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Electronic Recorder Study

Final Report

by

Kenneth L. Campbell
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The University of Michigan
Transportation Research Institute

and

Michael C. Smith
Science Applications International Corporation

June 1998

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16. Abstract <p>Information on the current use of electronic recorders and opinions on mandatory electronic recorder use was obtained from truck and bus fleets and owner operators through the cooperation of several trucking industry associations. This study does not address the relationship of electronic recorders to compliance with HOS, nor the relationship of compliance with HOS to fatigue or safety. Due to the low response rate (12 percent), the results cannot be considered as representative of the larger population of fleets and trucks. One-third or more of responding NPTC members, and large private and for-hire fleets used electronic recorders, although only about half were equipped with the HOS function. There is a clear pattern, evident in the responses received and the 1992 TIUS data, of increasing ER use with larger fleets. ER use ranges from 0 to only a few percent in small truck fleets, among owner operators, and in bus fleets.</p> <p>Use of electronic recorders to maintain HOS records saved drivers 20 minutes per day in comparison to paper logbooks, based on the median difference. Administrative personnel saved 20 minutes per driver per month using electronic recorders. These results should not be considered representative of the national population due to the low response rate and small sample size.</p> <p>The association between fleet size and the use of electronic recorders appears to be an important issue. Based on the 1996 MCMIS data, 90 percent of all carriers operate less than 9 trucks. There is no evidence that ERs are cost effective in small fleets. The overwhelming view of fleets of all sizes is that mandatory use of electronic recorders would require an excessive expenditure for minimal benefits.</p>					
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ft	feet	0.305	meters	m	meters	3.28	feet	ft
yd	yards	0.914	meters	m	meters	1.09	yards	yd
mi	miles	1.61	kilometers	km	kilometers	0.621	miles	mi
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gal	gallons	3.785	liters	L	liters	0.264	gallons	gal
ft ³	cubic feet	0.028	cubic meters	m ³	cubic meters	35.71	cubic feet	ft ³
yd ³	cubic yards	0.765	cubic meters	m ³	cubic meters	1.307	cubic yards	yd ³
NOTE: Volumes greater than 1000 l shall be shown in m ³ .								
MASS								
oz	ounces	28.35	grams	g	grams	0.035	ounces	oz
lb	pounds	0.454	kilograms	kg	kilograms	2.202	pounds	lb
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact)								
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celsius temperature	°C	Celsius temperature	1.8C + 32	Fahrenheit temperature	°F
ILLUMINATION								
fc	foot-candles	10.76	lux	lx	lux	0.0929	foot-candles	fc
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS								
lbf	poundforce	4.45	newtons	N	newtons	0.225	poundforce	lbf
lbf/in ²	poundforce per square inch	6.89	kilopascals	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 September 1993)

FOREWORD

This study was a joint effort. The Federal Highway Administration Office of Motor Carriers sponsored the project. Bryan Price (OMC) served as Contract Technical Manager (CTM) and provided the objectives, scope and basic approach. The study was managed by Dave Barry of the National Private Truck Council (NPTC). The study was conducted jointly by The University of Michigan Transportation Research Institute (UMTRI), Science Application International Corporation (SAIC), and NPTC.

The study team wishes to acknowledge the cooperation and assistance of the 5 associations: the National Private Truck Council (NPTC), Owner Operator Independent Drivers Association (OOIDA), Independent Truck Drivers Association (ITDA), American Bus Association (ABA), and the United Motorcoach Association (UMA). The study relied on the assistance of these associations and their members for the information provided. We would also like to acknowledge many other private and for-hire fleets that provided information individually.

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1 Introduction

The Insurance Institute for Highway Safety (IIHS) and other organizations have petitioned the Federal Highway Administration (FHWA) several times to initiate rulemaking to require electronic recorders in commercial vehicles that are currently required to maintain logbooks. In 1986, the IIHS first petitioned FHWA to require interstate carriers to use on-board recording devices for recording driver's hours of service (HOS). After initially denying the request, it was reconsidered and rulemaking was initiated the following year to allow use of "automatic on-board recording devices" in lieu of paper logbooks on a voluntary basis. This rule became final in 1988 as 49 CFR 395.15. At that time, the majority of comments received opposed a mandatory requirement, although they welcomed the opportunity for carriers to use them if they wished. The high cost of electronic recorders was a key issue cited in the comments. One manufacturer of on-board recorders offered that their system was not designed to be cost-effective for small carriers.

The IIHS was joined by several other organizations in August 1995 to renew their petition for mandatory use of electronic recorders. The petition asserts that required use of electronic recorders would improve compliance with hours of service regulations by drivers. Improved compliance is, in turn, expected to reduce fatigue among interstate truck drivers and improve safety. Economic benefits are also described as arising from improved safety and efficiencies associated with electronic recorder use.

In this report, a device that meets the requirements of 49 CFR 395.15 will be referred to as an electronic recorder, abbreviated as ER. It is estimated that approximately 5 percent of all medium and heavy duty trucks are equipped with a trip recorder of some type (1992 Truck Inventory and Use Survey).

The objective of this study was to query trucking industry associations on the costs and benefits of the use of electronic recorders for compliance with hours of service (HOS) regulations and industry attitudes towards mandatory use of electronic recorders. The scope of the study is all truck and bus fleets authorized for interstate operation. Owner operators were also included. For purposes of this study, an owner operator does not have interstate authority, but operates under the authority of the company they are hauling for. This definition avoids overlap among the available fleet listings since owner operators that have their own operating authority are included with small authorized fleets.

The study does not address the relationship of electronic recorders to compliance with HOS, nor the relationship of compliance with HOS to fatigue or safety. While pertinent to the petition, the purpose of this study was to gather information from carriers on the current use of electronic recorders. The relationship of HOS to fatigue and safety is

complex and is the subject of other research programs.¹ Study designs were considered to address the relationship of electronic recorders to compliance with HOS. Such information could be best obtained during roadside enforcement stops or during carrier reviews, but current policy for both roadside inspections and carrier reviews concentrates on carriers that are suspected of safety violations. A study of HOS compliance and electronic recorder use could not be added to current enforcement operations because the fleets (and vehicles) currently inspected are not representative. Shifting enforcement to a random sample would be too disruptive and the small number of electronic recorders currently in use makes any study very difficult. Information on compliance with HOS is considered too sensitive to expect accurate responses in a voluntary survey of carriers. In addition, multiple variables (differing routes, schedules, drivers, management practices, etc.) would make it very difficult to definitively tie improved compliance solely to ERs. ERs are only useful in controlling HOS to the extent that carrier management is committed to controlling HOS. In other words, ERs themselves do not improve compliance; management must act on the data provided by ERs. Given these considerations, an initial survey to collect more general and less sensitive information on the number of fleets using electronic recorders, the characteristics of the fleet operation, and the company view of electronic recorder use seems an appropriate starting point.

¹ Wylie, C.D., Shultz, T., Miller, J.C., Mitler, M.M.; Mackie, R.R. 1996. *Commercial Motor Vehicle Driver Fatigue and Alertness Study*. Essex Corporation, Goleta, Ca. 559p. Sponsor: Federal Highway Administration, Washington, D.C., Trucking Research Institute, Alexandria, Va., Transport Canada, Ottawa, Ontario. Report No. FHWA-MC-97-002/ TP 12876E.

2 Study Questions

Study questions were developed that focused on the costs and benefits of the use of electronic recorders to record HOS. The final version of the questions covered 4 pages. After a half-page introduction and instructions, questions were organized in the following 4 areas:

- I. Company and Operation
- II. Use of Electronic Recording Devices
- III. Hours of Service Recording
- IV. Comments

The first section addressed basic descriptive information on the type of company and operation. Questions included whether the fleet was private or for hire, interstate or intrastate, the number of power units and drivers, average annual miles per power unit, primary method of monitoring hours of service, and other questions addressing driver pay, regularity of routes and schedules, truckload versus less than truckload, and over-the-road versus local pickup and delivery operations.

The second section addressed fleets that had electronic recorders. The questions addressed the number of power units with electronic recorders, how long the ERs have been in use, costs of buying and operating the ER units, functions the electronic recorder provided and reasons for installing ERs.

Part III included only 2 questions on the time per day for drivers to comply with the reporting requirements for hours of service and the administrative time to maintain records of HOS compliance. Each question was asked for paper logbook use and electronic recorder use.

The last page asked for a description of the operational, economic, and safety effects mandatory electronic recorder use would have on their business. Fleets were also asked why they were not using electronic recorders. The complete set of questions is in Appendix A.

Three versions of the questions were developed to address authorized trucking firms, owner operators, and bus fleets. The differences among the versions were largely changes in language appropriate for each carrier type. The form type is indicated as T, O, or B as shown later in Table 4 as part of a form number to identify the form version and group number. The 3 versions are included in Appendix A. Only questions in Part I (company information) of each form have wording differences. Parts II (use of electronic recorders) and III (hours of service recording) are the same for each form. The introduction on page 1 and the open-ended questions on page 4 are also the same across all forms.

The development and pilot testing of questions was a collaborative effort on the part of several organizations including the FHWA Office of Motor Carriers, Science Applications International Corporation (SAIC), the National Private Truck Council (NPTC), and University of Michigan Transportation Research Institute (UMTRI). The introduction and question items were written, reviewed, and edited several times before they were included in the final form drafts.

3 Method

The approach for this study was to solicit the cooperation of trucking industry associations to gather information on electronic recorder use from their members. Five associations agreed to participate in the study. Participating associations are listed in Table 1 below.

Table 1
Participating Associations

Association	Membership
National Private Truck Council (NPTC)	941
Owner Operator Independent Drivers Association (OOIDA)	9,510*
Independent Truck Drivers Association (ITDA)	150
American Bus Association (ABA)	727
United Motorcoach Association (UMA)	850

*Members for more than 2 years that *do not* have their own operating authority. Total membership in OOIDA is about 35,000.

Unfortunately, the largest association, the American Trucking Associations, Inc. (ATA) declined to participate. The membership of participating truck associations was not felt to be representative of all truck fleets. The major gaps are for-hire carriers, represented by ATA, and small fleets. The majority of NPTC members are medium size fleets, with some large fleets and few small fleets.

The owner operator associations represent a special niche in the industry. They are carriers operating in interstate transportation that *do not* have interstate operating authority. They operate under the authority of the trucking firms they haul for. For the most part, these are all small fleets.

Bus fleets tend to be mostly medium and small fleets, with a few large bus companies. Since both bus associations agreed to participate, no effort was made to supplement their membership lists.

3.1 Census File Groups

In order to provide more comprehensive coverage of truck fleets, UMTRI obtained the Motor Carrier Management Information System (MCMIS) Census File (dated November 22, 1996) from the FHWA Office of Motor Carriers. This file lists the names of all carriers with interstate operating authority, both private and for-hire. Using this census file, interstate carriers were stratified into three size groups including small, medium, and large fleets. Each size grouping was separated into private and for-hire companies.

Approximately 60,000 carriers in the OMC census file were excluded from the selection process. These companies had missing, incomplete, or undeliverable addresses. They were also shippers, government carriers, passenger carriers, or had missing authority. An important variable for this study in the census file was the total number of trucks operated by the carrier, or fleet size. However about 17 percent of the remaining total were missing fleet size information. These were added into the small fleet size category. Table 2 shows the number of carriers in the OMC census population.

Table 2
1996 MCMIS Census File
Population of Companies by Company Type and Fleet Size

Fleet Size	For-Hire		Private		Total	
	N	Percent	N	Percent	N	Percent
Less than 9 or Unk	129,372	36.2%	192,152	53.8%	321,524	90.0%
9-100 trucks	15,711	4.4%	17,560	4.9%	33,271	9.3%
More than 100 trucks	1,411	0.4%	1,006	0.3%	2,417	0.7%
Total	146,494	41.0%	210,718	59.0%	357,212	100.0%

Table 2 shows the overwhelming proportion of fleets with less than 9 trucks. Small fleets make up 90 percent of all authorized interstate carriers. There are somewhat more private fleets (59 percent) in comparison to for-hire fleets (41 percent). Private fleets carry their own goods, while for-hire fleets carry goods for others. Most of the difference in the distribution of carriers between private and for-hire fleets is in the small fleet size group where there are more private fleets. Among for-hire fleets, there are more large fleets.

The three size categories were developed so that the full range of companies would be represented if possible. The use of electronic recorders is expected to be more common among medium and large fleets, while small companies make up most of the trucking industry businesses. Consequently, fleet size is expected to be an important variable for relating the study findings to the larger population of all interstate carriers.

It is also of interest to look at the distribution of trucks by the size of the fleet they are in. The number of trucks in each fleet is recorded in the MCMIS census file. As in Table 2, fleets with unknown fleet size (17 percent) were assumed to be small and assigned the average number of trucks per fleet for this strata. The resulting estimates of the distribution of trucks by fleet size are shown in Table 3.

Here, the dominance of the large fleets is shown. Based on Table 3, large fleets operate about 40 percent of all interstate trucks, while the small fleets operate less than 30 percent. However, this result should be regarded as an estimate. The census file was not intended to support estimates of the truck population. The fleet size information was provided by the carrier. All vehicles are included in the count, not just medium and heavy power units. This information has not been verified or compared to other estimates of the truck population. However, it provides an illustration of the differences

in distribution by fleet size, depending on whether one counts fleets (Table 2) or trucks (Table 3).

Table 3
1996 MCMIS Census File
Truck Population by Company Type and Fleet Size

Fleet Size	For-Hire		Private		Total	
	N	Percent	N	Percent	N	Percent
Less than 9 or Unk	271,206	11.4%	424,681	17.8%	695,887	29.2%
9-100 trucks	369,601	15.5%	360,448	15.1%	730,049	30.6%
More than 100 trucks	584,740	24.5%	375,113	15.7%	959,853	40.2%
Total	1,225,547	51.4%	1,160,242	48.6%	2,385,789	100.0%

A sample of carriers from the census file was randomly selected to supplement the memberships of the cooperating associations. In order to capture the small number of large companies with over 100 power units, all large companies were selected. Approximately equal numbers of medium and small companies were also chosen. The selected OMC companies span all three size categories, as well as for-hire and private fleets. Table 4 shows the number of companies selected from the OMC census file by fleet size and company type.

Table 4
Fleets Selected from the OMC Census File by Size and Type

Fleet Size	For-Hire	Private	Total
Less than 9 or Unknown	1,002	1,000	2,002
9-100 trucks	1,047	1,032	2,079
More than 100 trucks	1,411	1,006	2,417
Total	3,460	3,038	6,498

The 6 groups selected from the OMC census file were combined with the 5 associations to form 11 analysis groups for the study. Table 5 shows the 11 groups. A primary objective was to get cost-benefit information from carriers with ERs. However, no listing that identified fleets with electronic recorders was available to the study. In the general population, the use of ERs is believed to be only about 5 percent of all fleets. This means that a sample that cannot distinguish ER use in advance will achieve very disparate sample sizes for fleets with and without ERs. This is a fundamental problem with a broad survey. Response rates to this form were anticipated to be as low as 20 percent in some groups. Assuming 5 percent recorder use, about 125 responses from fleets with ERs was expected.

Table 5
11 Groups for the Electronic Recorder Study

Association/ Census Groups	Form No.	Population N	Selection N
NPTC	T1	941	941
Large Private	T2	1,006	931
Medium Private	T3	17,560	1,032
Small Private	T4	192,152	1,000
Large For Hire	T5	1,411	1,411
Medium For Hire	T6	15,711	1,047
Small For Hire	T7	129,372	1,002
OOIDA	O1	9,510	1,500
ITDA	O2	150	150
ABA	B1	727	727
UMA	B2	850	850
TOTAL			10,591

3.2 Mailing Forms

Forms were provided to each of the participating associations. Each association included its own cover letter describing the nature and substance of the questions and distributed the forms. For example, OOIDA randomly selected 1,500 members to receive the form. The cover letters included a description of hours of service recording and the use of electronic recording units. See Appendix C for copies of the cover letters. The NPTC also mailed forms to the 3 OMC private fleet groups (T2 — T4). UMTRI mailed forms to the remaining 3 groups (T5 - T7). No cover letter was enclosed with the forms sent to for-hire carriers. See Appendix B for a listing of approximate mailing dates for each of the 11 groups.

The selected number of companies to receive the T2 form was reduced from 1,006 to 931 before mailing. NPTC manually removed firms selected from groups T2 that were also members of NPTC to avoid duplicate mailings. These 75 companies were subsequently deleted from the OMC T2 groups. The forms do not include an identification number to allow a returned form to be linked to an individual respondent. The form number, however, is indicated on the top right corner of page 1 and page 4. The form number allowed each return to be grouped into one of the 11 association/census groups for data management and analysis.

4 Response and Data Management

4.1 Response Rates

Response rates for the 11 groups ranged from 3.1 percent for small private fleets (T4) to 24.4 percent from OOIDA members (O1). The overall response rate was 11.8 percent. These rates were based on the number of returned questionnaires divided by the selected N. Known undeliverable returns range from 0 to 100 for small for-hire fleets (T7). The number of forms that could not be delivered is unknown for three associations. Table 6 shows the response rate and number of forms that were undeliverable for each groups.

**Table 6
Response Rates by Group***

Association/ Census Groups	Form List	Selection N	Response N	Response Rate	Not Delivered
NPTC	T1	941	210	22.3%	3
Large Private	T2	931	47	5.0%	46
Medium Private	T3	1,032	47	4.6%	58
Small Private	T4	1,000	31	3.1%	78
Large For Hire	T5	1,411	101	7.2%	69
Medium For Hire	T6	1,047	88	8.4%	80
Small For Hire	T7	1,002	50	5.0%	100
OOIDA	O1	1,500	366	24.4%	0**
ITDA	O2	150	23	15.3%	?
ABA	B1	727	115	15.8%	?
UMA	B2	850	168	19.8%	?
TOTALS		10,591	1,246	11.8%	

* Results as of 3/12/97

** Replaced 4 undeliverable companies with 4 additional companies

Forms were mailed out during the month of January 1997. In order to initiate analyses of the data, a cut-off date of March 12, 1997, was determined. Only 13 forms were returned after this date, and only two of these companies used recorders. Information from these late returns was not included.

