31**
No	**Skip to Q.32**
Don't know	**Skip to Q.32**
Refused	**Skip to Q.32**

31. Was this problem big enough that you felt harassed by the request to see your records?

Yes
No
Don't know
Refused

32. Federal regulations state that if drivers have safety complaints, firms must not coerce them against filing their complaints. Firms also can't coerce them to drive when fatigued -- by discriminating against the driver, or otherwise disciplining him or firing him.

In your opinion, how effective are these regulations? **Read list. Accept only one answer.**

Very effective
Somewhat effective
Not too effective
Not effective at all
Do not read:
Don't know/Not sure
Refused

Hand Card 33.

33. To prevent carriers from harassing their drivers by using information about hours of service which are logged automatically, which of the items on that list do you think are good ideas? **Record all that apply.**

Drivers can get copies of the logs through the device
Carriers must provide drivers back copies of their logs, for up to six months
Carriers are explicitly prohibited from harassing drivers
A formal process for complaint procedures
Mute functionality so you're not bothered when off-duty
An "edit" function, with edits needing mutual approval
Limitations on how often and when the carrier can get location data from the EOBR/ELD
Enforcement actions that keep drivers' personal information private
None of these
NOT ON CARD
Don't know
Refused

Hand Card 34.

34. If the Federal Motor Carrier Safety Administration found that a carrier was harassing its drivers, which of the steps below do you think would be appropriate? **Record all that apply.**

    Closer federal monitoring
    Fines and penalties
    Publication of carrier actions
    Something else (**SPECIFY**:)

    _____
    _____
    _____

Hand Card 35.

35. The Federal Motor Carrier Safety Administration is concerned about the use of EOBRs or ELDs to harass drivers or coerce them. It needs to make sure it properly defines these terms. Please read the description I just gave you. **(Wait for driver to finish.)** How well does that definition describe your idea of harassment? Do you think it describes your idea of harassment… **Read list.**

    Very well
    Somewhat, or
    Not at all
    Do not read:
    Don't understand it
    Don't know
    Refused

Take back Card 35. Hand Card 36.

36. Please read the description I just gave you. **(Wait for driver to finish.)** How well does that definition describe your idea of coercion? Do you think it describes your idea of coercion… **Read list.**

    Very well
    Somewhat, or
    Not at all
    Do not read:
    Don't understand it
    Don't know
    Refused

We are almost done. The last few questions are for classification purposes only.

37. How many trucks does your company have, across all its locations? Please give me your best estimate.

    1-5
    6-10
    11-20
    21-50
    51-100
    101-250
    251-500
    501-1,000
    1,001-3,000
    More than 3,000
    Don't know
    Refused

38. Do you work as… **ACCEPT MULTIPLE ANSWERS**.

    An employee of the company
    An independent owner-operator
    Something else? **(SPECIFY:)**
    _____
    _____

39. Is the company you currently work for… **Read list. Accept only one answer.**

    A carrier for hire (someone else owns the freight and has hired your company)
    A private carrier (the company owns the freight)
    Do Not Read:
    Don't know
    Refused

40. Is your firm's ***primary*** type of business… **Read list. Accept only one answer.**

    Truck load
    Less than truckload
    Parcel
    Other

41. Are you a member of a union or covered by a collective bargaining agreement?

    Yes
    No
    Don't know
    Refused

42. How many years have you had a commercial driver's license? **Ask for best estimate. Accept only one answer.**

Less than a year
1-2 years
3-5 years
6-10 years
11-15 years
More than 15 years
Don't know
Refused

43. How long have you worked for your current employer? Your best estimate is fine.

Less than a year	**Continue with Q44**
1-2 years	**Skip to Q45**
3-5 years	**Skip to Q45**
6-10 years	**Skip to Q45**
11-15 years	**Skip to Q45**
More than 15 years	**Skip to Q45**
Don't know	**Skip to Q45**
Refused	**Skip to Q45**

44. Over the **past 12 months**, for how many different companies have you driven a truck?

#_____ -221

45. Lastly, how old are you?

18-24
25-34
35-44
45-54
55 or older
Refused

46. **DO NOT ASK. RECORD GENDER.**

Male
Female

This concludes our survey. Thank you for participating in this important research.

DRIVERS: "HAND CARDS" USED DURING QUANTITATIVE SURVEY

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

CARD 1

A. Driver alertness monitoring system *(an alarm system that alerts you if you start to show signs of fatigue or inattention to your driving)*

B. Forward collision warning system *(a system that monitors the roadway ahead of the truck and warns of a potential collision risk exists)*

C. Lane departure warning system *(an alarm system that warns you when you veer out of your lane)*

D. An EOBR/ELD *(a device that electronically records your service hours and duty status, automatically when the truck starts or stops, as well as when you manually start it logging)*

E. None of these

CARD 6/7

Miles per week

Loads per week

Shipments per week

Stop count (pickups and/or deliveries per week)

Meeting customer service schedules

Avoiding chargeable accidents

Fuel mileage

Avoiding freight damage claims

Avoiding workers compensation claims

Avoiding out-of-route miles

Avoiding hard braking events

Avoiding recorded hours of service violations

Some other way

CARD 9

Paper

Tachographs

Stand-alone EOBR/ELD

EOBR/ELD in a system with other functionality

CARD 10

A smartphone synched to the engine, and logging the hours

A laptop synched to the engine, and logging the hours

A console/display that is not a smartphone or computer, branded with a manufacturer's name

Another device (Please specify)

CARD 14/15/16/17

Schedules:

A. Ask you to meet a customer load schedule you viewed as unrealistic

B. Ask a customer to adjust a load schedule so it was realistic for you

Fatigue:

C. Ask you to operate when you judged you were fatigued

D. Ask that you shut down if you felt fatigued

Logging and breaks:

E. Ask you to log your hours inaccurately to get more work time or delay a break

F. Ask you to log your hours accurately when you could have had more work time or delayed a break by being inaccurate

G. Change your log record after it was made to give you more work time or delay a break

H. Ask you to take sufficient time off duty to recover from fatigue

Communications:

I. Interrupt your off-duty time with a message at an inappropriate time

J. Contact you promptly about a new job task so you didn't have to wait without pay

Paid and Unpaid Time:

K. Pay you for customer delays in picking up or delivering freight

L. Require you to wait for customer delays for more than two hours without pay

M. Arrange your loads so you had little delay time between loads

N. Require you to wait between loads for more than two hours without pay.

CARD 19

Told to record your loading/unloading hours as off-duty

Told to log your duty status as a fixed number of minutes on-duty, and the rest of the time as off duty while loading or unloading

Contacted by your carrier, to find out why your truck isn't moving

Your carrier changed your duty status in your logs

None of these

CARD 21/27

(A) Fewer assignments
(B) Less favorable assignments
(C) Lower raises than deserved
(D) Considered looking for another job
(E) More arguments at home
(F) Didn’t sleep as well
(G) Felt ashamed
(H) More isolated from co-workers
(I) Began smoking/drinking, or did so more often
(J) None of these

CARD 29

Agree completely

Agree somewhat

Disagree somewhat

Disagree completely

CARD 33

Drivers can get copies of the logs through the device

Carriers must provide drivers back copies of their logs, for up to six months

Carriers are explicitly prohibited from harassing drivers

A formal process for complaint procedures

Mute functionality so you're not bothered when off-duty

An "edit" function, with edits needing approval mutual approval

Limitations on how often and when the carrier can get location data from the EOBR/ELD

Enforcement actions that keep drivers' personal information private

None of these

CARD 34

Closer federal monitoring

Fines and penalties

Publication of carrier actions

Something else (Please specify)

CARD 35

HARASSMENT

Harassment is an act by a motor carrier, involving the use of information available through EOBR/ELD technology (either alone or in combination with other technology) to track a commercial motor vehicle driver's hours of service and requiring the driver to violate federal hours of service rules or fatigue or ill driving restrictions.

CARD 36

COERCION

Coercion is a threat by a motor carrier, shipper, receiver, or a transportation intermediary, to deny business or work based on a commercial motor vehicle driver's refusal to violate federal regulations governing operating a commercial motor vehicle based, at least in part, on information available through EOBR/ELD technology or a combination of technology that includes an EOBR/ELD feature.

DRIVERS: NON-RESPONSE FOLLOW-UP SURVEY

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

FMCSA-

Trucking Survey

Non-Response Survey

NR1. Can I ask you just a few quick questions to help us to better understand the answers that we do get? Of course, I can't give you $10 since it's not the actual survey, but it will be very helpful. **IF DRIVER REFUSES, THANK AND TERMINATE.** First, can you tell me why you don't want to participate? **Do not read list. Record all that apply.**

1 Don't have time for it/In a rush/Running late
2 Money not enough for the time
3 Don't believe answers will be confidential/Too risky
4 Never do surveys
5 Other (**Specify:**_____)
6 Don't know/not sure
7 Refused

NR2. Are you required to keep a record of your hours to comply with the Federal hours of service regulations?

1 Yes
2 No **Terminate**
3 Don't know/refused **Terminate**

NR3. Do you keep those records using paper logs or something electronic or mechanical?

1 Paper
2 Something electronic/mechanical
3 Don't know/refused **Terminate**

If "Something electronic/mechanical" ask NR4. Otherwise skip to NR5:

NR4. Is it a tachograph, or a different kind of stand-alone piece of equipment that only records your hours and nothing else, or is it part of a system which does a variety of functions?

1 Tachograph
2 Stand-alone piece of equipment
3 Part of a system which does a variety of functions
4 Don't know/not sure
5 Refused

NR5. Are you a member of a union or covered by a collective bargaining contract?

1 Yes
2 No
3 Don’t know/not sure
4 Refused

NR6. How many years have you had a commercial driving license? **Ask for best guess if unsure**.

1 Less than a year
2 1-2 years
3 3-5 years
4 6-10 years
5 11-15 years
6 More than 15 years
7 Don’t know/not sure
8 Refused

NR7. Lastly, how old are you? **Read list.**

1 18-24
2 25-34
3 35-44
4 45-54
5 55 or older
Do not read
6 Don’t know/not sure
7 Refused

Thank you for answering these few questions.

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APPENDIX G: CARRIER SURVEYS AND RECRUITMENT LETTERS

CARRIERS' QUALITATIVE RECRUITMENT SURVEY

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

MCSA-

Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Qualitative Discussion Guide
One-on-one In Depth Interview with Carriers

Recruitment Questionnaire

ASK TO SPEAK TO SOMEONE IN CHARGE OF THE TRUCK FLEETS AND DRIVERS. POTENTIAL TITLES INCLUDE: FLEET MANAGER, FLEET SUPERVISOR, TRAFFIC MANAGER, DISPATCHER.

TRY AND GET THE NAME OF THE PERSON TO WHOM YOU WILL BE TRANSFERRED.

IF ASKED FOR EXPLANATION.

R1. My name is {**INTERVIEWER NAME**) and I'm calling from Abt SRBI, a national research company. We're conducting a very important research project about freight and truck driving for the Federal Motor Carrier Safety Administration and your company was scientifically selected as a company to participate.

ONCE TRANSFERRED TO THE INDIVIDUAL/ASSISTANT.

R2. My name is {**INTERVIEWER NAME**) and I'm calling from Abt SRBI, a national research company. We're conducting a very important research project about freight and truck driving for the Federal Motor Carrier Safety Administration and your company was scientifically selected as a company to participate. We're specifically looking for people whose responsibilities are to manage truck fleets and their drivers. Are you, yourself, responsible for managing truck drivers at your company?

1	Yes	**Continue**
2	No	**Ask for name of individual with that responsibility, and ask to be transferred**
3	Unavailable	**Set up callback.**
4	Refused	**Attempt to convert. Say: "The subject of this survey is of significant interest to the trucking industry. Your participation isn't mandatory, but it would be very valuable." If unsuccessful, thank and terminate.**

WHEN SPEAKING TO THE PERSON WITH THIS RESPONSIBILITY (NOT THE ASSISTANT).

R3. Before we continue, I want to point out that this is solely for research purposes, and everything you say will be held in the strictest confidence. Some of the topics are of a sensitive nature, and cover regulations and

compliance. But this is only for research purposes, and your participation is voluntary, not mandatory. Can we continue?

1	Yes	**Continue**
2	No	**Thank and Terminate. Do not attempt to convert refusal.**

R4. Let's start off with a few preliminary questions. First, what is your title?