These response rates are lower than anticipated and disappointing. Response rates from 20 to 35 percent are generally expected from a single mailing without any follow-up. Five of the selection groups were associations querying their own members, and the three private fleet groups were queried by an association representing private carriers. Among these, OOIDA achieved the highest response rate (24 percent), followed by NPTC at 22 percent. The remaining associations had responses between 15-20 percent. Only about 5 percent of the privates fleets not belonging to an association responded.

From 5-8 percent of for-hire fleets responded to forms sent by UMTRI. Although forms were sent to a representative cross section of the industry, the information obtained can only be considered as representative of the responses received due to the low response rate.

4.2 Data Management

Data Editing. After logging each returned form into groups by association and list number, information from each of the 1,246 returns was reviewed twice. First, an editor read each answer for clarity and uniform responses across forms. Decisions about written comments in the margins were also made. A second editor reviewed the work of the first editor to ensure accuracy and completeness of the data. Specific editing and check-editing procedures are given for each of the three form types (T, O, and B) in Appendix B. This appendix also provides information on coding that was the same across the three forms.

Page 4 of the questionnaire was not edited or check-edited (see Appendix A for copies of the forms). Rather, this page of open-ended questions was photo copied for each return after carefully masking the identifying information of the respondent's name and telephone number. These copies were sent to the five respective associations (NPTC, OOIDA, ITDA, ABA, and UMA) for review. A listing of which returns had ERs, and which did not have ERs, was also sent to the associations. It was believed that knowledge of ER use would aid the reader in interpreting questions on operational effects, economic effects, safety, and reasons for not using an ER. A complete set of page 4 copies for all returned questionnaires was sent to Science Applications International Corporation.

Data Entry. After editing, answers to all questions on pages 1 through 3 of each form were keypunched into electronic data files using Raosoft² software. This software program allows the keypuncher to enter answers into an electronic screen which looks like the original questionnaire. This capability helps to reduce the number of errors entered. Initially, 11 files were created, one for each of the 11 stratification lists (i.e. T1 through T7, O1, O2, B1 and B2). To ensure accuracy of data entry, each form was entered twice; this procedure produced 22 data files. The two files for each of the 11 lists were converted into ASCII files and compared using a checking utility. Finally, the 7 cleaned T-form files were concatenated into one file. This was also done for the O files and B files. Data analyses were performed using these final 3 ASCII data files.

Data Analyses. Statistical Analysis System (SAS)³ was used to conduct all analyses. Univariate frequencies, means, standard deviations, minimum and maximum codes are shown as descriptive outcomes for several items in the questionnaire. The majority of

² Raosoft Inc. 1992 *Raosoft Survey First*. Version 2.5 for PC and Compatibles. Seattle, WA.

³ SAS Institute Inc. 1996. *Statistical Analysis System (SAS)*. Release 6.11 for Windows. Cary, NC.

the analyses involved two-way contingency tables that show selection groups or company size by HOS or ER use variables. Other two-way tables are also shown.

Measures. Several measures, based on questionnaire items and sampling design were used in the analyses. These include selection groups, company fleet size and operation, HOS primary method and reporting, four scales measuring vehicle miles driven, and recorder use variables.

Association/Census groups were described previously and include the 11 groups sampled, including the 3 kinds of company fleets (T, O, and B) and 2 types of T-form companies (private and for hire). Five truck and bus associations are represented.

Company fleet size was defined by the OMC census file measure as small (1-9 trucks), medium (10-100 trucks), and large (more than 100 trucks). Company operation was the two categories of "interstate" and "intrastate."

The primary method used by companies for monitoring driver HOS included the 5 categories of paper logbooks, timecards, electronic recorder with HOS module, other, and mixed (companies with no clear "primary" method). Question 6 on T-forms and O-forms, and question 7 for B-forms provided this measure. Responses to this item for O-form companies could be used exactly as coded. The primary method for T-form and B-form returns was determined as follows: Because 16.0 percent of the B-form responses and 36.6 percent of the T-form responses had one or more primary method marked, the number of drivers reported for each method was divided by the sum of drivers using the 4 methods of paper logbooks, timecards, ER, and other. This was done for each company. If the outcome was greater than or equal to 50 percent use for a given HOS method, and less than 50 percent use for all other methods, that company was defined as having the first method. For example, if Company X had 50 percent paper logbooks, and less than 50 percent in timecards, electronic recorders, and other, then Company X used paper logbooks as a primary method for HOS. In addition, if a company had ≥ 50 percent for paper logbooks, and 50 percent or more for *any* of the other 3 methods, the company was coded as having paper logbooks as primary. If a company had < 50 percent paper logbooks, ER as ≥ 50 percent, and one or both of the remaining two methods as ≥ 50 percent, then the company was coded as having ERs as primary.

Recorder use was measured in two ways. First, the company had ERs if the respondent filled out Part II of the questionnaire, and gave a nonzero number to Question 10. "How many vehicles are equipped with electronic recorders?" A second measure of recorder use included answering "yes" to the HOS recording function in Question 15. Both of these measures are dichotomous variables with "yes" and "no" categories.

Recorder variables are all of the items in Part II of the questionnaire. These include the continuous-level measures of (1) number of vehicles with recorders; (2) number of years with recorders; (3) cost per vehicle for installing recorders; and (4) maintenance and operating cost per vehicle. There are also several category items including: (1) Will the company recover its investment? The categories include "yes," "no," and "uncertain." (2) The performance rate of recorder, which includes the categories of "trouble free," "occasional problems," and "frequent problems." (3) Seven recorder functions with "yes" and "no" categories. These functions include engine operation, vehicle status, vehicle location, communications, regulatory compliance, driver HOS, and other. (4) Seven reasons for acquiring ERs ranked from 1 (highest rank) to 7 (lowest rank). These ranks include HOS compliance, taxes or fees compliance, vehicle operating cost, business management, engine/vehicle maintenance, communications, and other.

5 Electronic Recorder Use

This section focuses on the number of fleets using ERs and the characteristics of those fleets. First, study returns are described by association/census groups. Population inferences on ER equipment and the use of the HOS function to comply with reporting requirements are discussed.

5.1 Description of Returns

Returns for the 11 association/census groups involve 3 kinds of fleets; truck (T), owner operator (O), and bus (B); 2 types of operations (private and for-hire); 5 associations; and 3 fleet size categories. As described earlier in the Method, the census groups are based on fleet size and company type. Table 7 shows the overall returns (interstate and intrastate) by selection group. There were a total of 574 T companies, 389 O companies, and 282 B companies. The column percents show the distribution of the responses received across the groups. The largest number of responses was received from OOIDA (366), followed by NPTC (210).

Table 7
Number and Percent of Returns by Group

Form No	Association/Census Groups	N	Column Percent
T1	NPTC	210	36.6
T2	Large Private	47	8.2
T3	Medium Private	47	8.2
T4	Small Private	31	5.4
T5	Large For Hire	101	17.6
T6	Medium For Hire	88	15.3
T7	Small For Hire	50	8.7
Total		574	100.0
O1	OOIDA	366	94.1
O2	ITDA	23	5.9
Total		389	100.0
B1	ABA	114	40.4
B2	UMA	168	59.6
Total		282	100.0

Table 8 and each succeeding table only includes *interstate* carriers. The *intrastate* carriers inadvertently included are omitted from Table 8 and all subsequent tabulations in this section. There are a total of 535 private and for-hire interstate truck fleets, 373 interstate owner operator companies, and 279 interstate bus companies. Owner

operators with interstate operating authority are included in groups T4 or T7. Only owner operators without their own operating authority were included in groups O1 and O2.

Table 8
Interstate Companies by Association/Census Groups

List	Groups	N	Percent
T1	NPTC	202	37.8
T2	Large Private	44	8.2
T3	Medium Private	40	7.5
T4	Small Private	26	4.9
T5	Large For Hire	97	18.1
T6	Medium For Hire	81	15.1
T7	Small For Hire	45	8.4
Total		535	100.0
O1	OVIDA	350	94.1
O2	ITDA	22	5.9
Total		372	100.0
B1	ABA	113	40.5
B2	UMA	166	59.5
Total		279	100.0

Table 9 shows the reported company size for T, O, and B companies. About half of the T and B companies are medium-sized fleets (9-100 units), while 97.6 percent of the O companies are small (1-8 units). Over one quarter of the T companies are large (over 100 units), where as very few of the O and B companies are large. Table 9A shows the size breakdown for NPTC (T1) companies only. While nearly 19 percent are large, 66.8 percent are medium-sized companies.

Table 9
Reported Interstate Company Fleet Size
by T, O, and B Companies

Fleet Size	Truck Fleets		Owner operators		Bus Fleets	
	N	Percent	N	Percent	N	Percent
1-8	112	21.0	360	97.6	113	40.5
9-100	273	51.2	6	1.6	155	55.6
101+	148	27.8	3	0.8	11	3.9
Total	533	100.0	369	100.0	279	100.00
	(Missing = 2)		(Missing = 3)			

Table 9A
Reported Interstate Company Fleet Size
by NPTC Companies

Size	Group T1 (NPTC)	
	N	Percent
1-8	29	14.4
9-100	135	66.8
101+	38	18.8
Total	202	100.00

For each of the census groups (T2-T7), reported fleet size was compared with the selection group size (table not shown). Of the 364 T2-T6 returns, 12.9 percent were large private and 27.8 percent were large for-hire companies. Only 8.2 percent of these private fleets and 23.9 percent of the for-hire reported having 100 or more power units. This represents about a 3.9 percent to 4.7 percent *reduction* in the number of large OMC companies. The reported size in both the small and medium companies was a modest *increase* of 1.3 percent to 2.8 percent. These differences in selection group size and reported size are likely due to company reporting. When the form was being filled out by the company owner/manager, perhaps only the actual number of units currently on site were reported. These differences in selection group size and reported group size are not of practical significance for this project. In the tables that follow, the fleet size category for groups T2-T7 is based on the original selection group, not reported fleet size. For each of the other 5 association groups, reported fleet size is shown for comparison.

Table 10 shows the distribution of returns by company type and fleet size for interstate truck fleets in the same format as the carrier population data from the MCMIS census file shown in Table 2. The objective was to achieve approximately equal numbers of responses in each of the 6 categories shown. The returns show somewhat fewer for-hire carriers (41.7 percent) as compared to private (58.3 percent). It is only coincidence that these proportions approximately match the populations proportions in Table 2. The distribution across fleet size is not quite uniform as intended. Large fleets are approximately as intended at one-third, but the small fleets are less than 20 percent and nearly half are medium-size fleets. These deviations are a consequence of differential response rates (shown in Table 6) and the dominance of medium-size fleets among NPTC members (as shown in Table 9A above).

Table 10
Distribution of Responses by Company Type and Fleet Size
for Interstate Authorized Truck Fleets (T1-T7)

Fleet Size	For-Hire		Private		Total	
	N	Percent	N	Percent	N	Percent
Less than 9 or Unknown	45	8.4%	55	10.3%	100	18.7%
9-100 trucks	81	15.1%	175	32.7%	256	47.9%
More than 100 trucks	97	18.1%	82	15.3%	179	33.5%
Total	223	41.7%	312	58.3%	535	100.0%

No attempt was made to weight the returns to represent the national population of carriers in the aggregate. There are several reasons for this approach. (1) Due to the low response rates, the returns are not likely to be representative of the population. This limits the analysis to characterizing the responses received. (2) the population is dominated by the more than 300,000 small carriers that operate less than 9 trucks. Weighted statistics would be dominated by this group and would tend to obscure the returns from other groups. (3) The objective was to characterize the use of recorders in various segments of the industry as defined by the study groups. Although response rates were low, the study design ensured more or less uniform numbers of returns for each group. The design supports analysis of differences in the responses across the 11 groups. To this end, most results will be shown separately for the 11 groups. Although column totals are shown in most tables, they represent only the aggregate of the responses. As such, they do not represent the population of all carriers, since some study groups were drawn from much larger population groups than others.

5.2 Electronic Recorders

A major objective of this study was to analyze the use of electronic on-board recording devices to monitor driver HOS. Although companies may have an electronic HOS device, they may not use it as their primary method of reporting driver hours of service. Before looking at companies who reported having an electronic HOS module in more detail, we examined the extent of ER installation across the industry. One would like to know how many fleets (and trucks) have ERs already and whether their use is more prevalent in particular segments of the industry. The following section begins with data on recorders from the 1992 Truck Inventory and Use Survey (TIUS).

The best existing survey data covering all medium and heavy trucks is the 1992 Truck Inventory and Use Survey (TIUS) conducted by the Census Bureau. The TIUS is based on a large sample of registered trucks covering all states. The survey form is mailed to the registered owner of the selected trucks. Thus, one important difference is that TIUS is a survey of *trucks*, while the questions on this electronic recorder survey were addressed to the company or fleet.

Fleet size is recorded in three categories for each truck in the 1992 TIUS. Consequently, the TIUS file provides another opportunity to look at the distribution of

trucks by fleet size, as we attempted to do in Table 3 using the MCMIS census file. The corresponding result from the 1992 TIUS file is shown in Table 11.

Table 11
Truck Population
by Company Type and Fleet size
1992 Truck Inventory and Use Survey

Fleet Size	For-Hire		Private		Total	
	N	Percent	N	Percent	N	Percent
Less than 10 or Unk	244,877	6.3%	1,904,990	49.4%	2,149,867	55.7%
10-99 trucks	191,061	5.0%	796,733	20.7%	987,794	25.6%
More than 99 trucks	310,439	8.0%	408,694	10.6%	719,133	18.6%
Total	746,377	19.4%	3,110,417	80.6%	3,856,794	100.0%

We would like to compare the results from the 1992 TIUS with results from the 1996 MCMIS census file and with responses to our questions on electronic recorder use. However, several differences make the comparisons approximate at best. (1) As already mentioned, the TIUS data are from 1992 and TIUS is a survey of trucks, rather than fleets. (2) The fleet size categories differ by one. For example, small fleets are 1-9 trucks in TIUS and 1-8 trucks in the MCMIS census file. (3) Most important is that interstate carriers cannot be accurately identified in TIUS. This problem apparently arises due to missing data on vehicle ICC regulation questions. In previous TIUS surveys, this question was only addressed to trucks operated by for-hire carriers. In 1992, only a few percent of privately operated medium and heavy trucks were coded as ICC regulated and about half of for-hire trucks. In the 1987 and 1982 TIUS, about 90 percent of for-hire tractors were coded as *interstate*.⁴ The coded response in the 1992 TIUS file cannot distinguish missing data from intrastate. The responses make it clear that many interstate carriers failed to make the appropriate indication. Consequently, all medium and heavy trucks were included in Table 11.

Comparing Table 3 from the 1996 MCMIS census file and Table 11 from the 1992 TIUS reveals large differences in the estimates of the national truck population. On the surface, the main difference is that trucks operated by *intrastate* carriers are included in Table 11 from TIUS. However, Table 11 shows about half a million fewer for-hire trucks and 1.75 million more private trucks. Overall, the 1992 TIUS survey shows about 1.2 million more medium and heavy trucks than the figure estimated from the 1996 MCMIS census file. This illustrates another problem with the TIUS data. Light trucks are miscoded as medium duty, inflating the number of private medium duty trucks. This inflates the number of trucks in small private fleets. For this purpose, the 1992 TIUS data appear less reliable than the MCMIS census file. However, the

⁴ Massie, D.L., Campbell, K.L., and Blower, D.F. 1993. *Comparison of Large Truck Travel Estimates from Three Data Sources*. Transportation Research Record No. 1407.

distribution by fleet size of trucks operated by for-hire carriers from the 1992 TIUS data is approximately the same as the MCMIS data in Table 3.

The 1992 TIUS also asked whether the truck is equipped with a "trip recorder." The responses to this question are presented in Table 12 by company type and fleet size. Overall, 3.3 percent of trucks in private fleets and 10 percent of trucks in for-hire fleets reported having a "trip recorder" in the 1992 TIUS. Fleet size is strongly associated with the use of recorders. The proportion of trucks with recorders is 5-10 times greater in large fleets as compared to small fleets. Overall, the 1992 TIUS data show approximately 180,000 trucks equipped with trip recorders.

Table 12
Trip Recorder Use
by Company Type and Fleet Size
1992 Truck Inventory and Use Survey

Strata	No	Yes	Total
Large Private (100+)	367,596	41,098	408,694
	89.9%	10.1%	100.0%
Medium Private (10-99)	763,955	32,778	796,733
	95.9%	4.1%	100.0%
Small Private (1-9)	1,688,937	26,489	1,715,426
	98.5%	1.5%	100.0%
Unknown Private	186,298	3,266	189,564
	98.3%	1.7%	100.0%
All Private	3,006,786	103,631	3,110,417
	96.7%	3.3%	100.0%
Large For Hire (100+)	257,547	52,892	310,439
	83.0%	17.0%	100.0%
Medium For Hire (10-9)	179,057	12,004	191,061
	93.7%	6.3%	100.0%
Small For Hire (1-9)	196,114	6,687	202,801
	96.7%	3.3%	100.0%
Unknown For Hire	39,189	2,887	42,076
	93.1%	6.9%	100.0%
All For Hire	671,907	74,470	746,377
	90.0%	10.0%	100.0%
Total	3,678,693	178,101	3,856,794
	95.4%	4.6%	100.0%

Table 13 shows electronic recorder equipment for the 11 groups in this study. The table includes the original sample size, the number of returns, and the number with ERs. Fleets with recorders as a percent of all responding fleets is shown in the next to the last column labeled "Percent Returns." To prepare this table, Part II of the questions that describes ER use was reviewed. If any responses indicated that the fleet had one

or more ERs, the response was coded as "yes" for ER use. These responses were used to form Table 13. Later tables will examine the more detailed information in Part II.