R5. And, how long have you held this position at your company?

R6. Did you hold a similar position at another company? (How many years?)

R7. Now, I'm going to read you a list of various equipment which some carriers have put into their trucks. Not all have done so. Please let me know which of them, if any, are in your company's trucks. (**READ LIST. CHECK ALL THAT APPLY.**)

1 GPS devices
2 Radio or satellite communication devices
3 Fuel management systems
4 Devices which automatically log drivers' hours of service, either as a stand-alone device or as part of a multi-function system
5 Devices which cap the truck's speed
6 Information panels telling drivers of their progress
7 Systems which alert you to erratic or unsafe driving
8 Other (SPECIFY)

9 None of these

R8. And, are your trucks' shipments interstate or all within one state?

1	Interstate	
2	All within one state	
3	A mix	
4	Don't know/Not sure	**Thank respondent. You probably haven't reached the right person, ask to speak to someone else with these responsibilities.**
5	Refused	**Thank and terminate**

IF ANSWER TO R7=4, QUALIFIES FOR "USER." IF NOT, QUALIFIES FOR "NON-USER." IF QUOTA NOT REACHED, CONTINUE WITH R9. OTHERWISE THANK AND TERMINATE.

R9. Thank you. What I'd like to do is set up an appointment for an interview with a specialist to call you. The discussion will take about a half hour, and as with this discussion you and I have had, everything will be held confidential. It is only for research purposes. If you wish it can be conducted during your business hours or at some other time at another number.

SET UP APPOINTMENT AND THANK RESPONDENT. CONFIRM DAY, TIME, AND PHONE NUMBER BEFORE ENDING CALL.

CARRIERS: QUALITATIVE MAIN SURVEY

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

MCSA-

Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Qualitative Discussion Guide
One-on-one In Depth Interview with Drivers

Main Questionnaire

I want to thank you again for your time, and remind you that this discussion is for research purposes only. And that as compensation for your time, we will send you a check for $25.

Before we begin, can you give me some background information about your job? **(Do not ask about how hours are recorded, that was obtained in the recruitment. Probe for information such as whether employed by carrier/independent owner operator/lease truck, paid by hour or by mileage, typical route [distance, other states, etc.], type of freight, size of truck], how many trucks in company fleet.)**

1. What, if anything, do you **like** about your job? **(Probe for additional aspects and specifics.)**

2. And what, if anything, do you **dislike** about your job? **(Probe for additional aspects and specifics.)**

3. How would you describe your relationship with management? **(Probe for additional aspects and specifics.)**

4. 4. Has management ever asked you to do anything which put your health or well-being at risk? **(Probe for additional aspects and specifics.)**

5. Has management ever asked you to do anything which could have led to you working more hours than the law allows? **(Probe for specifics.)**

6. Have you ever chosen, on your own, to work more hours than the law allows? **(Probe for specifics.)**

7. **If have worked more hours than allowed by law:** When you've been on duty for more hours than the law allowed, how was that handled with the record keeping? **(Probe for specifics.)**

8. Looking back at your dealings with management, have there been any occasions when you think they might have harassed you over your work? **(If respondent asks what meant by harassment, tell him it is as he interprets it.) (Probe for specifics.)** What did they say? What did they want you to do? How often does that occur?

9. **If experienced something they consider harassment:** In your view what about it constituted harassment? **(Probe:** Was it what they were asking? The frequency? Tone? Potential consequences?**)**

10. We're speaking to a number of drivers, and have heard a variety of opinions. I'm going to read you a list of driver experiences, and I'd like you to tell me which of them, if any, you would consider harassment if management asked them of you. Management…

Schedules:	
Ask you to meet a customer load schedule you viewed as unrealistic	1
Ask a customer to adjust a load schedule so it was realistic for you	2
Fatigue:	
Ask you to operate when you judged you were fatigued	3
Ask that you shut down if you felt fatigued	4
Logging and breaks:	
Ask you to log inaccurately to get more work time or delay a break	5
Ask you to log accurately when you could have had more work time or delayed a break by being inaccurate	6
Change your log record after it was made to give you more work time or delay a break	7
Ask you to take sufficient time off duty to recover from fatigue	8
Communications:	
Interrupt your off-duty time with a message that woke you up	9
Contact you promptly about a new job task so you didn't have to wait without pay	10
Paid and Unpaid Time:	
Pay you for customer delays in picking up or delivering freight	11
Require you to wait for customer delays for more than two hours without pay	12
Arrange your loads so you had little delay time between loads	13
Require you to wait between loads for more than two hours without pay.	14

11. In a typical month, do you, yourself, experience each of these? Management…

Schedules:	
Asks you to meet a customer load schedule you viewed as unrealistic	1
Asks a customer to adjust a load schedule so it was realistic for you	2
Fatigue:	
Asks you to operate when you judged you were fatigued	3
Asks that you shut down if you felt fatigued	4
Logging and breaks:	
Asks you to log inaccurately to get more work time or delay a break	5
Asks you to log accurately when you could have had more work time or delayed a break by being inaccurate	6
Changes your log record after it was made to give you more work time or delay a break	7
Asks you to take sufficient time off duty to recover from fatigue	8
Communications:	
Interrupts your off-duty time with a message that woke you up	9
Contacts you promptly about a new job task so you didn't have to wait without pay	10
Paid and Unpaid Time:	
Pays you for customer delays in picking up or delivering freight	11

Requires you to wait for customer delays for more than two hours without pay	12
Arranges your loads so you had little delay time between loads	13
Requires you to wait between loads for more than two hours without pay.	14

12. Are there other things they do to you which you consider harassment? (**Probe for specifics.**) Do they happen in a typical month?

13. If you haven't complied with management's requests or if you've pushed back, have there been any consequences? **(Probe for specific: make sure you get the request that was made, connected to the consequence.)**

14. Has management ever used your service logs or records to argue for you working longer hours or taking on additional work? **(Probe for specifics.)**

IF USER AND R9="PART OF A SYSTEM WITH OTHER CAPABILITIES," ASK Q15.

15. Did your company need to use anything in addition to just the logs in order to make that happen? **(Probe if doesn't come up:)** Did they need real time communications, or GPS, something of that nature? (What?)