Table 13
Number and Percent of Returns with
Electronic Recorders by Group and Company Type

Association	Group Sample		Returns	Recorder?	Percent Returns	Percent Sample
Truck Fleets						
NPTC	T1	941	202	71	35.1	7.5
Large Private	T2	931	44	17	38.6	1.8
Medium Private	T3	1,032	40	8	20.0	0.8
Small Private	T4	1,000	26	0	0.0	0.0
All Private (T2-T4)		2,963	110	25	22.7	0.8
Large For Hire	T5	1,411	97	32	33.0	2.3
Medium For Hire	T6	1,047	81	8	9.9	0.8
Small For Hire	T7	1,002	45	1	2.2	0.1
All For Hire (T5-T7)		3,460	223	41	18.4	1.2
Fleet Total (T1-T7)		7,364	535	137	25.6	1.9
Owner Operators						
OODA	O1	1,500	350	13	3.7	0.9
ITDA	O2	150	22	1	4.5	0.7
O-O Total		1,650	372	14	3.8	0.8
Bus Fleets						
ABA	B1	727	113	10	8.8	1.4
UMA	B2	850	166	14	8.4	1.6
Bus Total		1,577	279	24	8.6	1.5
Total		10,591	1,186	175	14.8	1.7

More than 90 percent of the bus and owner operator companies did not have recorders, while over one third of the NPTC, large private, and large for-hire companies reported ERs. Overall, nearly 23 percent of private fleets (T2-T4) and 18 percent of for-hire fleets (T5-T7) had ERs. Assuming that the recorder questions in each study are interpreted the same by respondents, these proportions are much higher than in the 1992 TIUS (Table 12). Recorder equipment may have increased since 1992, but given the low response to our study questions, one should suspect that fleets with recorders were more likely to respond. Such differential response will bias the proportion of recorders on the high side. In the extreme, one might assume that all of the fleets not responding did not have recorders. With this assumption, one can calculate a lower bound on the proportion of recorders by dividing the number responding with recorders by the total in the sample. This result is shown in the last column of Table 13.

The best interpretation of our study responses is that the proportion with recorders is somewhere between the estimates in the last two columns of Table 13. Generally, the

percentage of recorders from TIUS in Table 12 also fall between the figures in the last two columns of Table 13.

For T and B fleets, medium and large companies are much more likely to have electronic recorders than small companies (Table 13). Only 14 of the 372 owner operators reported recorders. This finding is likely a reflection of the fact that nearly 98 percent of the owner operators are small carriers.

Table 14 shows ER use by reported fleet size for NPTC, owner operators, and bus organizations. Again, the larger the company, the greater the likelihood of electronic recorder use. This proportion was even greater for NPTC companies. Nearly two-thirds of large NPTC fleets reported using electronic recorders (63.2 percent). In addition, 33 percent of medium T1 companies, and 10 percent of small companies reported recorder use.

Table 14
Number and Percent of Returns with
Electronic Recorders by Reported Fleet Size
for Selected Groups

Size	T1 (NPTC)		Total
	No	Yes	
1-8	26	3	29
	89.7	10.3	100.00
9-100	91	44	135
	67.4	32.6	100.00
101+	14	24	38
	36.8	63.2	100.00
Total	131	71	202
Percent	64.8	35.2	100.00

Size	Owner Operators		Total
	No	Yes	
1-8	346	14	360
	96.11	3.89	100.00
9-100	6	0	6
	100.00	0.00	100.00
101+	3	0	3
	100.00	0.00	100.00
Total	355	14	369
Percent	96.2	3.8	100.0

(Missing = 3)

Size	Bus Fleets		Total
	No	Yes	
1-8	108	5	113
	95.58	4.42	100.00
9-100	137	18	155
	88.39	11.61	100.00
101+	10	1	11
	90.91	9.09	100.00
Total	255	24	279
Percent	91.40	8.60	100.00

5.3 Electronic Recorders with HOS Function

The HOS function is one of the six recorder functions included in item 15 of the form for each company. In this section, we describe companies with ERs that have HOS modules. Not all companies with HOS modules use them as their primary method of driver monitoring. For example, the 2 owner operators included here do not use their HOS module as their primary HOS method. Methods used for monitoring HOS are discussed in the next section. Prevalence of other ER functions is presented in Section 6. As before, tables by association/group and fleet size are shown to highlight the findings.

Table 15 shows the number of companies with HOS functions by groups. As seen with ER use, T companies were more likely to have HOS modules than O and B companies. There were 78 T companies, 2 O companies, and 3 B companies with HOS functions. Nearly a quarter of the NPTC companies had HOS, and almost one third of the large private companies had the function, while only 10 percent of the large for-hire companies had HOS. (None of these for-hire companies used their modules as a primary means for HOS reporting, see Table 18, next section). No small T companies had the HOS function and only 7 medium-sized private fleets had it.

Table 15
Number and Percent of Returns with
HOS Recorder Functions by Groups and Company Type

T Companies			
Groups	No	Yes	Total
NPTC	155	47	202
Percent	76.73	23.27	100.00
Large Private	30	14	44
Percent	68.18	31.82	100.00
Medium Private	33	7	40
Percent	82.5	17.5	100.00
Small Private	26	0	26
Percent	100	0	100.00
Large For Hire	87	10	97
Percent	89.69	10.31	100.00
Medium For Hire	81	0	81
Percent	100	0	100.00
Small For Hire	45	0	45
Percent	100	0	100.00
Total	457	78	535
Percent	85.42	14.58	100.00

O Companies			
Groups	No	Yes	Total
OVIDA	348	2	350
Percent	99.43	0.57	100.00
ITDA	22	0	22
Percent	100	0	100.00
Total	370	2	372
Percent	99.46	0.54	100.00

B Companies			
Groups	No	Yes	Total
ABA	111	2	113
Percent	98.23	1.77	100.00
UMA	165	1	166
Percent	99.4	0.6	100.00
Total	276	3	279
Percent	98.92	1.08	100.00

These tendencies are also apparent in the size comparisons in Table 16. Again, larger companies are more likely to have the HOS function than small and medium

companies. Approximately one-quarter of large T companies have the HOS module, less than 15 percent of medium T companies, and less than 2 percent of small companies have HOS. Less than 2 percent of all bus and owner operators have the module.

Table 16
Number and Percent of Returns with
HOS Recorder Functions by Size and Company Type

T Companies			
Status	No	Yes	Total
1-8	110	2	112
Percent	98.21	1.79	100.00
9-100	235	38	273
Percent	86.08	13.92	100.00
101+	110	38	148
Percent	74.32	25.68	100.00
Total	455	78	533
Percent	85.37	14.63	100.00
(Missing = 2)			

O Companies			
Size	No	Yes	Total
1-8	358	2	360
Percent	99.44	0.56	100.00
9-100	6	0	6
Percent	100	0	100.00
101+	3	0	3
Percent	100	0	100.00
Total	367	2	369
Percent	99.46	0.54	100.00
(Missing = 3)			

B Companies			
Size	No	Yes	Total
1-8	113	0	113
Percent	100	0	100.00
9-100	152	3	155
Percent	98.06	1.94	100.00
101+	11	0	11
Percent	100	0	100.00
Total	276	3	279
Percent	98.92	1.08	100.00

5.4 Primary HOS Method

Respondents were asked about the method used by their drivers to record hours of service in question 6 (See Appendix A). The question asks how many drivers use each of 4 listed methods, logbook, timecard, ER with HOS, and other. The method used by the majority of drivers in the fleet was then coded as the primary method for the fleet. (See discussion in Section 3 under Data Management.)

Table 17 shows the primary HOS method used by company type. Most companies used paper logbooks as their primary method of monitoring (74.8 percent for T companies, 98.1 percent for O companies, and 92.8 percent for B companies). Few companies used ERs as their primary method. Only 7 percent of T companies, no O companies, and only 1 B company used ERs for HOS reporting. The predominant use of paper logs was an expected finding. Logbooks for monitoring HOS is the current federal regulation in the trucking industry.

Table 17
Driver Primary HOS Method
by T, O, and B Companies

Method	T Companies		O Companies		B Companies	
	N	Percent	N	Percent	N	Percent
Logbook	395	74.8	363	98.1	256	92.8
Timecard	77	14.6	3	0.8	14	5.1
Recorder	37	7.0	0	0.0	1	0.4
Other	11	2.1	4	1.1	5	1.8
Mixed	8	1.5	0	0.0	0	0.0
Total	528	100.0	370	100.0	276	100.0
	(Missing = 7)		(Missing=2)		(Missing = 3)	

The use of timecards to record HOS is important to note. When drivers can demonstrate compliance with HOS with their timecard, a logbook is not required. An electronic recorder with an HOS module would not be of benefit to this group. About 15 percent of truck fleets and 5 percent of bus fleets indicated that timecards were the primary method for recording HOS. Fleets that do not use logbooks may have been less inclined to respond to these questions.

Table 18 also shows paper logbooks were the most common method for HOS reporting for *each* of the 11 association/census groups. Although more than 50 percent of each group used logbooks, private companies used logbooks less often than other groups. Approximately one quarter of each of the 3 private truck groups (T2-T4) used timecards as their primary method. The greatest use of ERs for HOS was in the NPTC fleets and large private fleets (T1 and T2) at about 15 percent. While some private truck companies primarily used ERs, none of the for-hire groups reported ER use as the

primary method for HOS. Also, the owner operator, small private, and the UMA had no primary HOS recorder use.

Table 18
Number and Percent of Driver Primary HOS Method
by Company Groups and Company Type

T Companies (Missing = 7)						
Groups	Logbook	Timecard	Recorder	Other	Mixed	Total
NPTC	146	20	27	5	4	202
Percent	72.28	9.90	13.37	2.48	1.98	100.00
Large Private	22	11	7	1	2	43
Percent	51.16	25.58	16.28	2.33	4.65	100.00
Medium Private	25	10	3	1	1	40
Percent	62.50	25.00	7.50	2.50	2.50	100.00
Small Private	16	7	0	2	0	25
Percent	64.00	28.00	0.00	8.00	0.00	100.00
Large For Hire	85	10	0	0	1	96
Percent	88.54	10.42	0.00	0.00	1.04	100.00
Medium For	69	11	0	0	0	80
Percent	86.25	13.75	0.00	0.00	0.00	100.00
Small For Hire	32	8	0	2	0	42
Percent	76.19	19.05	0.00	4.76	0.00	100.00
Total	395	77	37	11	8	528
Percent	74.81	14.58	7.01	2.08	1.52	100.00
O Companies (Missing = 2)						
	Logbook	Timecard	Recorder	Other	Mixed	Total
OVIDA	344	1	0	3	0	348
Percent	98.85	0.29	0.00	0.86	0.00	100.00
ITDA	19	2	0	1	0	22
Percent	86.36	9.09	0.00	4.55	0.00	100.00
Total	363	3	0	4	0	370
Percent	98.11	0.81	0.00	1.08	0.00	100.00
B Companies (Missing = 3)						
	Logbook	Timecard	Recorder	Other	Mixed	Total
ABA	107	3	1	0	0	111
Percent	96.40	2.70	0.90	0.00	0.00	100.00
UMA	149	11	0	5	0	165
Percent	90.30	6.67	0.00	3.03	0.00	100.00
TOTAL	256	14	1	5	0	276
Percent	92.75	5.07	0.36	1.81	0.00	100.00

6 Cost-Benefit Analysis of Electronic HOS Recording

6.1 Overview of Cost-Benefit Analysis

Generally speaking, commercial vehicle drivers who operate across state lines must record hours of service according to rules published in the Federal Motor Carrier Safety Regulations. (Exemptions to the HOS recording regulations apply in certain cases), Each time a driver's status changes (e.g., from driving to off-duty) an entry must be logged indicating when and where that change in status occurred. These HOS records must be maintained by drivers and carriers and may be audited periodically by state and federal motor carrier enforcement agencies.

This section presents an analysis of the costs and benefits reported by respondents to survey questions regarding electronic recording devices. All 176 respondents with ERs were included.⁵ Information was acquired with respect to electronic recording device installation costs, annual operating and maintenance costs, and the time required to record HOS using either these electronic devices or paper logs. The administrative time spent monitoring, summarizing, storing/retrieving, or auditing HOS records is also examined. Additionally, responses to open-ended questions regarding the effect of mandatory use of electronic on-board HOS recording on fleet operations, cost, and safety are summarized.

6.2 Electronic Recorder Costs

Electronic recorders are used to support numerous regulatory and fleet management functions. Carriers equip their fleets with ERs for a variety of economic, regulatory, and operational reasons. Figure 1 shows the primary and secondary reasons the 176 respondents with ER-equipped fleets chose to acquire ERs. Note that HOS compliance ranked second to "vehicle operating cost management" as the primary reason for acquiring ERs, with nearly one-fourth of the respondents indicating that HOS recording was their primary reason for acquiring ERs. If HOS recording *was not* the primary reason for acquiring ERs, it seldom ranked as the secondary reason. Figure 2 shows primary reasons for acquiring ERs by HOS module use. Carriers who use HOS modules acquired ERs for that purpose; those who do not use the HOS module did not.

⁵ The 176 fleets with electronic recorders includes one *intrastate* carrier that was excluded from tabulations in the previous sections.

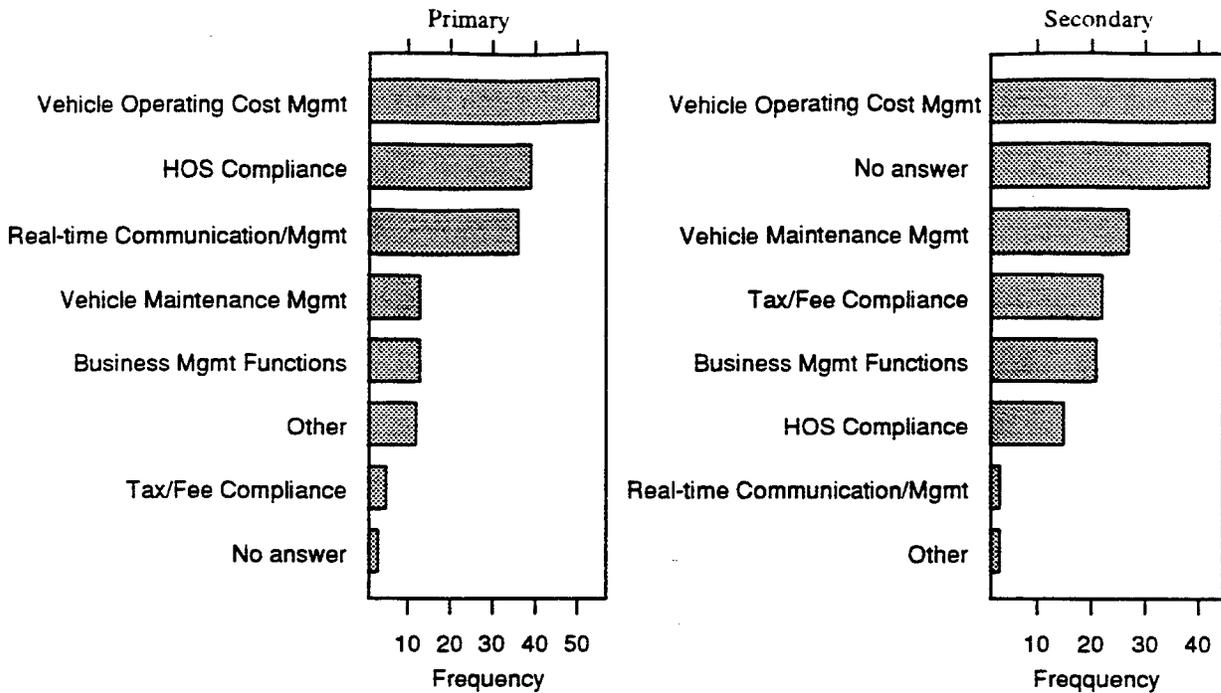


Figure 1. Primary and Secondary Reasons for Acquiring Electronic Recorder

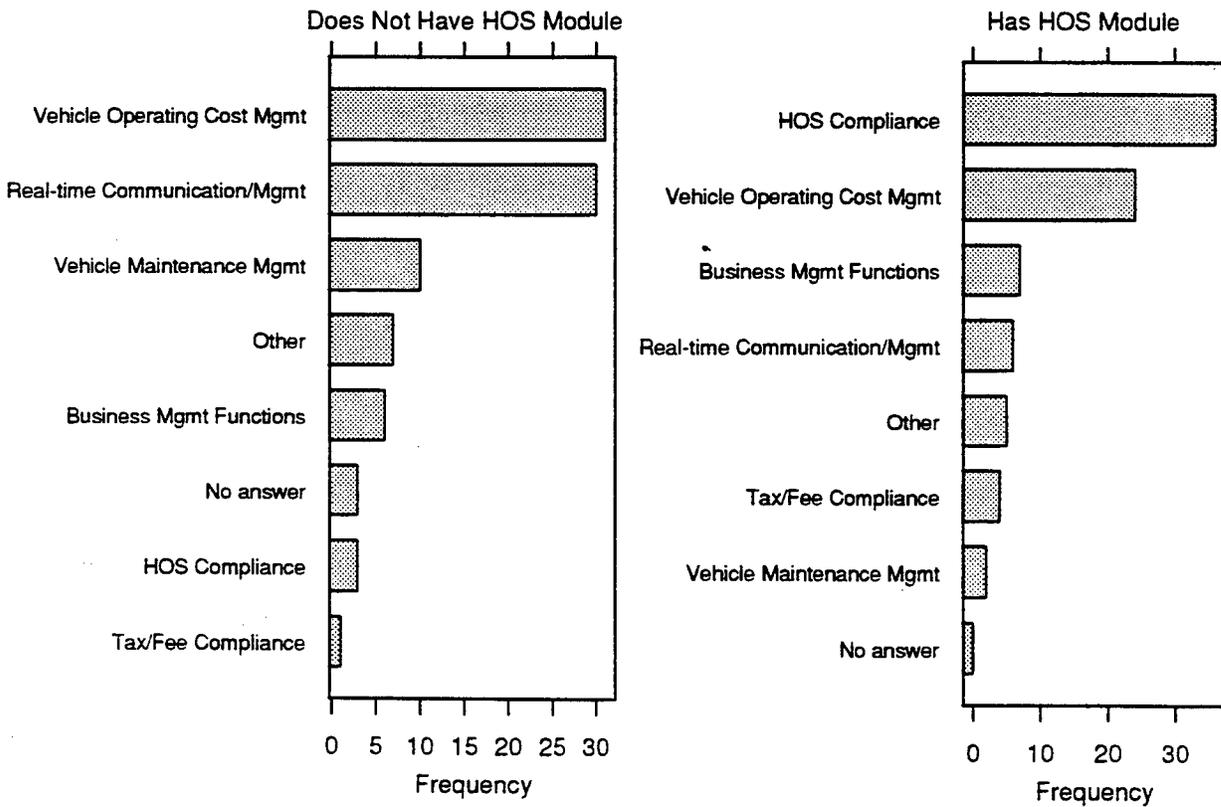


Figure 2. Primary Reason for Acquiring Electronic Recorder by HOS Module Use

As is seen in these responses, carriers acquire ERs for various and different reasons with less than one-fourth acquiring them primarily for electronic HOS recording. Consequently, the costs (installation and annual operating and maintenance costs) of ERs cannot be attributed primarily to HOS recording. However, electronic HOS recording typically requires ERs with capabilities that support multiple functions.

Electronic HOS recording costs are difficult to isolate because HOS recording is performed by ER capabilities that support multiple fleet management functions. Consequently, in this study, the total cost of acquiring and operating ERs was requested. The two parts of this section on electronic recorder cost summarize responses to questions concerning cost of ERs and, as appropriate, divide responses between carriers that use ERs for HOS recording and those that do not.

Installation Cost. Question 12 asked respondents to report the approximate cost per vehicle to acquire and install electronic recorders. Figure 3 shows the density and cumulative distribution for responses to this question from carriers that reported using ERs. Note the spike around \$2000 per vehicle in the density function and that about 60 percent of respondents (0.6 on the cumulative distribution) paid \$2000 or less per vehicle. The \$0 responses may reflect the fact that some vehicles may have been purchased with ER devices provided by the OEM and thus were not purchased separately by the carrier. The highest reported acquisition and installation cost is about \$4000 per vehicle.

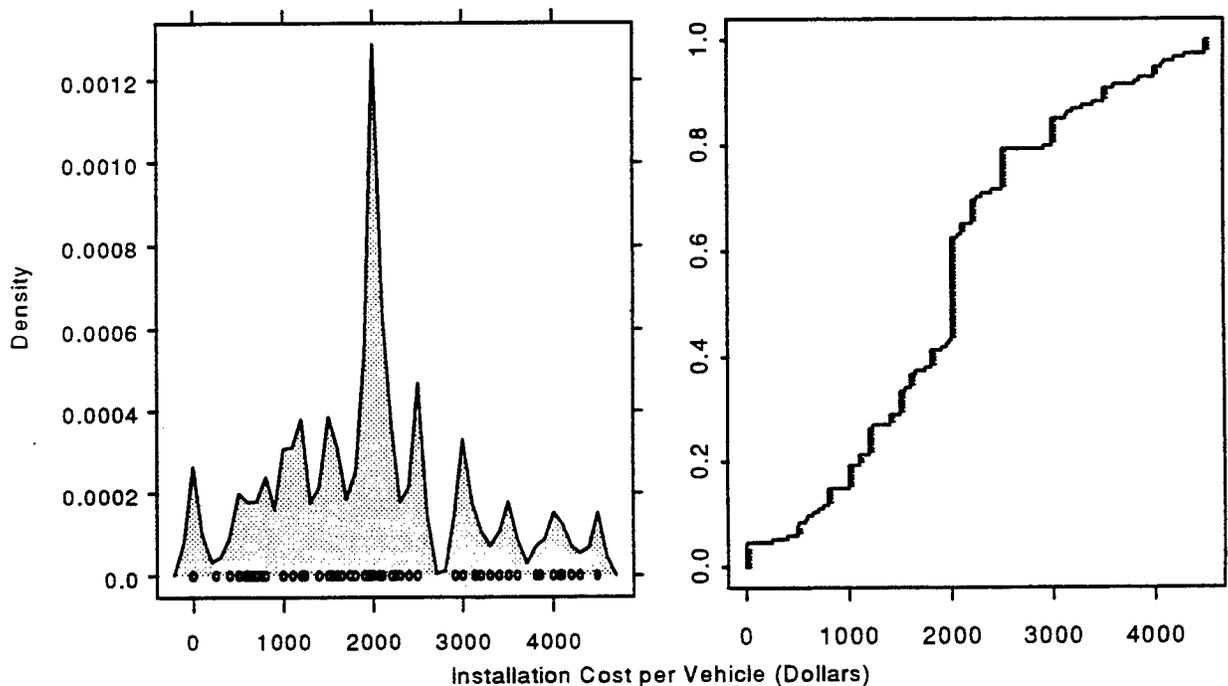


Figure 3. Density and Cumulative Distributions for ER Cost Per Vehicle (176 responses)

These costs do not separate fixed startup costs associated with training staff and adopting new record systems from per vehicle costs. Of the responding fleets with ERs, only 2 small truck fleets (NPTC) had the HOS function. The averages reported may underestimate the startup costs in small fleets.

The range in cost per vehicle certainly reflects differences in ER functions. However, another factor that affects acquisition and installation cost is when the ER was acquired. Figure 4 is a scatter plot showing how long each respondent has had ERs and their acquisition and installation costs per vehicle. Note that as years of ER use decrease, the cost per vehicle tends to increase. This could mean that newer ERs are more expensive or that carriers are, in more recent years, acquiring and installing ERs with more functional capability.

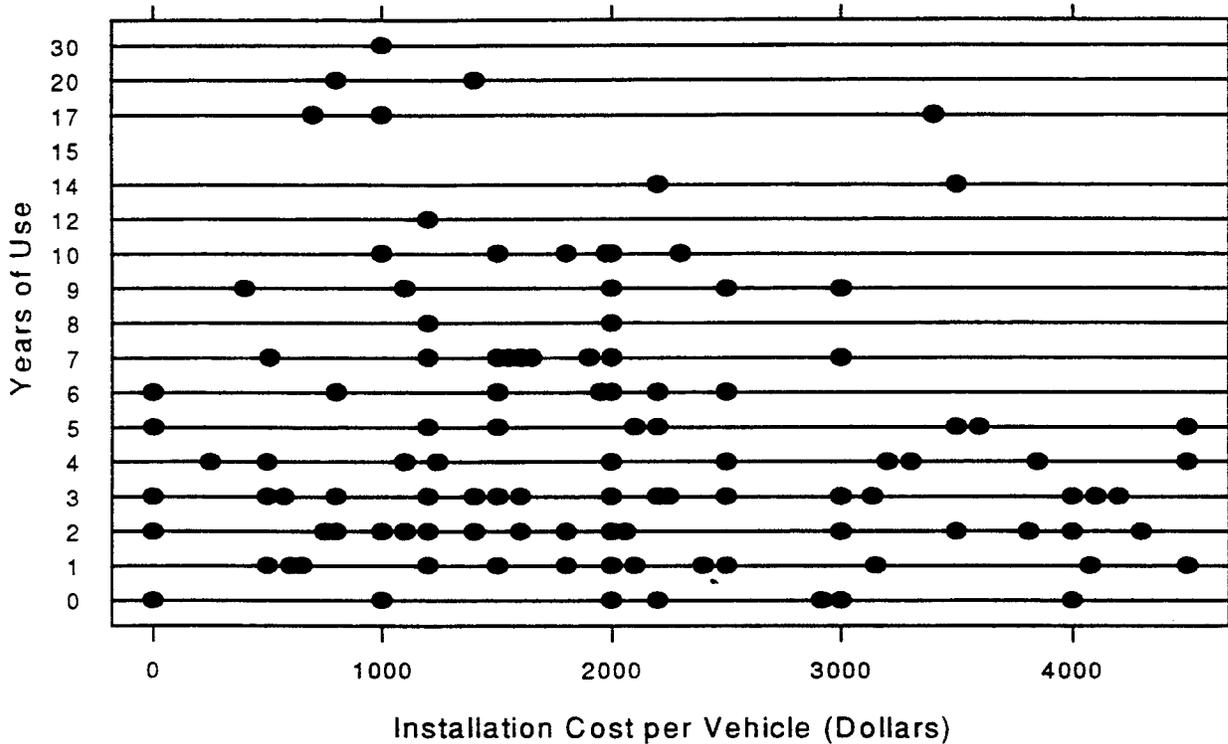


Figure 4. ER Installation Cost versus Years of Use

Another possible explanation for variation in ER acquisition and installation cost is the size and type of fleet to be equipped with ERs. The sample population was selected from a variety of carrier types and sizes, ranging from small private fleets to large for-hire carriers and over-the-road bus companies. As was discussed earlier, response rates from these various segments of the population varied widely, but the reported

acquisition and installation cost per vehicle was surprisingly similar among the different groups. Figure 5 shows these responses in a box and whisker chart.⁶

Note first that sample sizes range from a single response (T7 - small for hire, O2 - ITDA members) to 71 responses from large private fleet owners (T2). However, the median response for all trucking groups with more than one response is about \$2000 per vehicle. The two bus groups that responded have means around \$1000 per vehicle. The greatest variation in acquisition and installation cost per vehicle came from the large private and for-hire fleets, with values ranging from less than \$1000 per vehicle to nearly \$5000 per vehicle.

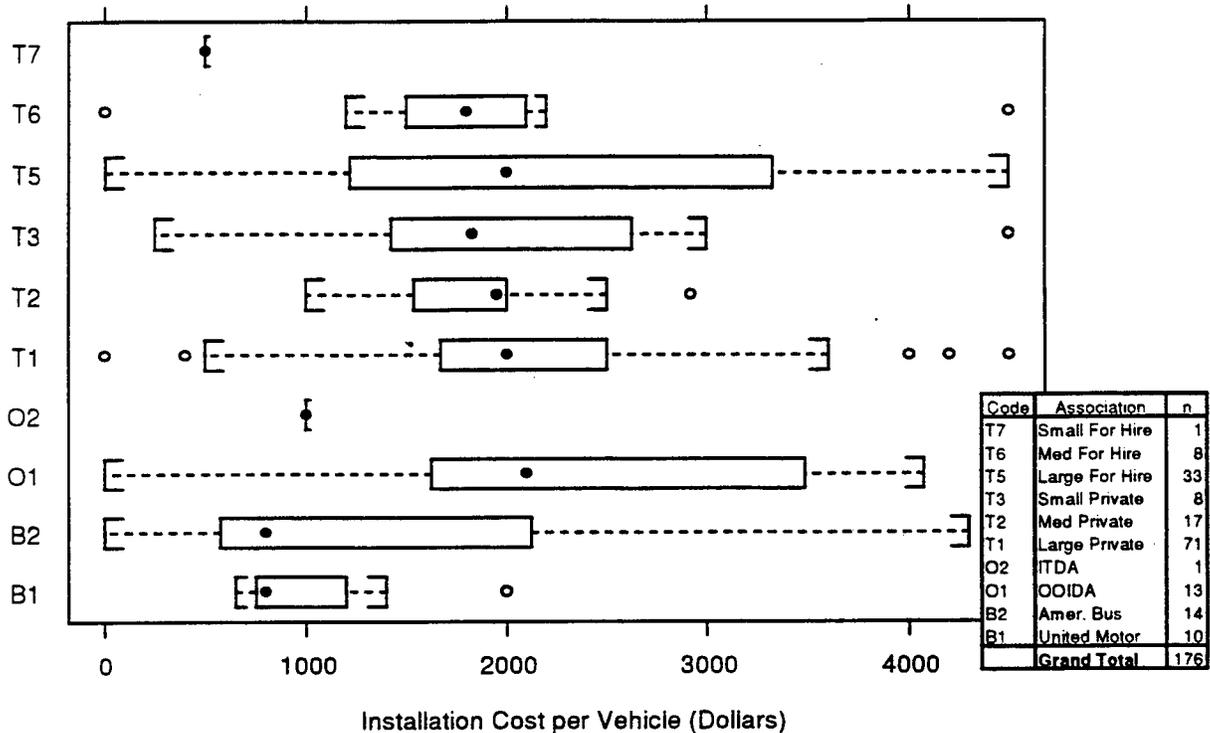


Figure 5. ER Acquisition and Installation Cost by Category of Respondent

⁶ Responses to several of the questions analyzed in this sections are summarized using *box and whisker charts* such as the one shown in figure 5. The rectangular box contains the middle half of the responses (i.e., 25 percent of the responses fall below the left side of the box, 25 percent of the response fall above the right side of the box). The point inside the box represents the median response (i.e., 50 percent of the responses fall below; 50 percent fall above). The lines (or *whiskers*) that extend to the left and right of the boxes extend a distance 1.5 times the interquartile range from the sides of the boxes. Points shown as circles outside the whiskers are outliers. For normally distributed populations, approximately 99 percent of the responses will fall between the limits shown by the whiskers.

The final factor considered in assessing ER acquisition and installation cost is the effect of the HOS module on cost per vehicle. Figure 6 shows that respondents using HOS modules for HOS recording report no greater acquisition and maintenance cost than did those who have ERs but do not use the HOS module. Both groups report median costs of approximately \$2000 per vehicle.

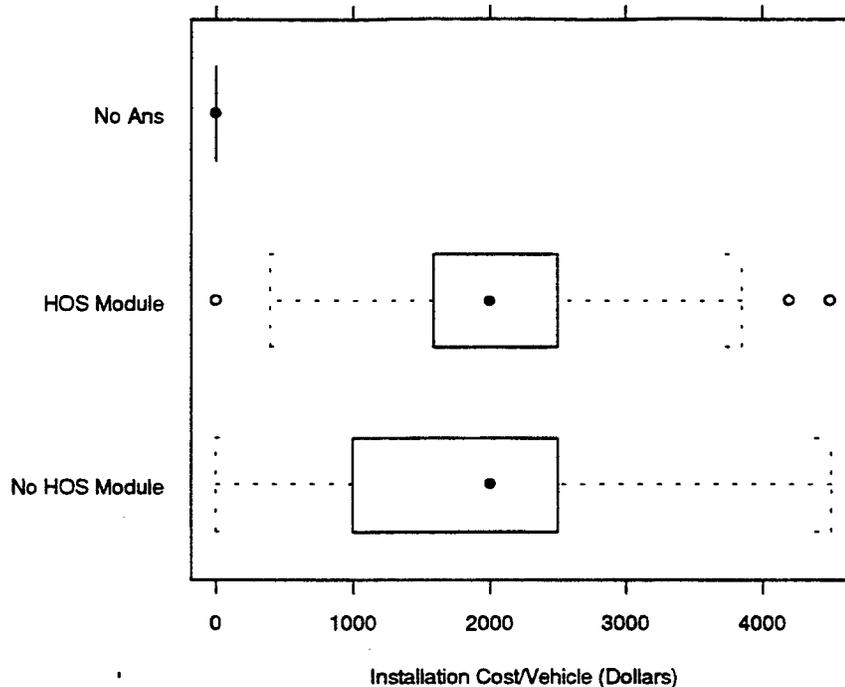


Figure 6. ER Acquisition and Installation by HOS Module Use

Based on responses from the 176 carriers that use ERs, the acquisition and installation cost of an ER is approximately \$2000 per vehicle with a tendency for the cost to go up as more modern (and potentially more capable) ER devices are acquired.

Annual Operating and Maintenance Cost. ER annual operating and maintenance (O&M) costs include costs for routine operation of the ER (typically by a driver) as well as routine servicing, calibration, and repair. Examples of these maintenance costs include display screen or keyboard repair and replacement, on-site ER repair and service, service contracts that included software upgrades and licensing, and driver key card replacement. Spare parts, spare units, and other inventory assets would also be considered part of the annual ER O&M costs.

Follow-up calls with respondents indicate an initial learning curve for drivers regarding the care and operation of ERs. Interviewed respondents said that once drivers understand and appreciated the recorder, maintenance costs begin to decline. A small number of respondents include operating costs in the annual per vehicle cost. This cost typically was for paper and cartridges associated with the electronic recorder systems. If a company leased recorders as part of a leased truck package, maintenance costs may

be defined as operating costs. On-site repair of a malfunctioning ER was cited as the most costly maintenance expense.

In question 13, survey respondents estimated the annual O&M cost per vehicle for electronic recorders. Figure 7 shows the density and cumulative distribution functions for responses to question 13. Note in the density function, the preponderance of responses in the \$100-\$200 per vehicle per year range. The cumulative distribution shows that 60 percent of the respondents estimate their annual O&M cost to be less than \$200.

Figure 8 shows reported annual O&M cost by segment of the respondent population. The OOIDA members and small to medium for-hire carriers report higher O&M costs than do other segments, but too few responses were received to conclude that these groups experience higher O&M costs. However, for-hire carriers report higher O&M costs than do private fleets. This could reflect differences in the types of ERs typically used by for-hire carriers or other factors not addressed in this survey.

Curiously, the annual O&M cost for fleets that use the HOS module for recording HOS is actually less than that reported by fleets that do not use the HOS module. Figure 9 shows this result.