16. Have their requests or consequences had any impact on other aspects of your life outside of your job? **(Probe for specifics.)**

17. Do you think that would be different if your hours of service were being recorded using some other method? (What kind of method? How would it be different?)

18. Some truck drivers are concerned that devices which automatically log their service hours electronically will allow management to harass its drivers. Can you think of anything which could be done to prevent that, either in the technology or the processes? **(Probe for specific harassing behavior and remedies.)**

If "USER", ASK 19.

19. Have you ever had any problem producing your electronic logs of your hours for a law enforcement agent or officer?

ASK ALL 20.

20. One of the objectives of our discussion is to understand the language and words that drivers like you use to refer to various systems used to track drivers' hours. When you think about the systems that automatically log hours when the truck starts or stops or when a driver forces it on manually, what do you call them?

IF THE RESPONDENT HAS NOT MENTIONED THE TERM "EOBR," ASK ABOUT FAMILIARITY WITH THE TERM AND USE. HAS (S)HE EVER HEARD THE TERM? KNOW WHAT IT IS? USE THE TERM?

Obtain information on who to make the check out to and where to send it. Thank and end interview.

CARRIERS: RECRUITMENT LETTER 1

U.S. Department
of Transportation
Federal Motor Carrier
Safety Administration

1200 New Jersey Ave., S.E.
Washington, D.C. 20590

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

Manager of Trucking and Truck Drivers
XYZ Corporation
1001 Lincoln Boulevard
Jacksonville, FL XXXXX-XXXX

Dear Manager:

The Federal Motor Carrier Safety Administration (FMCSA) is seeking input from the trucking industry to make important policy decisions regarding potential requirements for use of Hours of Service Monitoring Devices (HOS-MDs) or Electronic On Board Recorders (EOBRs or ELDs), which log drivers' status hours. If you, yourself, are not responsible for managing truck drivers, please pass this letter on to someone in your company who is. Your company's participation is extremely important to help ensure that the FMCSA understands the industry perspective regarding hours of service logging requirements.

The survey is available online and will take about 15 minutes of your time. We know your time is valuable, and thank you.

All of your answers will be strictly private. FMCSA has hired a third party, Abt SRBI, to host the survey and conduct the analysis. Your identity will never be disclosed to anyone at FMCSA, or the federal government. Your participation is completely voluntary, and there is no penalty if you don't participate.

The survey has been reviewed and approved by the U.S. Office of Management and Budget. The OMB control number is 2126-0055.

Again, if you do not manage truck drivers, please pass this invitation on to someone at your company who does.

You can complete the survey online by logging on to:

www.opinionport.com/trucking

Your password is: **<<INSERT PASSWORD>>**

Sincerely,

Federal Motor Carriers Safety Administration

CARRIERS: REMINDER POST CARD

U.S. Department of Transportation
Federal Motor Carrier Safety Administration
1200 New Jersey Ave., S.E.
Washington, D.C. 20590

«name»
«address»
«city», «state» «zipcode»

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

A week ago we sent you a letter asking you to participate in a survey regarding policy decisions on the use of Hours of Service Monitoring Devices (HOS-MDs, or EOBRs/ELDs). This postcard is just a reminder asking you to participate; if you have already completed the survey, thank you.

The letter included a password allowing you to answer the survey online, which is not included here for privacy concerns. Please refer to the letter which we mailed you, or, if you have lost that letter we will enclose the password again in a follow-up letter in about a week. We would also like to remind you that your participation is completely voluntary, and there is no penalty if you don't participate. In addition, all of your answers will be strictly private. FMCSA has hired a third party, Abt SRBI to host the survey and conduct the analysis. Your identity will never be disclosed to anyone at FMCSA or the federal government.

We appreciate your participation.

CARRIERS: RECRUITMENT LETTER 2

U.S. Department
of Transportation

Federal Motor Carrier
Safety Administration

1200 New Jersey Ave., S.E.
Washington, D.C. 20590

OMB Control Number: 2126-0055
Expiration Date: 1/31/2017

June 4, 2014

XYZ Corporation
1001 Lincoln Boulevard
Jacksonville, FL XXXXX-XXXX

Dear Mr. _____:

We recently sent you a letter regarding a survey on Hours-of-Service Monitoring Devices (HOS-MDs) or Electronic On Board Recorders/Electronic Logging Devices (EOBRs or ELDs), which log drivers' status hours. The survey is sponsored by the Federal Motor Carrier Safety Administration (FMCSA), which is seeking input from carriers on the uses of electronic logging devices. We are sending you this letter as a follow-up to our first letter and asking again that you participate. If you or someone at your company has already completed the survey, we thank you. If not, please read the rest of this letter. For additional information about the project, please go to the FMCSA website <http://www.fmcsa.dot.gov/safety/research-and-analysis/survey-electronic-logging-devices-and-driver-harassment>.

If you are not responsible for managing truck drivers, please pass this letter on to the appropriate person in your company. Your company's participation is extremely important to help ensure that FMCSA understands the uses of electronic logging services.

The survey is available online and will take about 15 minutes of your time. We know your time is valuable, and thank you.

All of your answers will be strictly private. FMCSA has contracted with a third party, Abt SRBI, to host the survey and conduct the analysis. Your identity will not be disclosed to anyone at FMCSA, or the Federal government. Your participation is completely voluntary, and there is no penalty if you choose not to participate.

The survey has been reviewed and approved by the U.S. Office of Management and Budget (OMB). The OMB control number is 2126-0055. If you have any questions, please contact FMCSA staff member Mr. Albert Alvarez at albert.alvarez@dot.gov or 202-385-2387. Thank you for your participation.

Again, if you do not manage truck drivers, please pass this invitation on to someone at your company who does. You can complete the survey online by logging on to:

www.opinionport.com/trucking

Your password is: **<<INSERT PASSWORD>>**

Sincerely,
Federal Motor Carrier Safety Administration

CARRIERS: QUANTITATIVE SURVEY

U.S. Department of Transportation **OMB Control Number: 2126-0055**
Federal Motor Carrier Safety Administration **Expiration Date: 1/31/2017**

MCSA-

Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Web Survey with Carriers

Introductory Screen

This research is being conducted for the Federal Motor Carrier Safety Administration (FMCSA); the purpose of the research is to give them guidance for rule making and to assist them in important policy decisions. Questions in the survey include topics such as working conditions and compensation, rules and regulations, complying with them or not, and dealings with your company's drivers. Be assured, all of your answers will be confidential, and will only be reported as part of a larger group. They will never be singled out, and they will never be connected to your identity. Your name and your company's name will not appear in the data, and all data will be stored on a password-protected computer in a remote location, protected by 24-hour security and surveillance. Your identity will never be shared with the FMCSA; we will not tell your company that you participated, and they will never have access to your answers. Also, your participation is voluntary; it is not mandatory or required.