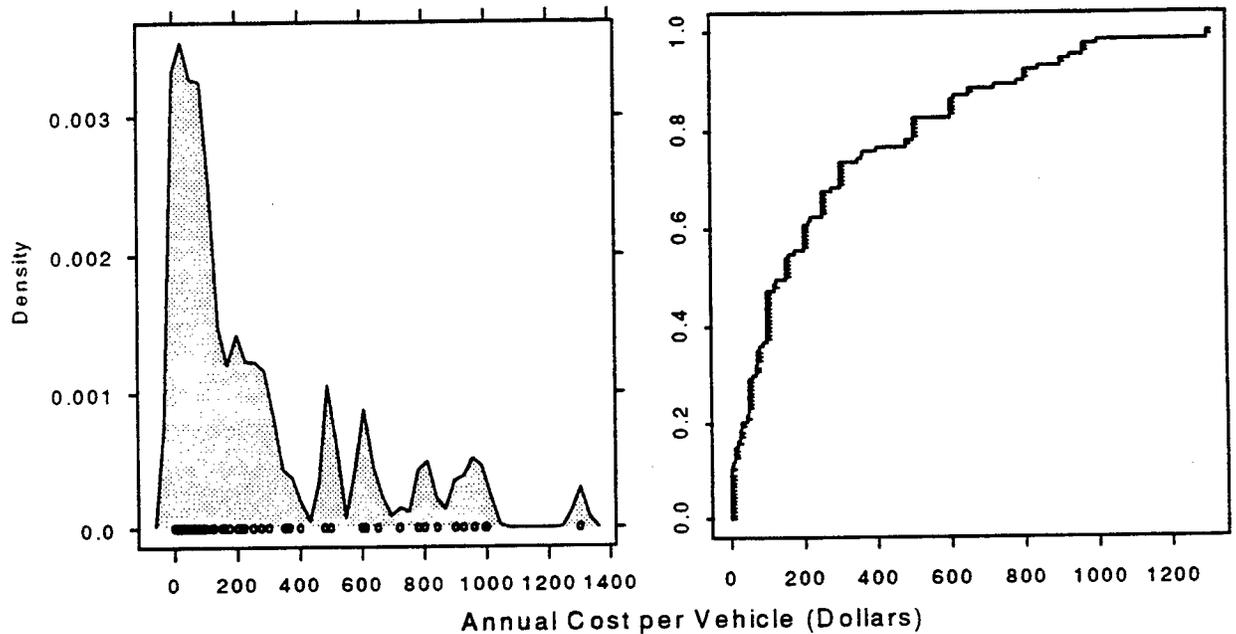


Figure 7. Annual ER O&M Cost per Vehicle

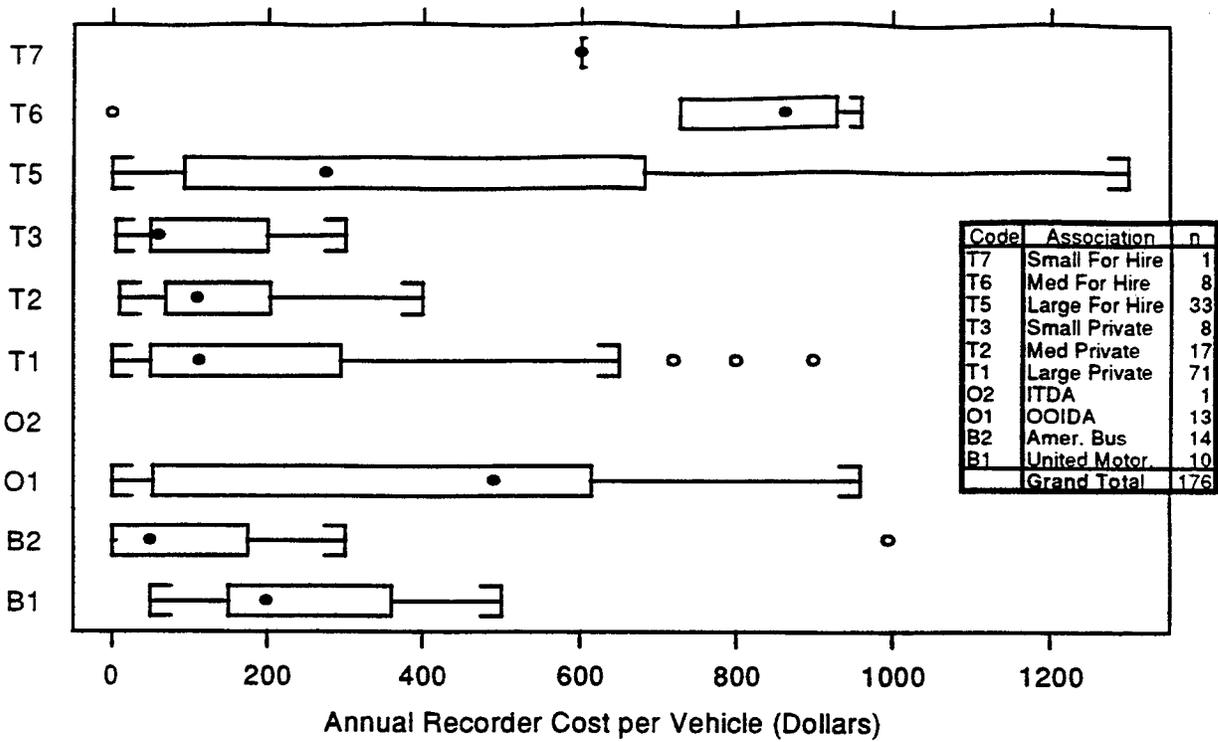


Figure 8. ER Annual O&M Cost by Type of Fleet

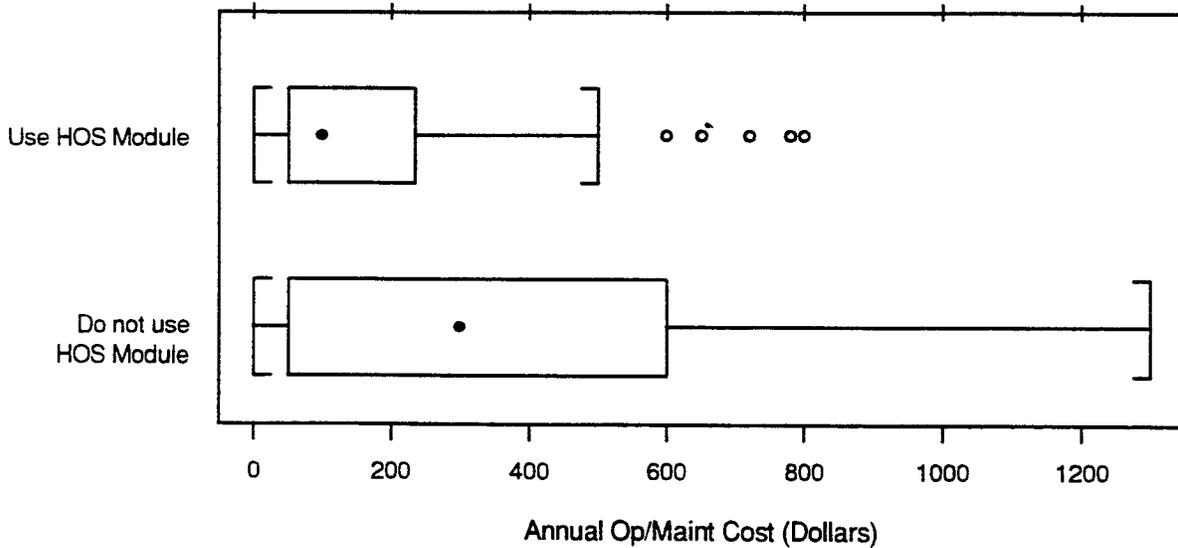


Figure 9. ER Annual O&M Cost by HOS Module Use

ER Cost Summary. Data from this survey suggest that ER acquisition and installation cost is approximately \$2000 per vehicle but this cost can vary substantially depending on when the unit is acquired and the types of functions available. Annual O&M costs are typically less than \$200 per vehicle but can be as much as \$1000 per vehicle. None of the variables examined clearly explain differences in either acquisition and installation cost or annual O&M cost. Use of HOS modules for hours of service reporting does not appear to increase the cost of acquiring and owning ERs.

6.3 Electronic Hours of Service Recording Benefits

The benefits of electronic HOS recording accrue to different populations based largely on perceptions of differences between manual (paper-based) HOS recording methods and electronic HOS recording methods. Electronic HOS recording is perceived to be more accurate, more reliable, and less time consuming for both drivers and fleet managers.

Recent studies indicate that driver fatigue is a major factor in motor carrier accidents and incidents.⁷ Highway safety interest groups believe that more accurate and reliable HOS recording will result in better enforcement of HOS regulations, leading to a reduction in driver fatigue and accidents and incidents that occur as a result of driver fatigue. Unfortunately, little data exist linking HOS violations to accidents and incidents involving motor carriers due, in part, to inadequate accident/incident reporting methods. Further, the linkage between driver fatigue and current HOS regulations is under study and results are inconclusive regarding the effects of current regulations on driver fatigue.⁸

Lacking conclusive findings regarding relationships between more accurate, reliable HOS recording and driver fatigue and the motor vehicle accidents and incidents resulting from driver fatigue, this study is restricted to examining the economic and operational benefits associated with electronic HOS recording. This study restriction does not imply that electronic HOS recording offers no safety or enforcement benefits, it simply acknowledges the lack of data needed to support credible conclusions. Moreover, by examining the operational and economic benefits of electronic HOS recording, carriers can determine whether or not electronic HOS recording makes good business sense regardless of the additional and possibly more important safety benefits that may be realized.

Assuming that HOS are captured accurately using either manual or electronic methods, the primary operational benefit of electronic HOS recording is the time required for

⁷ Wylie, C.D., Shultz, T., Miller, J.C., Mitler, M.M.; Mackie, R.R. 1996. *Commercial Motor Vehicle Driver Fatigue and Alertness Study*. Essex Corporation, Goleta, Ca. 559p. Sponsor: Federal Highway Administration, Washington, D.C., Trucking Research Institute, Alexandria, Va., Transport Canada, Ottawa, Ontario. Report No. FHWA-MC-97-002/ TP 12876E.

⁸ Wylie, et al., *Op. cit.*

drivers to record HOS and the administrative time fleet managers spend summarizing, storing, retrieving, and auditing HOS records. In the two sections that follow, these two elements of HOS management are examined based on responses from the 176 carriers that have ER-equipped fleets. Within this group, 57 carriers report using the HOS module for HOS recording; 119 report using paper logs for HOS recording.

Driver Time to Record Hours of Service. Each time a driver changes driving status (e.g., driving to off-duty, driving to riding, sleeper-berth to driving), a driver's log entry must be made to record the time, location, and status change. Drivers who use paper logs record these event manually; electronic HOS recorders use a variety of methods to capture events automatically (e.g., driver smart card, driver data entry) and retain this information for use by fleet managers and regulatory and enforcement agencies. Figure 10 shows the density function for time per driver per day to maintain the driver's log using paper versus electronic logs. Note the difference of 20 minutes in the median time required for paper logs versus electronic logbooks.

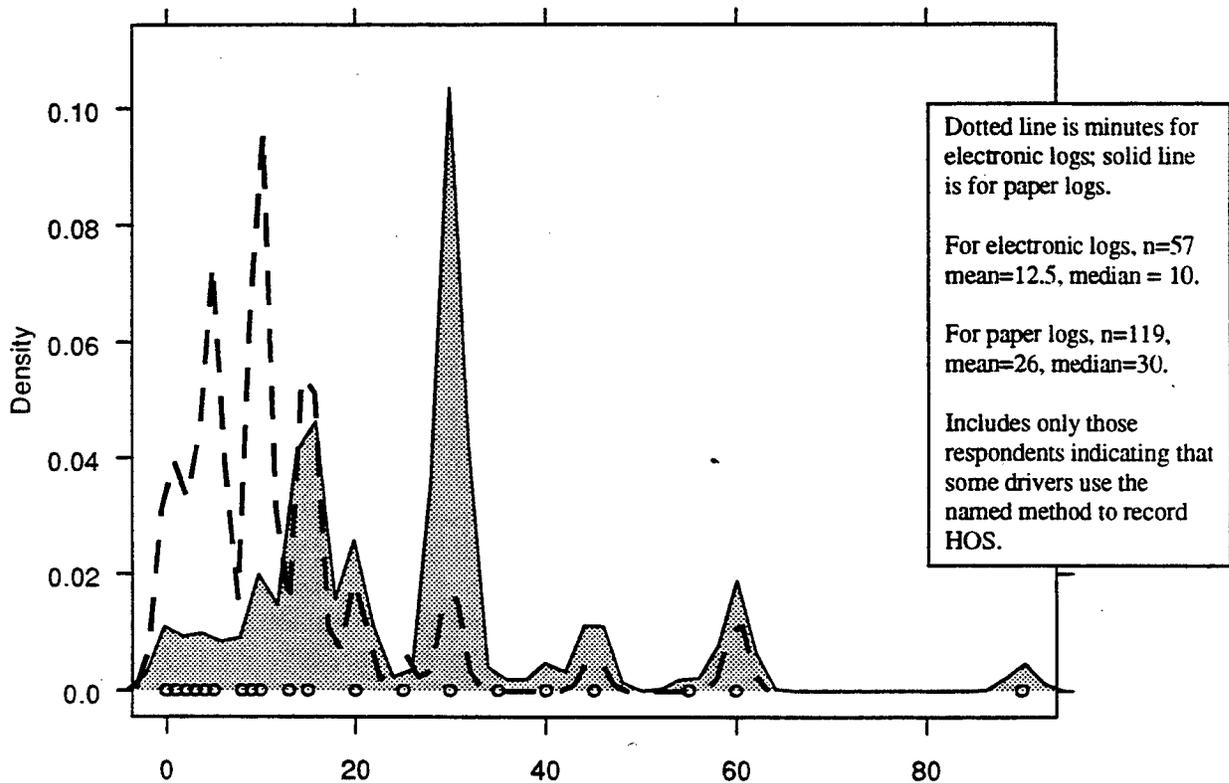


Figure 10. Density of HOS Recording Time/Driver/Day by HOS Recording Method

Figure 11 shows the cumulative distribution for these responses. Note the 20 minute difference in the median minutes per driver per day and note that about 90 percent of the reported electronic HOS recorder times are less than the median time required by drivers that use paper logs. The value to carriers of this 20 minute time savings per driver per day depends on many factors, including how drivers are compensated, whether or not drivers use available driving time to complete driver logs, and

alternative uses of this time. Each carrier will have to evaluate this difference based on the specific operating and compensation factors. If driver time is valued at a modest \$45 per hour, the 20 minutes per day savings equates to \$15 per day, enough to recover both the median acquisition/installation and annual O&M costs in less than one year. Clearly, every carrier will not be able to convert the time savings into real dollar savings but those that can should be able to justify their investment based on driver time savings alone.

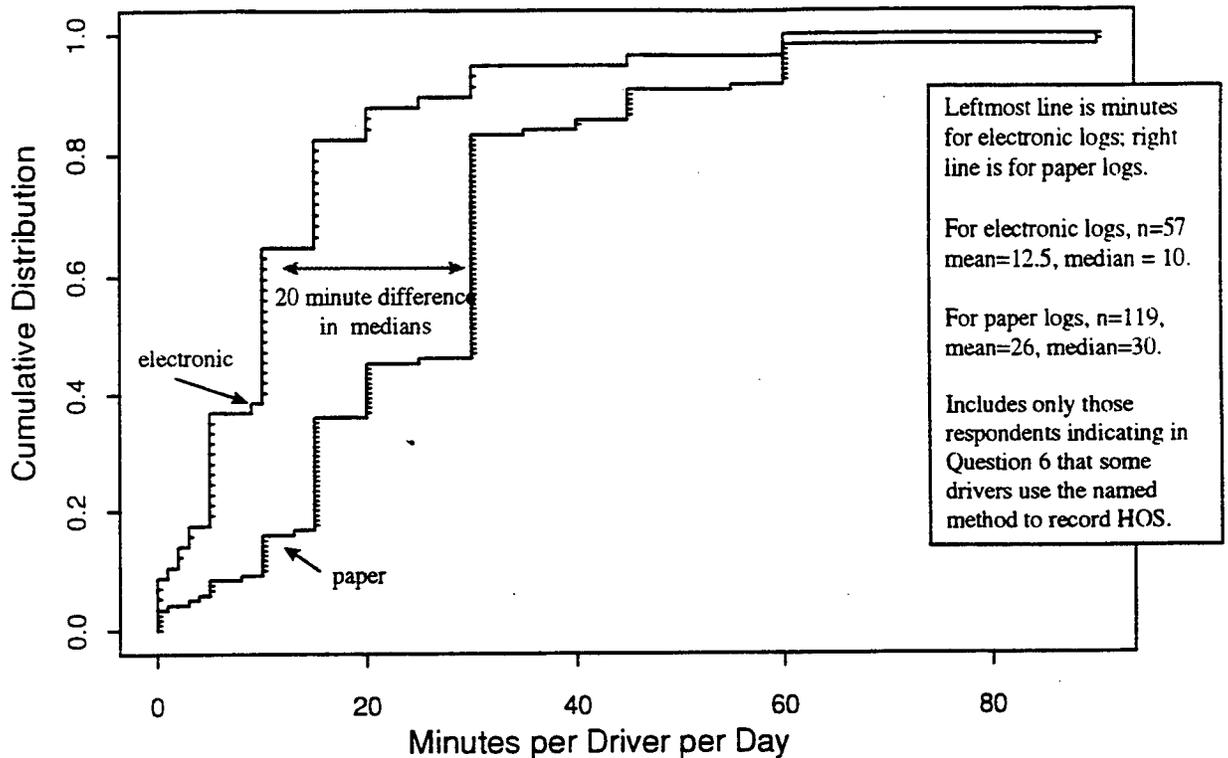


Figure 11. Comparison of Cumulative Distribution of Electronic and Paper HOS Recording Times per Driver per Day

Administrative Time to Support Hours of Service Report. Every carrier is required by law to maintain HOS records so that regulatory and enforcement agencies can review these records to ascertain HOS compliance. Consequently, each carrier must expend administrative time collecting, summarizing, storing, retrieving, organizing, auditing, and managing these records. Carriers that use electronic HOS recording devices are able to capture, store and manage HOS records electronically; those that use paper logs must acquire and otherwise manage the paper documents completed by drivers. Electronic HOS records obviously offer administrative efficiency through ease of access to and management of these records. Because HOS records must be maintained on all drivers, the administrative workload for HOS records management increases with the number of drivers employed. In this analysis, the administrative time required is normalized on a per driver per month basis so that comparisons can be made across fleets of different sizes.

Figure 12 shows the distribution of administrative hours per driver per month for carriers that have ERs, with carriers that use their ERs for HOS recording shown separate from those that do not. Both the median and the mean responses show a difference between electronic and paper HOS recording of about 20 minutes per driver per month for administrative activities related to HOS recording. Figure 13 shows the cumulative distribution. About 80 percent of carriers that use electronic HOS recorders spend less than the median amount of time that paper-based carriers spend administering HOS records.

The effects of electronic HOS recording on administrative functions extends beyond administrative time savings but those effects are not assessed here. Electronic records are more easily retrieved, they require less storage space, they are more easily collected from drivers and offer other logistical advantages. The economic value of these benefits again depends on the specific circumstances of each carrier but, for larger fleets, result in considerable savings. For example, a fleet of 1000 power units could expect to save over 300 hours of administrative time per month.

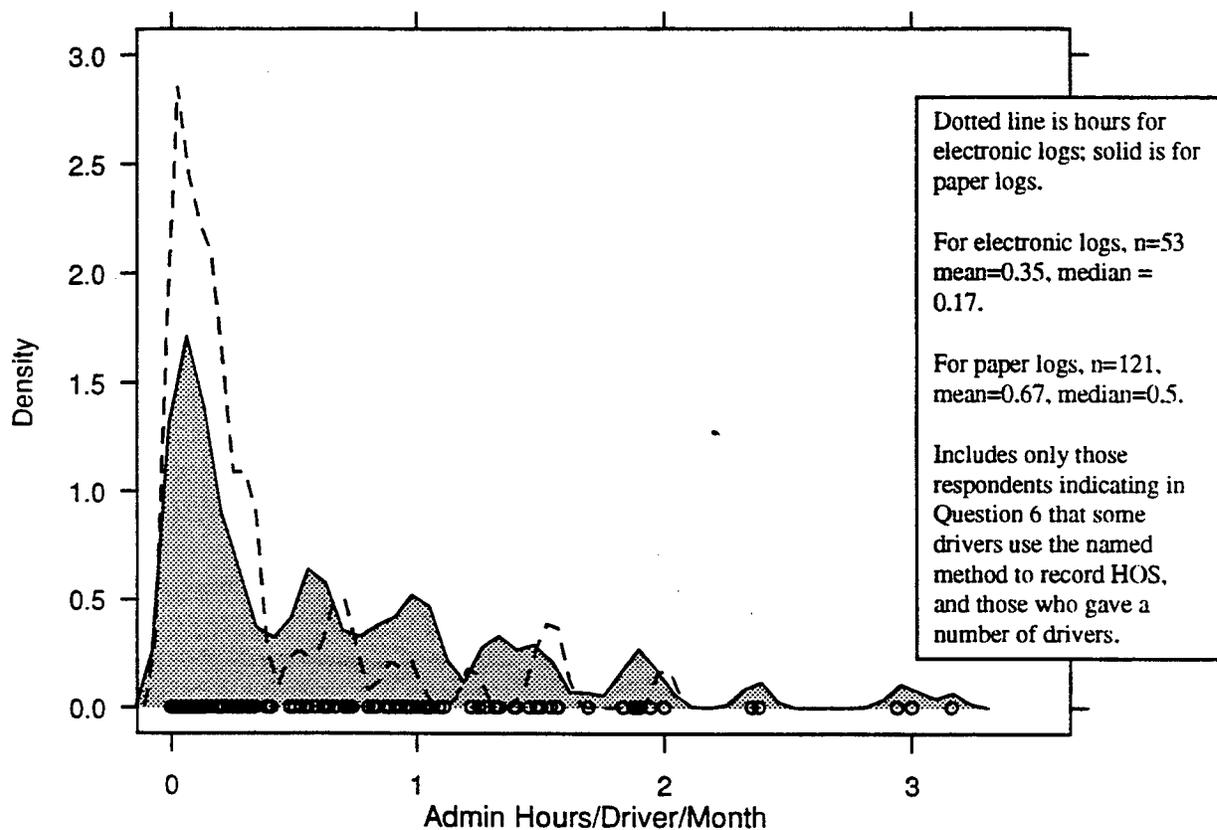


Figure 12. Distribution of Administrative Time by HOS Recording Method

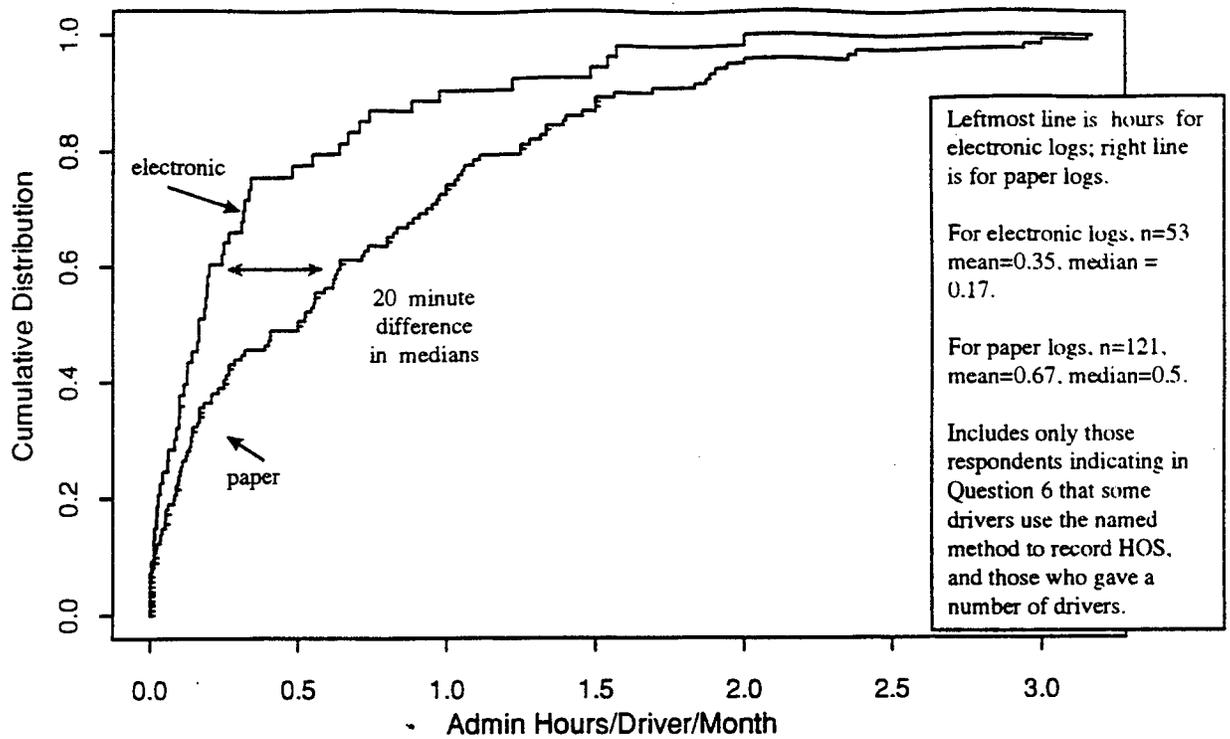


Figure 13. Cumulative Distribution of Administrative Time for HOS Recording by HOS Recording Method Used

ER Performance and Return on Investment. In questions 14 and 17 of the survey, respondents with ERs were asked to estimate the time required to recover their investment in ERs and to assess ER overall performance. Figure 14 shows the respondents' assessments of overall ER performance. About 10 percent of the respondents indicated that they experience frequent problems with ERs; over three-fourths reported no problems or occasional problems.

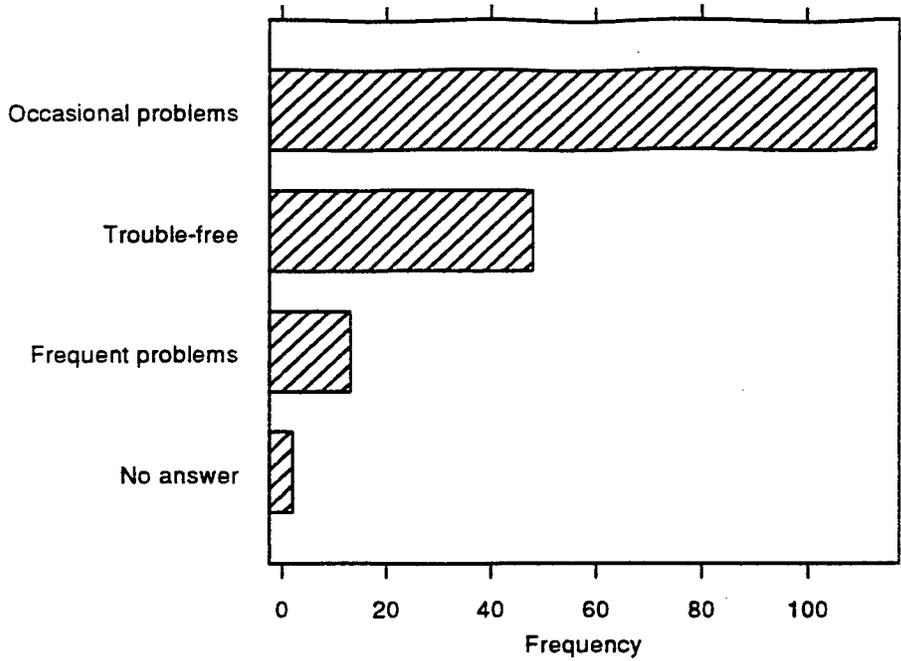


Figure 14. ER Overall Performance Ratings

Respondents were asked to estimate the time required to recover their investment in ERs. Figure 15 shows their responses to this question. Nearly half of the respondents expected to recover the investment in less than three years; nearly one-fourth were uncertain; and the balance felt either the recovery period would exceed three years or the investment would not be recovered at all.

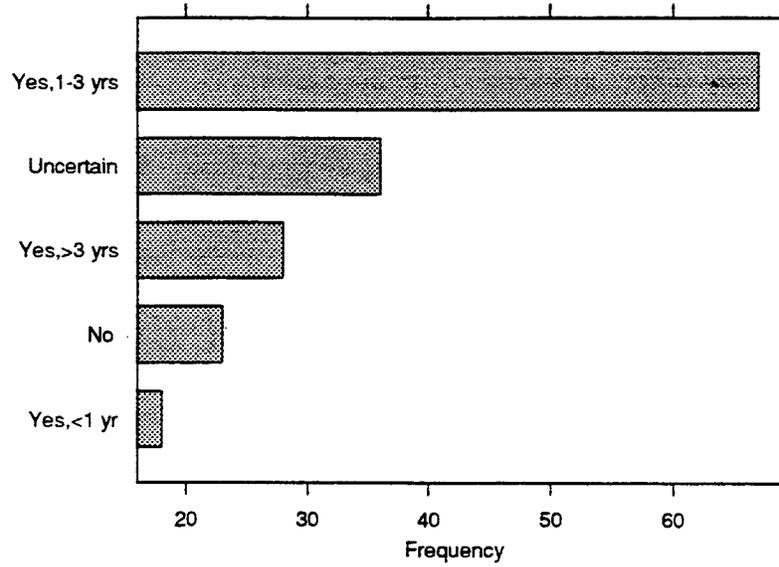


Figure 15. Estimated Time to Recover Investment in ERs

Interestingly, the estimated recovery period does not appear to be related to the acquisition and installation cost of the ER. Figure 16 shows the acquisition and installation costs for respondents in each response category. Note that respondents who did not expect to recover their investments in ERs actually have the lowest median acquisition and installation cost. Median cost for other categories varied little from the overall median of about \$2000 per vehicle. The range of acquisition and installation cost was greatest in response categories where the recover period exceeds three years or the respondent is uncertain about the recovery period.

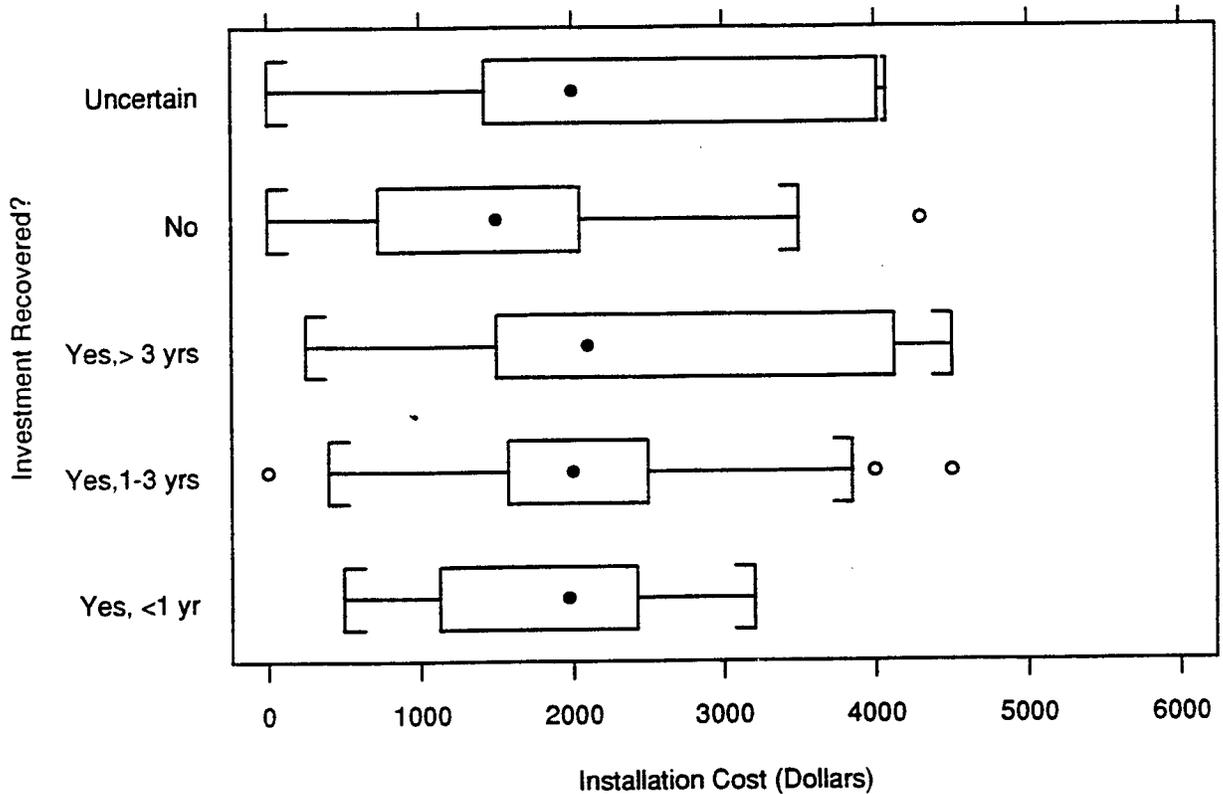


Figure 16. Investment Recovery Period by Acquisition/Installation Cost

ER Benefits Summary. The benefits of ERs accrue to different populations depending on the measures of interest. In this study, benefits assessment is restricted to assessing the economic and operational benefits to carriers. Unfortunately, as the data presented above illustrate, carriers seldom acquire ERs exclusively for electronic capture of HOS records. Consequently, both the cost and benefits of ERs for HOS recording is confounded by the fact that many other functions are also supported by ERs.

While ERs may offer significant benefits for fleet management, the value of electronic HOS recording lies largely in the time savings associated with drivers logs, including both the driver's time to complete the log and the administrative time required to manage HOS records. The survey indicates that drivers with electronic logs spend about 20 minutes per day less recording HOS than do drivers that use paper logs. Fleet managers with fleets using electronic HOS recorders save an additional 20 minutes per driver per month in time needed to administer HOS records at the fleet level. However,

because drivers are often paid by the mile or by the trip, the time savings to drivers may not be realized by the carriers since savings in the time spent logging hours of service may not accrue to the carrier.

In general, most carriers feel that their investment in ERs is recovered within three years and ERs typically perform without major technical problems. Again, this recovery period is based on all of the functions that the ERs perform.

6.4 Qualitative Assessment of Electronic HOS Recording

In addition to questions with categorical or numeric responses, carriers were asked to respond to four open-ended questions dealing with mandatory use of electronic on-board HOS recording devices. While some differences in response were associated with the size and type fleets, for the purpose of this study, results are provided for those that use ERs and those that do not use ERs. For each of the four questions, each response was read by an analyst, response categories were derived from the responses received, and all responses were mapped into the categories. The number of response categories formed varied between 6-12 across the 4 questions.

Operational Effects of Mandatory Electronic On-Board HOS Recording.

Figures 17 and 18 show responses to the question “What operational effects would mandatory use of electronic on-board hours of service recording devices have on your business?”

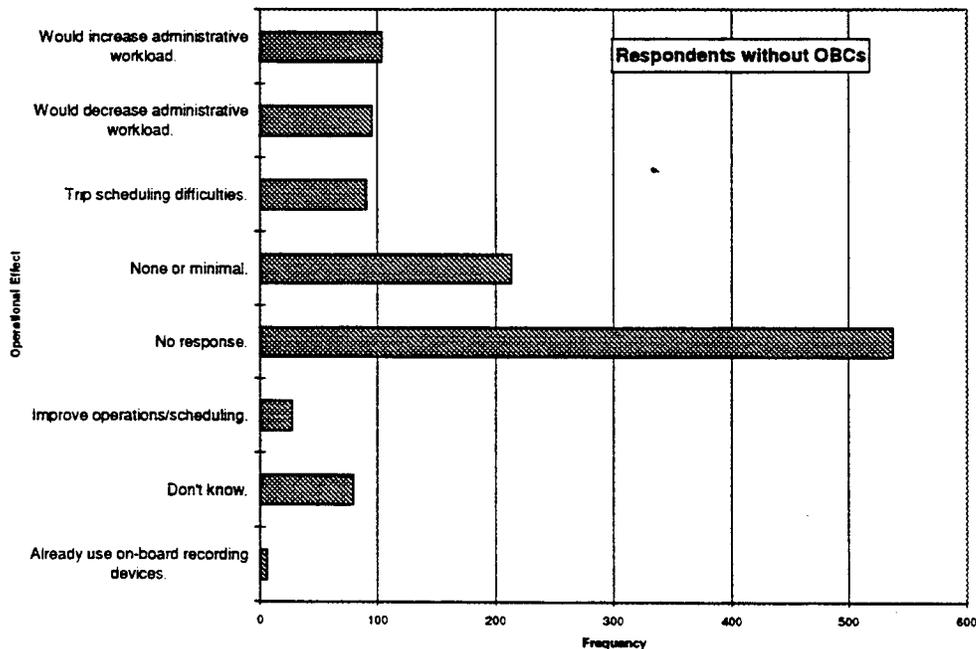


Figure 17. Operational Effects of Mandatory Use of Electronic HOS Recorders -- Non-ER Fleets

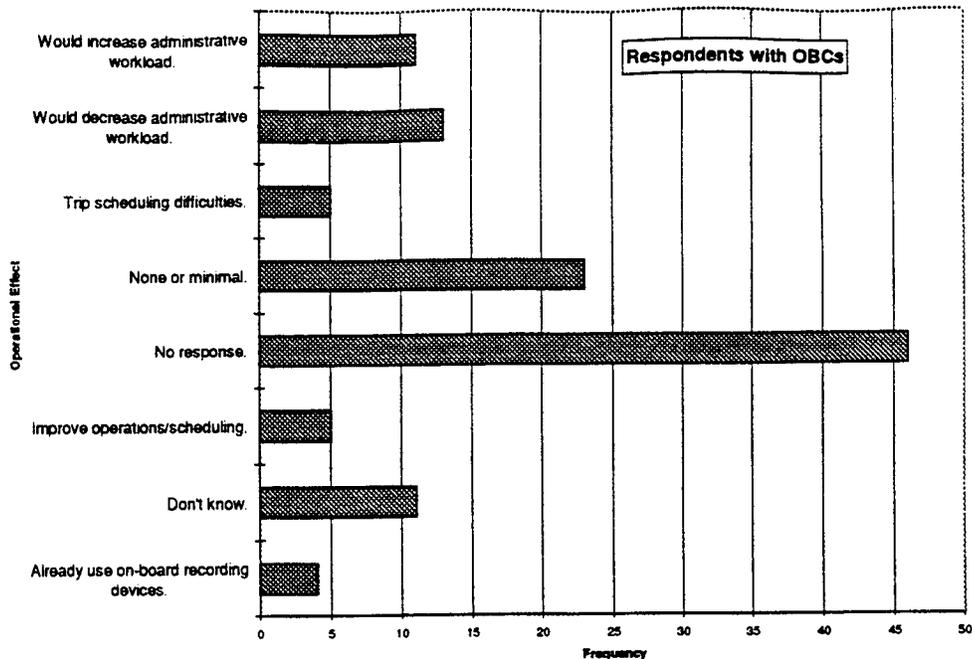


Figure 18. Operational Effects of Mandatory Use of Electronic HOS Recorders -- ER-Equipped Fleets

As Figures 17 and 18 show, the most frequent response from both groups was “no response.” Among those who did respond, the most frequent response was “none or minimal.” Interestingly, about the same number of respondents in each group felt that mandatory electronic HOS recorders would “increase administrative workload” as felt it would “decrease administrative workload.” The greatest difference between the 2 response groups is that carriers without ERs cited “trip scheduling difficulties” more often than “improve operations/scheduling” by a 3-1 margin, while carriers with ERs offered these responses about equally.