1. Are you responsible for managing truck drivers at your company? (At some companies the title might be "fleet manager" or "dispatcher.")

   1 Yes
   2 No **Go to FORWARD**

FORWARD Will you please forward your letter to someone in your company with these responsibilities? Thank you.

Provide exit button for respondent to click.

2. Are the truck drivers at your company required to keep a record of hours?

   1 Yes
   2 No **Terminate**

In this survey we will be focusing on your responsibilities managing truck drivers. You may have other responsibilities at your company, but when this survey talks about your job, please only think about your responsibilities managing truck drivers.

3. Overall, how satisfied are you with your job? *Please click one answer.*

   4 Very satisfied
   3 Somewhat satisfied
   2 Somewhat dissatisfied
   1 Very dissatisfied

4. Do you, yourself, deal directly with the truck drivers, or does someone else deal with the drivers? *Please click one answer.*

   1 I deal directly with the drivers
   2 Someone else deals with the drivers **Skip to Q6**

5. How satisfied are you with your relationship with the drivers you deal with? *Please click one answer.*

   4 Very satisfied
   3 Somewhat satisfied
   2 Somewhat dissatisfied
   1 Very dissatisfied

6. What is the **main** way your drivers are paid? *Please click one answer.*
   1 Miles
   2 Hourly
   3 Salary
   4 Percentage of revenue
   5 Fixed fees (e.g., flat payment per load/shipment)
   6 Some other way (**Specify:**_____)

7. What is the **main** way in which supervisors at your company evaluate drivers' work? *Please click one answer.*

   1 Miles per week
   2 Loads per week
   3 Shipments per week
   4 Stop count (pickups and/or deliveries per week)
   5 Meeting customer service schedules
   6 Avoiding chargeable accidents
   7 Fuel mileage
   8 Avoiding freight damage claims
   9 Avoiding workers compensation claims
   10 Avoiding out-of-route miles
   11 Avoiding hard braking events
   12 Avoiding recorded hours of service violations

8. In what **other** ways (if any) do supervisors at your company evaluate drivers' work? *Please check all that apply.*

1 Miles per week
2 Loads per week
3 Shipments per week
4 Stop count (pickups and/or deliveries per week)
5 Meeting customer service schedules
6 Avoiding chargeable accidents
7 Fuel mileage
8 Avoiding freight damage claims
9 Avoiding workers compensation claims
10 Avoiding out-of-route miles
11 Avoiding hard braking events
12 Avoiding recorded hours of service violations
13 Some other way (**Specify:**_____)
14 None of these/No other way

9. How satisfied are you with those ways of measuring your drivers' performance? *Please click one answer.*

4 Very satisfied
3 Somewhat satisfied
2 Somewhat dissatisfied
1 Very dissatisfied

Our next set of questions is about how you or your company communicates with drivers and how you track and manage their work time.

10a. What tools does your company use to track your drivers' "duty status" for compliance with the Federal hours of service regulations? *Please check all that apply.*

1 Paper logs
2 Tachographs
3 An EOBR or ELD which only logs your drivers' duty status (automatically when the truck starts and stops, as well as when they manually start it logging)
4 An automatic EOBR or ELD which is part of a fleet management system, including other functions such as real time communications between your company and your drivers

Q10a must be answered.

If "Automatic Logging" answered in 10a (answer 3 or 4), ask 10b. Otherwise skip to 14.

10b. Are your company's fleet management systems able to process logged service hours for long haul and short haul drivers separately, so that dispatchers can treat them differently when scheduling trips?

1 Yes
2 No
3 Don't know

If answer 4 in 10a, ask 11. If answer 3 in 10a continue with 12.

11. The list below shows a variety of types of equipment which are synched to the engine to automatically record service hours, and serving the function of an EOBR/ELD. Which of them does your company have in the truck you usually drive? *Please click one answer.*

    1 A smartphone synched to the engine, and logging the hours
    2 A laptop synched to the engine, and logging the hours
    3 A console/display that is not a smartphone or computer, branded with a manufacturer's name
    4 Another device (Please Specify)

12. How satisfied are you with the automatic status logging functionality of the EOBRs/ELDs your company uses? *Please click one answer.*

    4 Very satisfied
    3 Somewhat satisfied
    2 Somewhat dissatisfied
    1 Very dissatisfied

If 10a=4 ("EOBR which is part of a fleet management system"), ask 13. Otherwise skip to 14.

13. And, thinking about those devices' other functions, how satisfied are you with the devices your company uses? *Please click one answer.*

    4 Very satisfied
    3 Somewhat satisfied
    2 Somewhat dissatisfied
    1 Very dissatisfied

The next questions are about your interactions with your drivers.

14. Different companies have different interactions with their drivers. Please think of a TYPICAL DRIVER in your fleet, and the interactions your company might have with him or her in a typical month. In a typical month, does management… *Please give an answer for each item.*
(Note: groups of items will be randomized, and order within group will be randomized so as to lead consistently with a negative or a positive.)