Economic Effects of Mandatory Electronic On-Board HOS Recording. Figures 19 and 20 show responses to the question “What economic effects would mandatory use of electronic on-board hours of service recording devices have on your business?” The major difference in responses to this question is that about half of the respondents from carriers without ERs responded that mandatory electronic HOS recording would result in “high initial costs plus system maintenance costs.” About 15 percent of respondents with ER-equipped fleets mentioned initial/maintenance costs as an economic effect.

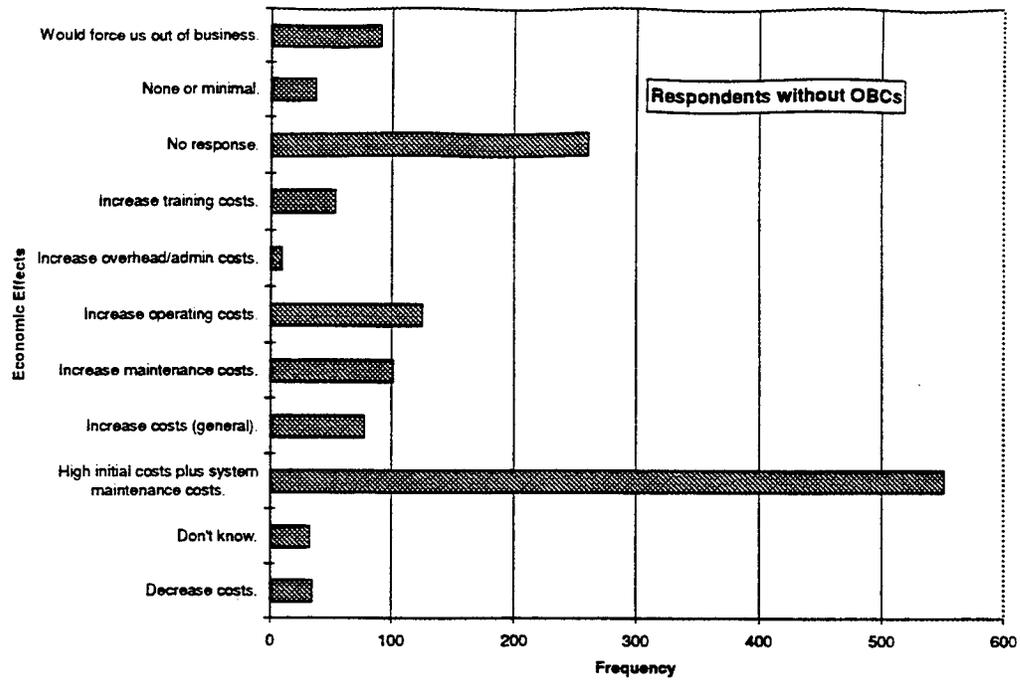


Figure 19. Economic Effects of Mandatory Use of Electronic HOS Recorders -- Non-ER Fleets

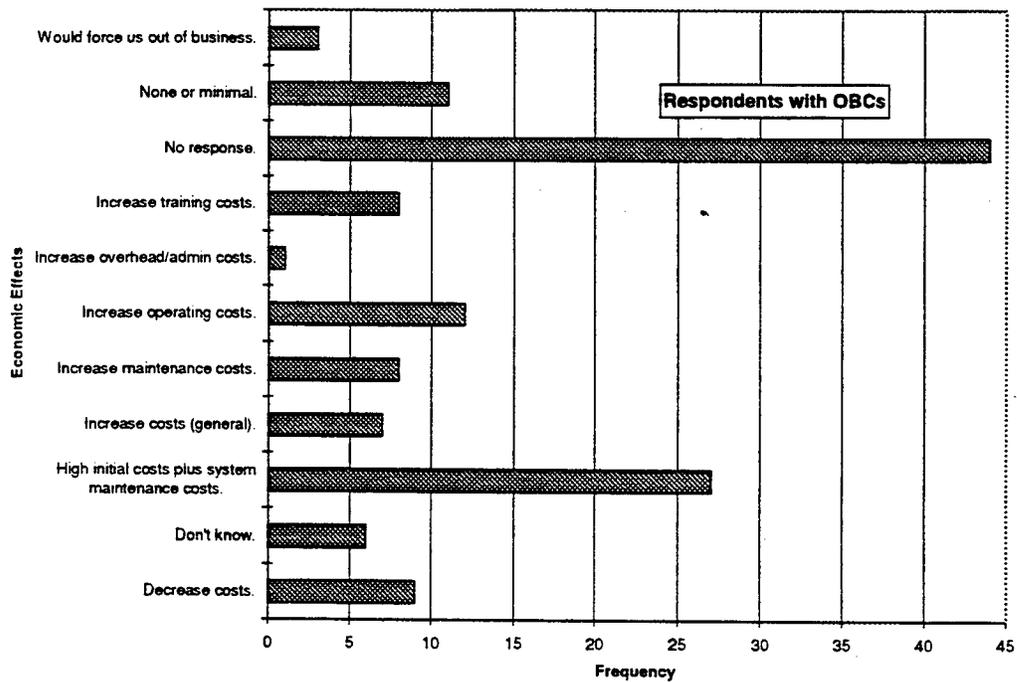


Figure 20. Economic Effects of Mandatory Use of Electronic HOS Recorders -- ER-Equipped Fleets

Safety Effects of Mandatory Electronic On-Board HOS Recording. Figures 21 and 22 show responses to the question “How would mandatory use of electronic on-board hours of service recording devices affect the overall safety of commercial vehicles?” The most frequent response from both groups is that they “will have little or no effect on safety.” However, carriers with ERs were much more likely to state that mandatory use of electronic HOS recording will improve safety and encourage driver compliance with laws.

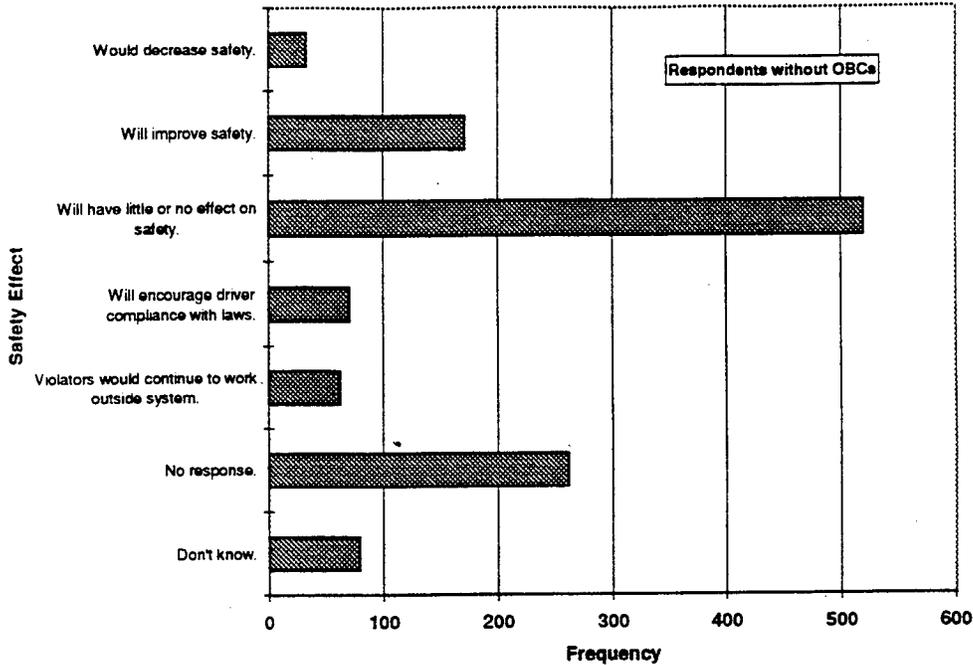


Figure 21. Safety Effects of Mandatory Electronic HOS Recorder Use -- Non-ER Fleets

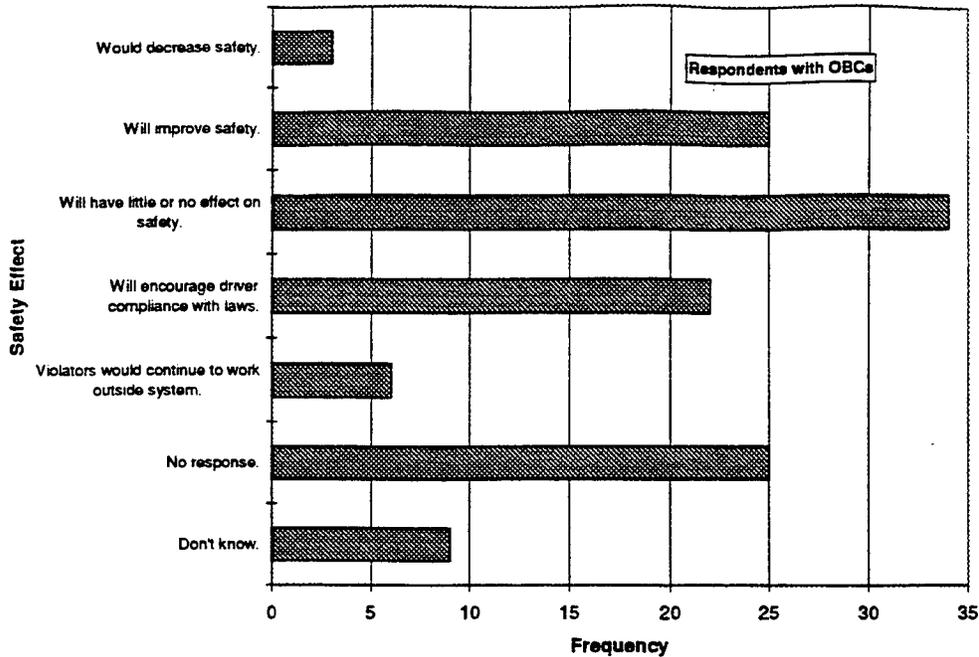


Figure 22. Safety Effects of Mandatory Electronic HOS Recorder Use -- ER-Equipped Fleets

Reasons for Not Using Electronic On-Board HOS Recording. The final questions asked those who do not currently use electronic on-board recording devices for HOS recording to state reasons for not using them. Figures 23 and 24 show responses to this question.

Carriers without ERs overwhelmingly cited excessive cost as the reason for not using electronic on-board HOS recording devices; many carriers with ERs did not respond to this question but, among those that did, excessive cost was the most frequently given reason. After excessive cost, the next most frequent response was that carriers felt that their current systems adequately maintain driver's hours.

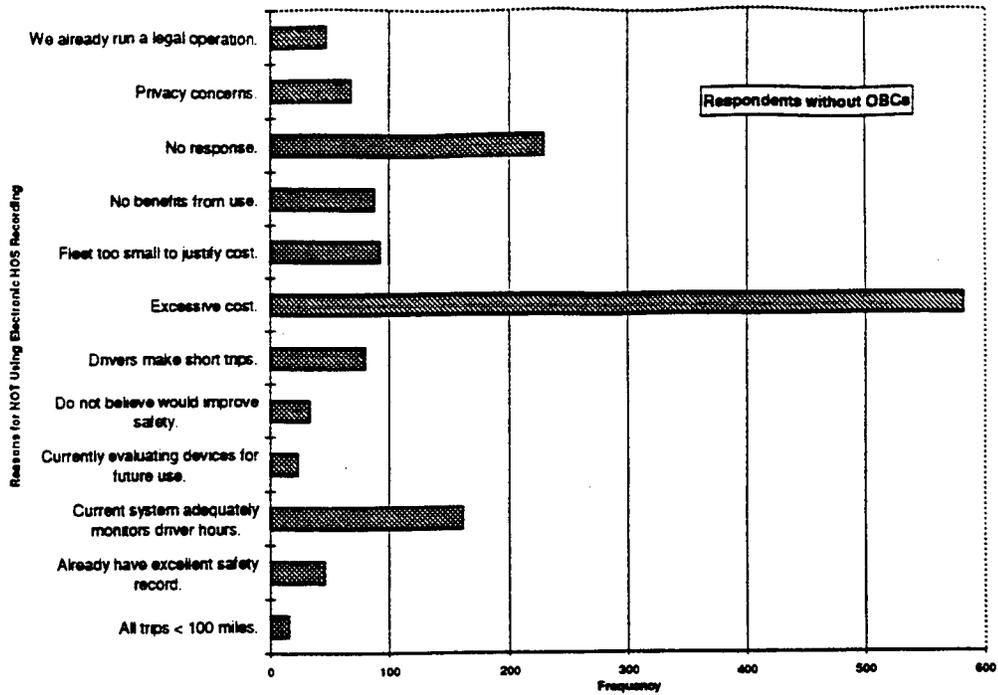


Figure 23. Reasons for Not Using Electronic HOS Recorders -- Non-ER Fleets

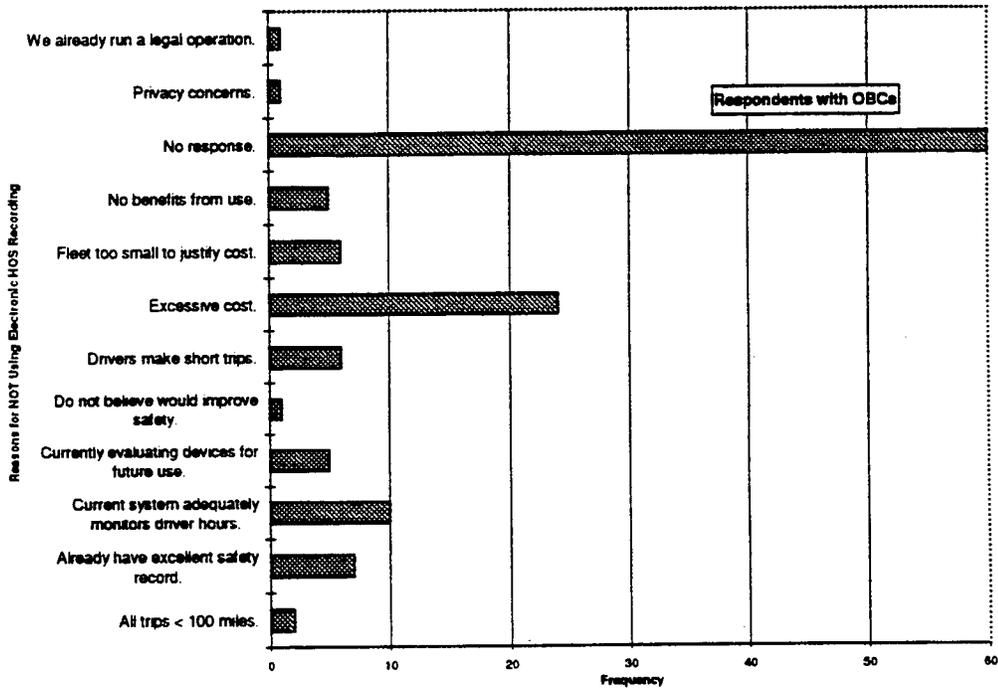


Figure 24. Reasons for Not Using Electronic HOS Recorders -- ER-Equipped Fleets

6.5 Cost-Benefit Analysis Summary

Carriers elect to acquire and operate electronic recorders for a variety of reasons, including electronic HOS recording. The median acquisition and installation cost for ERs is approximately \$2000 per vehicle but more recently acquired ERs tend to be more costly. Annual operating and maintenance cost is typically about \$200 per vehicle per year. However, only a few percent of small fleets have ERs. The reported per vehicle costs (from medium and large fleets) may underestimate fixed costs for training and computer installation in small fleets.

The benefits to carriers of ERs include better fleet management, more economical fleet operations, and reduced administrative costs. Although not studied here, highway safety interest groups believe electronic HOS recording could improve highway safety. This survey indicates driver logging and administrative time savings associated with electronic on-board HOS recording to be about 20 minutes per vehicle per day for driver logging and about 20 minutes per vehicle per month for HOS records management functions. However, due to the methods many drivers are paid (e.g., by the mile or by the trip), savings in the time spent by drivers completing hours of service logs may not result in cost savings to carriers.

Most carriers that have purchased ERs for their fleets feel they recover their investment within three years based on all of the functions performed by the ERs and most feel that ERs have relatively few technical performance problems.

Carriers see no significant operational effects of mandatory use of electronic on-board HOS recording devices but believe such a requirement would result in high initial costs plus system maintenance cost while having little or no effect on commercial vehicle safety. ERs are only one way to get data on HOS. HOS compliance depends on whether management acts on the available information. Carriers who do not use electronic on-board HOS recording devices most often cite excessive cost as the reason they do not, and they believe the systems they currently use adequately monitor driver hours.