	Never	Once a Month	2+/ Month	Don't know/ Ref.
Schedules: For each item below, keep in mind a TYPICAL driver…				
Ask a driver to meet a customer load schedule they viewed as unrealistic	1	2	3	4
Ask a customer to adjust a load schedule so it was realistic for the driver	1	2	3	4
Fatigue: For each item below, keep in mind a TYPICAL driver…				
Ask a driver to operate when the driver felt they were fatigued	1	2	3	4
Ask a driver to shut down if they felt fatigued	1	2	3	4
Logging and breaks: For each item below, keep in mind a TYPICAL driver…				
Ask a driver to log their hours inaccurately to get more work time or delay a break	1	2	3	4
Ask a driver to log their hours accurately when they wanted more work time or to delay a break	1	2	3	4
Change a driver's log record after it was made to give them more work time or delay a break	1	2	3	4
Ask a driver to take sufficient time off duty to recover from fatigue	1	2	3	4
Communications: For each item below, keep in mind a TYPICAL driver…				
Interrupt a driver's off-duty time with a message at an inappropriate time	1	2	3	4
Contact a driver promptly about a new job task so they didn't have to wait without pay	1	2	3	4
Paid and Unpaid Time: For each item below, keep in mind a TYPICAL driver…				
Pay a driver for customer delays in picking up or delivering freight	1	2	3	4
Require a driver to wait for customer delays for more than two hours without pay	1	2	3	4
Arrange a driver's loads so they had little delay time between loads	1	2	3	4
Require a driver to wait between loads for more than two hours without pay.	1	2	3	4

Questions 15-17 will only ask about items they engage in at least once a month (Q14).

15. Which of these interactions, if any, do you think your drivers might consider harassment? *Please give an answer for each.*

	Yes	No	Don't know
Schedules:			
Asking a driver to meet a customer load schedule they viewed as unrealistic	1	2	3
Asking a customer to adjust a load schedule so it was realistic for the driver	1	2	3
Fatigue:			
Asking a driver to operate when the driver felt they were fatigued	1	2	3
Asking a driver to shut down if they felt fatigued	1	2	3
Logging and breaks:			
Asking a driver to log their hours inaccurately to get more work time or delay a break	1	2	3
Asking a driver to log their hours accurately when they wanted more work time or to delay a break	1	2	3
Changing a driver's log record after it was made to give them more work time or delay a break	1	2	3
Asking a driver to take sufficient time off duty to recover from fatigue	1	2	3
Communications:			
Interrupting a driver's off-duty time with a message at an inappropriate time	1	2	3
Contacting a driver promptly about a new job task so they didn't have to wait without pay	1	2	3
Paid and Unpaid Time:			
Paying a driver for customer delays in picking up or delivering freight	1	2	3
Requiring a driver to wait for customer delays for more than two hours without pay	1	2	3
Arranging a driver's loads so they had little delay time between loads	1	2	3
Requiring a driver to wait between loads for more than two hours without pay.	1	2	3

If EOBRs in 10a (whether or not device has other functionality, answer 3 or 4), ask 16. Otherwise skip to instructions before 17.

16. Whether or not consider those requests harassment, which of them, if any, are facilitated specifically by the **service hours logging functionality** in your company's EOBRs/ELDs? (Think specifically of the service hours logging, vs. other functionality the device may offer such as GPS location, communication, and so on.) *Please check all that apply.*

Schedules:	
Asking a driver to meet a customer load schedule they viewed as unrealistic	1
Asking a customer to adjust a load schedule so it was realistic for the driver	2
Fatigue:	
Asking a driver to operate when the driver felt they were fatigued	3
Asking a driver to shut down if they felt fatigued	4
Logging and breaks:	
Asking a driver to log their hours inaccurately to get more work time or delay a break	5
Asking a driver to log their hours accurately when they wanted more work time or to delay a break	6
Changing a driver's log record after it was made to give them more work time or delay a break	7
Asking a driver to take sufficient time off duty to recover from fatigue	8
Communications:	
Interrupting a driver's off-duty time with a message at an inappropriate time	9
Contacting a driver promptly about a new job task so they didn't have to wait without pay	10
Paid and Unpaid Time:	
Paying a driver for customer delays in picking up or delivering freight	11
Requiring a driver to wait for customer delays for more than two hours without pay	12
Arranging a driver's loads so they had little delay time between loads	13
Requiring a driver to wait between loads for more than two hours without pay.	14
None of these	15

If "EOBR which is part of a fleet management system" in 10a (answer 4), ask 17. Otherwise skip to 18.

17. Which of those, if any, do you see as coming from management's use of other technology in the devices in your trucks, whether in combination with the automatically logged service hours or not? *Please check all that apply.*

Schedules:	
Asking a driver to meet a customer load schedule they viewed as unrealistic	1
Asking a customer to adjust a load schedule so it was realistic for the driver	2
Fatigue:	
Asking a driver to operate when the driver felt they were fatigued	3
Asking a driver to shut down if they felt fatigued	4
Logging and breaks:	
Asking a driver to log their hours inaccurately to get more work time or delay a break	5
Asking a driver to log their hours accurately when they wanted more work time or to delay a break	6
Changing a driver's log record after it was made to give them more work time or delay a break	7
Asking a driver to take sufficient time off duty to recover from fatigue	8
Communications:	
Interrupting a driver's off-duty time with a message at an inappropriate time	9
Contacting a driver promptly about a new job task so they didn't have to wait without pay	10
Paid and Unpaid Time:	
Paying a driver for customer delays in picking up or delivering freight	11
Requiring a driver to wait for customer delays for more than two hours without pay	12
Arranging a driver's loads so they had little delay time between loads	13
Requiring a driver to wait between loads for more than two hours without pay.	14
None of these	15

18. We would like your opinion of devices which automatically log duty status regarding specific characteristics. Even if you do not have them in your company's trucks, please base your answers on anything you might know or have heard. Please tell us whether you agree completely, agree somewhat, disagree somewhat, or disagree completely that each statement describes automatic duty status logging devices such as EOBRs and ELDs. *Click one answer for each.*
PROGRAMMING: RANDOMIZE ORDER OF ITEMS.

EOBRs and ELDs…	Agree Completely	Agree Somewhat	Disagree Somewhat	Disagree Completely
Protect drivers from management being overbearing	1	2	3	4
Prevent drivers from doing their job the way they want	1	2	3	4
Make management confident that truck drivers are not overworking themselves	1	2	3	4
Improve decisions which fleet managers and drivers make about driving and rest times, and management of loads	1	2	3	4
Make drivers feel less independent	1	2	3	4
Means drivers have less paperwork to fill out	1	2	3	4
Enhance the relationship between fleet managers and drivers to assure compliance and safe operations	1	2	3	4
Give management too much of an insight into drivers' days	1	2	3	4
Save management time and makes it easier for me to report HOS	1	2	3	4
Make the roads safer for everyone	1	2	3	4

If Carrier has EOBRs (10a=3 or 4), continue with 24a. Otherwise skip to 20.

19a. Thinking only about the benefits associated with automatically logging drivers' service hours, what benefits does your company get out of its EOBRs/ELDs? *Please check all that apply.*

1 Easier to record service
2 Easier to monitor service
3 Easier to maintain historic records of service
4 Can ensure that drivers are not working too long
5 Smoother accounting for payroll
6 Direct input to productivity analyses
7 Drivers are less likely to drive while fatigued
15 Other (specify)_____
16 None of these

19b. Approximately what percentage of your fleet's trucks have EOBRs/ELDs installed on them? *Please give us your best estimate.*

___%

19c. Think of the cost of each EOBR/ELD your company has installed, on average…

How much did the unit itself cost (including any software)? (whole dollars): $_____
How much does it cost to install a single unit? (whole dollars) $_____
How much is the annual operational cost of a single unit? (whole dollars) $_____

20. Federal regulations state that if drivers have safety complaints, firms must not coerce them to not file their complaints. Firms also can't coerce them to drive when fatigued -- by discriminating against the driver, or otherwise disciplining him or firing him.

In your opinion, how effective are these regulations? *Please click one answer.*

1 Very effective
2 Somewhat effective
3 Not too effective
4 Not effective at all

21. To prevent carriers from harassing their drivers by using information about hours of service which are logged automatically, which of the following do you think are good ideas? *Please click all that you feel are good ideas*.

1 Drivers can get copies of the logs through the device
2 Carriers must provide drivers back copies of their logs, for up to six months
3 Carriers are explicitly prohibited from harassing drivers
4 A formal process for complaint procedures
5 Mute functionality so drivers are not bothered when off-duty
6 An "edit" function, with edits needing mutual approval
7 Limitations on how often and when the carrier can get location data from the EOBR/ELD
8 Enforcement actions that keep drivers' personal information private
9 None of these

22. If the Federal Motor Carrier Safety Administration found that a carrier was harassing its drivers, which of the steps below do you think would be appropriate? *Please check all that apply.*

1 Closer federal monitoring
2 Fines and penalties
3 Publication of carrier actions

4 Something else (Please specify)

23. The Federal Motor Carrier Safety Administration is concerned about the use of EOBRs/ELDs to harass drivers or coerce them. It needs to make sure it properly defines these terms. *Please read the description on the next screen.* (Click to continue to next screen.)

HARASSMENT

Harassment is an act by a motor carrier, involving the use of information available through EOBR/ELD technology (either alone or in combination with other technology) to track a commercial motor vehicle driver's hours of service and requiring the driver to violate federal hours of service rules or fatigue or ill driving restrictions.

How well does this description describe your idea of harassment?

1 Very well
2 Somewhat
3 Not at all

24. Please read the definition of coercion below.

COERCION

Coercion is a threat by a motor carrier, shipper, receiver, or a transportation intermediary, to deny business or work based on a commercial motor vehicle driver's refusal to violate federal regulations governing operating a commercial motor vehicle based, at least in part, on information available through EOBR/ELD technology or a combination of technology that includes an EOBR/ELD feature.

How well does this description describe your idea of coercion?

1 Very well
2 Somewhat
3 Not at all

25. Has your company ever asked a driver to drive or work more hours than federal regulations allow?

1 Yes
2 No

If Q25=Yes, Continue With Q26. Otherwise skip to Q30.

26. How often has that happened in the last year? *Please give us your best guess if you are uncertain.*

1 Once
2 Twice
3 Three to five times
4 Six to ten times
5 11 – 25 times
6 26 - 50 times
7 More than 50 times

27. Do drivers ever reject those requests or tell you that they don't want to work more than the federal regulations allow?

1 Yes
2 No

If Q27=Yes, Continue With Q28. Otherwise skip to Q30.

28. When that happens, does your company ever threaten their job security, or with fewer assignments?

1 Yes
2 No

If Q28=Yes and Carrier Has EOBRs, Continue With Q29. Otherwise skip to Q30.

29. Is your company able to do that as a result of having access to their hours of service through their EOBRs/ELDs?

1 Yes
2 No

30. The last few questions are for classification purposes only. How many trucks does your company have, across all its locations? *Please give us your best estimate.*

1 1-5
2 6-10
3 11-20
4 21-50
5 51-100
6 101-250
7 251-500
8 501-1,000
9 1,001-3,000
10 More than 3,000

31. Do your drivers work as… *Please check all that apply.*

1 Employee of the company
2 Independent owner-operators
3 Something else? (Please specify)

32. Is your primary type of business…

1 Truck load
2 Less than truckload
3 Parcel
4 Other (Please Specify)

33. And are you a carrier for hire, or are you private?

1 For hire
2 Private

34. Approximately what percent of your drivers are members of a truck drivers union, or covered by a collective bargaining agreement?

1 None
2 1-10%
3 10-19%
4 20-29%
5 30-39%
6 40-49%
7 50-59%
8 60-69%
9 70-79%
10 80-89%
11 90-99%
12 100% (all of them)

35. Are you…

1 Male
2 Female

36. Lastly, how old are you?

1 18-24
2 25-34
3 35-44
4 45-54
5 55 or older

This concludes our survey. Thank you for participating in this important research.

CARRIERS: NON-RESPONSE FOLLOW-UP SURVEY

U.S. Department of Transportation **OMB Control Number: 2126-0055**
Federal Motor Carrier Safety Administration **Expiration Date: 1/31/2017**

MCSA-

Survey Research to Support Revisions to the Agency's Electronic Onboard Recorder (EOBR) Rule

Non-Response Survey with Carriers (Telephone)

ASK TO SPEAK TO SOMEONE IN CHARGE OF THE TRUCK FLEETS AND DRIVERS. POTENTIAL TITLES INCLUDE: FLEET MANAGER, FLEET SUPERVISOR, TRAFFIC MANAGER, DISPATCHER.

TRY AND GET THE NAME OF THE PERSON TO WHOM YOU WILL BE TRANSFERRED.

IF ASKED FOR EXPLANATION.

R1. My name is {**INTERVIEWER NAME**) and I'm calling on behalf of the Department of Transportation. We're conducting a very important research project about freight and truck driving for the Federal Motor Carrier Safety Administration and your company was scientifically selected as a company to participate. It will only take five minutes once I'm connected.

IF NEEDED: All answers will be kept strictly private. Under the requirements of the Paperwork Reduction Act a federal agency may not conduct or sponsor a collection of information, and a person is not required to respond to it nor subject to a penalty for failing to participate. Participation is completely voluntary. There is an OMB control number for this quick survey, and it is 2126-0055.

1. **When connected:** My name is **INTERVIEWER NAME** and I'm calling on behalf of the Department of Transportation. We're doing a quick 5 minute survey with people who deal with truck drivers.

IF NEEDED: All answers will be kept strictly private. Under the requirements of the Paperwork Reduction Act a federal agency may not conduct or sponsor a collection of information, and a person is not required to respond to it nor subject to a penalty for failing to participate. Participation is completely voluntary. There is an OMB control number for this quick survey, and it is 2126-0055.

Are you responsible for managing truck drivers at your company? (At some companies the title might be "fleet manager" or "dispatcher.")

1 Yes
2 No **Ask to speak to someone with that responsibility. Record contact information.**

2. Are the truck drivers at your company required to keep a record of hours? *Please click one answer.*

1 Yes
2 No **Terminate**

3. Your company was sent a letter about this survey, asking that someone with responsibility for managing truck drivers to go online and fill out our survey. **CONSULT SAMPLE ELEMENTS. IF SAMPLE=NONRESPONDER, SCRIPT=**No one from your company did, **IF SAMPLE=BREAKOFF, SCRIPT=**Someone from your company started it but didn't finish it, **ALL:** and we're trying to learn more. Do you remember getting the letter about the survey on EOBRs and ELDs?

1 Yes **Continue with Q4**
2 No **Skip to Q3a**
3 Don't know/not sure **Skip to Q3a**
4 Refused **Skip to Q9**

3a. Could it possibly have been sent to someone else?

1 Yes **Who? Ask to be transferred to that person or sent to operator. Repeat introduction when speaking to that person.**
2 No **Skip to Q9**
3 Don't know/not sure **Skip to Q9**
4 Refused **Skip to Q9**

ONLY ALLOW TWO LOOPS BETWEEN BOTH Q3A AND Q4. (AFTER INTERVIEWER HAS EXHAUSTED THREE CONTACTS [INCLUDING FIRST CALL], SKIP TO Q6.)

4. Did you forward the letter to someone else to fill out?

1 Yes **Ask to be transferred to that person; record contact information. Repeat introduction when speaking to that person.**
2 No **Continue with instructions before Q5a**
3 Don't know/not sure **Skip to Q9**
4 Refused **Skip to Q9**

IF SAMPLE = NONRESPONDER, CONTINUE WITH Q5a.
IF SAMPLE = BREAKOFF, CONTINUE WITH Q6.

5a. We hear a variety of reasons why people don't fill out surveys. I'm going to read you a list, and for each item please tell me whether or not it was a reason why you didn't go online and fill out the survey. **Read each item one at a time and record yes/no for each. (Order will be randomized.)**

	Yes	No	DK	Ref
I didn't have the time	1	2	3	4
I didn't think my answers would matter	1	2	3	4
I was afraid my answers would become known	1	2	3	4
I didn't want to use a work computer, and don't have Internet access at home	1	2	3	4
My company doesn't let us fill out surveys	1	2	3	4
I don't trust the government	1	2	3	4
Surveys ask too much sensitive information	1	2	3	4
I started to fill it out but got nervous	1	2	3	4
I tried to, but the survey was already closed.	1	2	3	4

5b. Besides what we just discussed, are there any other reasons which you might have had for not filling out the survey? **Record verbatim. Probe:** Any other reasons?

_____

IF SAMPLE = NONRESPONDER, SKIP TO Q9
SAMPLE=BREAKOFF CONTINUE HERE.

6. Did you start the survey?

1	Yes	**Continue with Q7a**
2	No	**Skip to Q8**
3	Don't know	**Skip to Q9**
4	Refused	**Skip to Q9**

7a. We hear a variety of reasons why people don't finish filling out surveys. I'm going to read you a list, and for each item please tell me whether or not it was a reason why you didn't finish filling out the survey. **Read each item one at a time and record yes/no for each. (Order will be randomized.)**

	Yes	No	DK	Ref
I didn't have the time	1	2	3	4
I didn't think my answers would matter	1	2	3	4
I was afraid my answers would become known	1	2	3	4
I didn't want to use a work computer, and don't have Internet access at home	1	2	3	4
My company doesn't let us fill out surveys	1	2	3	4
I don't trust the government	1	2	3	4
Surveys ask too much sensitive information	1	2	3	4
I started to fill it out but got nervous	1	2	3	4
I tried to, but the survey was already closed.	1	2	3	4
Questions seemed biased or unfair	1	2	3	4

7b. Besides what we just discussed, are there any other reasons which you might have had for not finishing the survey? **Record verbatim. Probe:** Any other reasons?

_____

AFTER ASKING 5b, SKIP TO Q9

8. Do you know who might have?

1	Yes	**Who? Ask to be transferred to that person or sent to operator. Repeat introduction when speaking to that person.**
2	No	**Skip to Q9**
3	Don't know/not sure	**Skip to Q9**
4	Refused	**Skip to Q9**

9. Thanks. Now please tell me, what tools does your company use to track your drivers' "duty status" for compliance with the Federal hours of service regulations? **Read list. Record all that apply.**

1 Paper logs
2 Tachographs
3 An EOBR/ELD which only logs your drivers' duty status (automatically when the truck starts and stops, as well as when they manually start it logging)
4 An automatic EOBR/ELD which is part of a fleet management system, including other functions such as real time communications between your company and your drivers
5 Don't know/not sure

If answer 4 in 9, ask 10. Otherwise skip to end.

10. There are a variety of types of equipment which are synched to the engine to automatically record service hours, and serving the function of an EOBR/ELD. Which of them does your company have in its trucks? **Read list. Record all that apply.**

1 A smartphone synched to the engine, and logging the hours
2 A laptop synched to the engine, and logging the hours
3 A console/display that is not a smartphone or computer, branded with a manufacturer's name
4 Another device (Please Specify)
5 None of these

Do not read

6 Don't know/not sure
7 Refused

This concludes our survey. Thank you for participating in this important research.

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