7 Summary of Findings

The purpose of this study was to gather information from carriers on the current use of electronic recorders (ERs). The scope of this study was to query truck and bus associations on the costs and benefits of the use of electronic recorders for compliance with hours of service (HOS) regulations and industry attitudes towards mandatory use of electronic recorders.

Size and composition of the trucking industry

Information on the number of trucking companies by fleet size and company type was obtained from a November 1996 version of the MCMIS census file. More than 350,000 private and for-hire interstate trucking companies were identified. The number of interstate private and for-hire carriers in the census file is shown in Figure 25 by three fleet size groups.

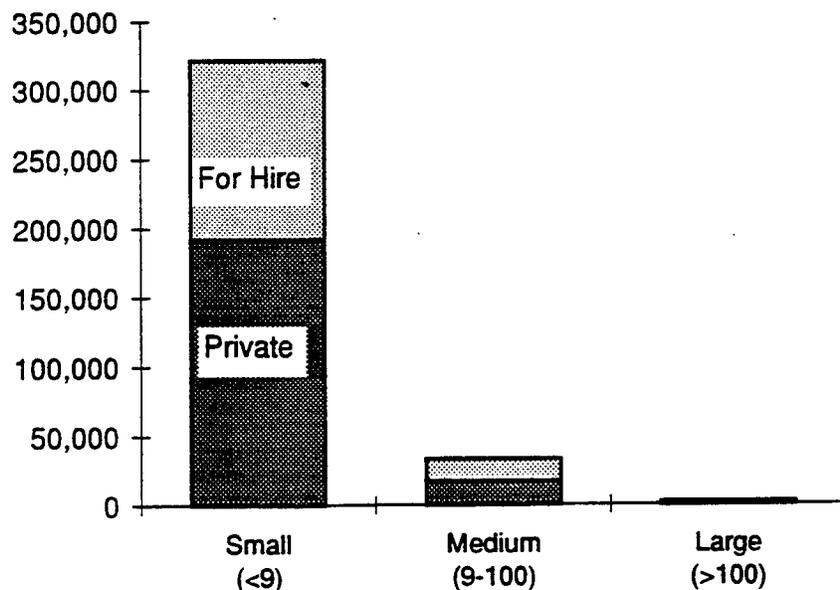
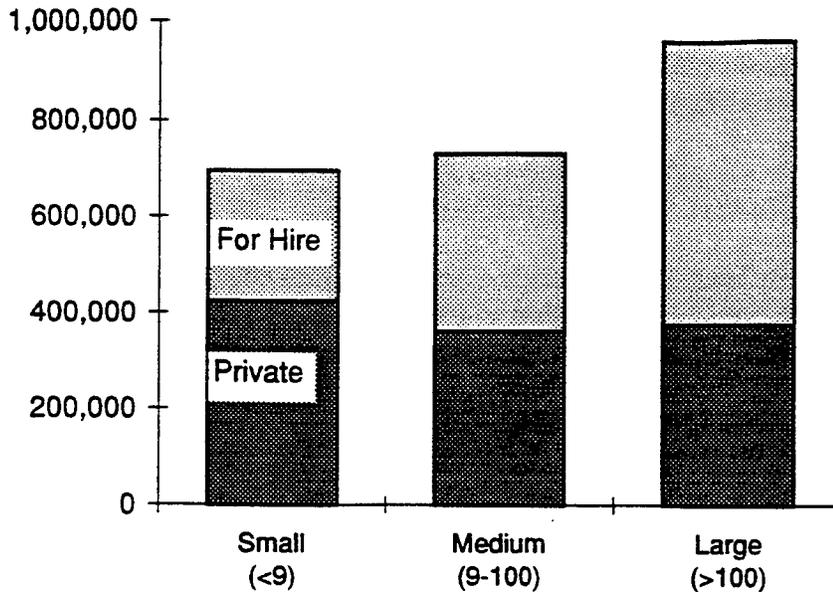


Figure 25. Number of Trucking Companies by Company Type and Fleet Size 1996 MCMIS Census File

Ninety percent of all carriers have less than 9 trucks. Less than 1 percent of all carriers have more than 100 trucks. Based on operating authority, nearly 60 percent are private carriers and 40 percent are for hire.

The distribution of trucks is much different, as shown in Figure 26. Large carriers operate about 40 percent of the trucks, based on fleet size information in the census file. Small carriers (less than 9 trucks) and medium carriers (9-100 trucks) each operate

about 30 percent of the trucks. Thus the fleet size categories selected correspond to approximately equal proportions of the truck fleet.



**Figure 26. Number of Trucks by Company Type and Fleet Size
1996 MCMIS Census File**

Study Design

UMTRI and SAIC developed the questions. They were provided to 5 truck and bus associations that agreed to participate. They were:

- National Private Truck Council (NPTC)
- Owner Operator Independent Drivers Association (OOIDA)
- Independent Truck Drivers Association (ITDA)
- American Bus Association (ABA)
- United Motorcoach Association (UMA)

The American Trucking Associations, Inc. (ATA) declined to participate.

In order to provide more comprehensive coverage of interstate carriers, the association membership lists were supplemented by about 6,500 carriers selected randomly from the 1996 MCMIS census file to provide approximately uniform coverage across private and for-hire carriers in each of three fleet size categories.

In January 1997, the participating associations sent out more than 10,000 forms to members and nonmembers with cover letters encouraging a reply. No cover letters were included with forms sent to for-hire carriers. Response rates are shown in Figure 27 for each association or census file group.

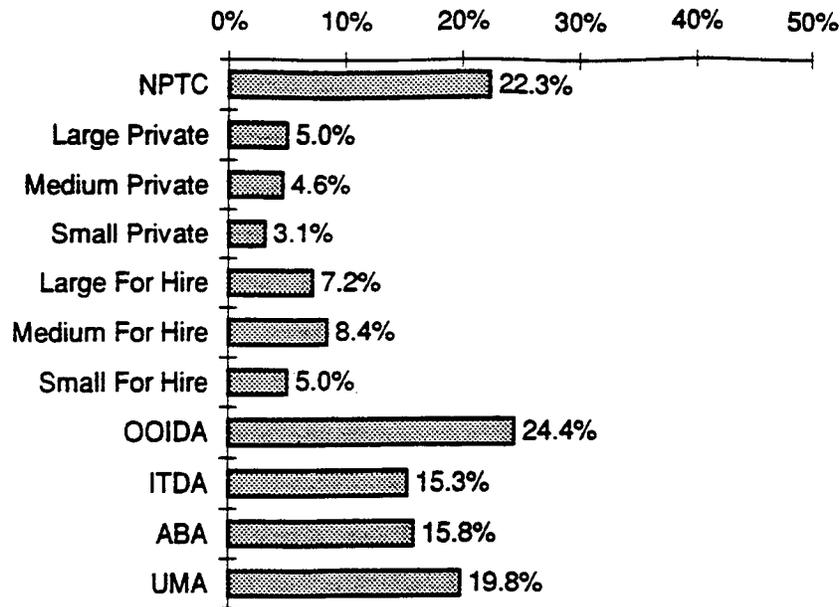


Figure 27. Response Rates by Association/Census Group

Response rates were lower than expected, especially among nonmembers of the participating associations. About 21 percent of association members responded as compared to only 4 percent of nonmember private fleets and 6 percent of for-hire carriers. Although forms were sent to a representative cross section of the industry, the information obtained can only be considered as representative of the responses received due to the low response rate.

Electronic Recorder Use

The extent of electronic recorder use in the trucking industry was an important question for this study. The result is shown in Figure 28 for each association/census group. One-third, or more, of large-truck fleets or NPTC-member respondents reported use of electronic recorders. ER use is much lower in all other groups queried. There is a clear pattern of decreasing use of ERs as fleet size decreases. Only a few percent of small truck fleets and owner operators reported ERs. Most bus fleets fell in the medium fleet size category, and reported ER use among bus fleets was comparable to medium-size truck fleets. However, these results cannot be considered as representative of the national population due to the low response rates.

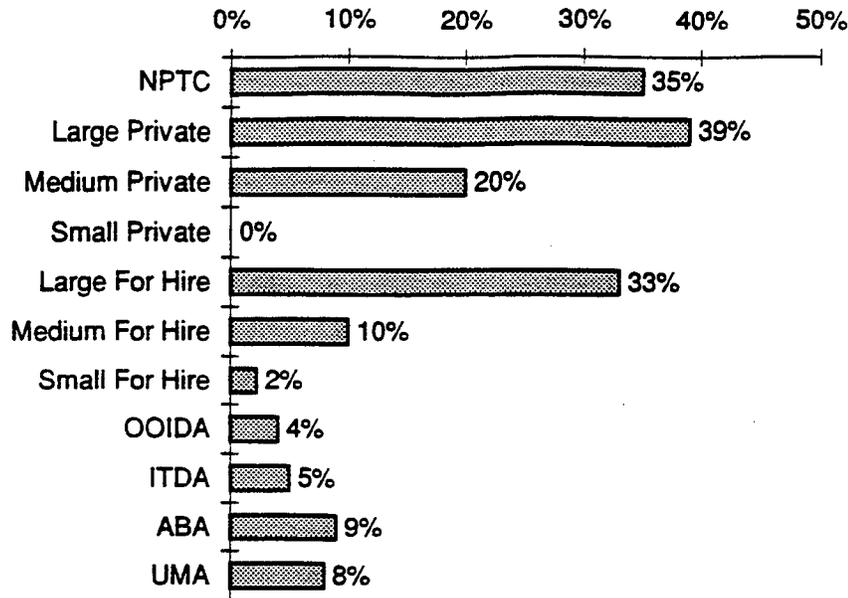


Figure 28. Survey Responses on Electronic Recorder Use by Association/Census Group

In order to provide some perspective for the survey responses on ER use, we looked for data on the national truck population. The 1992 Truck Inventory and Use Survey (TIUS) asked whether the truck was equipped with a "trip recorder." The use of trip recorders from the 1992 TIUS is shown in Figure 29 by carrier type and fleet size. Because interstate carriers cannot be adequately identified in the TIUS file, Figure 29 includes both intra- and interstate carriers. Overall, the 1992 TIUS data indicates that about 180,000 truck are equipped with a trip recorder. No information is available from this survey on the functions of these recorders.

The 1992 TIUS figures for any "trip recorder" are lower than the percentages of respondents with electronic recorders shown previously in Figure 28. Recorder use may have increased since 1992, or carriers using electronic recorders may have been more likely to return the survey, so that the percentage of respondents with electronic recorders is not representative of the larger trucking industry. Another problem with the 1992 TIUS data is that medium-duty trucks are apparently over-estimated due to the inclusion of some light trucks. This has the effect of inflating the number of small private fleets. However, patterns of recorder use by fleet size are consistent in both the TIUS data and survey responses.

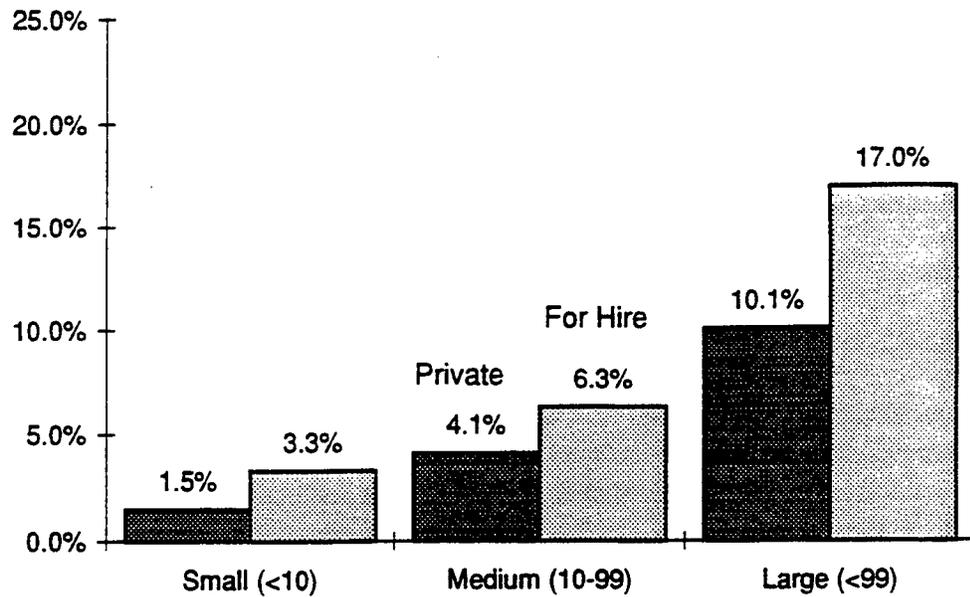


Figure 29. Trip Recorder Use by Company Type and Fleet size for All Medium and heavy Trucks 1992 Truck Inventory and Use Survey (TIUS)

Electronic Recorders with the HOS Function

Among respondents with electronic recorders, the following observations were made with regard to the HOS function.

- Of the 137 trucking fleets with ERs, a little over half (57 percent) said the recorders were equipped with the HOS function.
- Of the trucking fleets with ERs, 27 percent used ERs as the primary method for HOS compliance.
- Most of the truck fleets using ERs for HOS were NPTC members, and the rest were large or medium private fleets.
- No responding for-hire fleets used ERs as the primary method for HOS compliance.
- No owner operators used ERs as the primary method for HOS compliance.
- Only one bus fleet used ERs as the primary method for HOS compliance.

Cost

Data from this survey suggest that ER acquisition and installation cost is approximately \$2000 per vehicle but this cost can vary substantially depending on

when the unit is acquired and the types of functions available. Annual O&M costs are typically less than \$200 per vehicle but can be as much as \$1000 per vehicle. None of the variables examined clearly explain differences in either acquisition and installation cost or annual O&M cost. Use of HOS modules for hours of service reporting does not appear to increase the cost of acquiring and owning ERs. The reported per vehicle costs (from medium and large fleets) may underestimate fixed costs for training and computer installation in small fleets.

Benefits

The benefits of ERs accrue to different populations depending on the measures of interest. In this study, benefits assessment is restricted to assessing the economic and operational benefits to carriers. While ERs may offer significant benefits for fleet management, the value of electronic HOS recording lies largely in the time savings associated with drivers logs, including both the drivers' time to complete the log and the administrative time required to manage HOS records. The survey indicates that drivers with electronic logs spend about 20 minutes less time per day recording HOS than do drivers that use paper logs. Fleet managers with fleets using electronic HOS recorders save an additional 20 minutes per driver per month in time needed to administer HOS records at the fleet level.

Qualitative Responses

Carriers see no significant operational effects of mandatory use of electronic on-board HOS recording devices but believe such a requirement would result in high initial costs plus system maintenance cost while having little or no effect on commercial vehicle safety. ERs are only one way to get data on HOS. HOS compliance depends on whether management acts on the available information. Carriers who do not use electronic on-board HOS recording devices most often cite excessive cost as the reason they do not, and they believe the systems they currently use adequately monitor driver hours.

9 Conclusions

A primary objective of this study was to determine if fleets with electronic recorders thought they were cost-effective for recording HOS compliance. Five participating trucking industry associations distributed more than 10,000 study forms to members and a representative sample of all interstate truck fleets. About 1,200 responses were received, for about a 12 percent response rate. Of the 1,200 responding fleets, 175 used electronic recorders, and 78 (57 percent) were equipped with an HOS function. Information on the time spent by drivers and administrative personnel to maintain HOS records using electronic recorders was provided by 57 fleets. In 37 (27 percent) medium and large private fleets, electronic recorders were the primary method for HOS records.

Use of electronic recorders to maintain HOS records saved drivers 20 minutes per day in comparison to paper logbooks, based on the median difference. Administrative personnel saved 20 minutes per driver per month using electronic recorders. These results should not be considered representative of the larger fleet populations due to the low response rate and small sample size.

One-third or more of responding NPTC members, and large private and for-hire fleets used electronic recorders, although only about half were equipped with the HOS function. There is a clear pattern, evident in both the responses received and the 1992 TIUS data, of increasing ER use with larger fleets. ER use ranges from 0 to only a few percent in small truck fleets, among owner operators, and in bus fleets. Survey responses suggest that private fleets are more likely to use the HOS function.

The association between fleet size and the use of electronic recorders appears to be an important issue. Based on the MCMIS data, 90 percent of all carriers operate less than 9 trucks. This study found only 2 small fleets using ERs for HOS records. The reported costs for ER acquisition (by medium and large fleets) may underestimate these costs for small fleets. Thus, there is no evidence that ERs are cost-effective in small fleets.

The overwhelming view of fleets of all sizes is that mandatory use of electronic recorders would require an excessive expenditure for minimal benefits. HOS compliance is a management decision. An electronic recorder provides information about hours of service (and many other vehicle functions), but the information has no impact if it is not reviewed and acted on.

Caveats

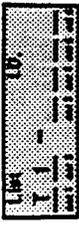
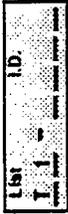
This study does not address the relationship of electronic recorders to compliance with HOS, nor the relationship of compliance with HOS to fatigue or safety. While pertinent to the petition, the purpose of this study was to gather information from carriers on the current use of electronic recorders. The relationship of HOS to fatigue and safety is complex and is the subject of other research programs.

Response rates were lower than expected, especially among nonmembers of the participating associations. About 21 percent of association members responded as compared to only 4 percent of nonmember private fleets and 6 percent of for-hire carriers. Although forms were sent to a representative cross section of the trucking industry, the information obtained can only be considered as representative of the responses received due to the low response rate.

Appendices

Appendix A Study Questions

The three forms sent to selected companies are included in this appendix. The T Form was sent to Office of Motor Carrier (OMC) Motor Carrier Management Information Systems (MCMIS) Census file companies and National Private Truck Company (NPTC) members. The O Form was sent to the Owner Operator Independent Drivers Association (OOIDA) members and the Independent Truck Drivers Association (ITDA) members. The B Form was sent to members of two bus associations, American Bus Association (ABA), and United Motorcoach Association (UMA).



The University of Michigan
Transportation Research Institute
Center for National Truck Statistics

20. Electronic on-board recording devices with hours of service modules typically cost between \$1500 to \$2000 per vehicle.

a. What operational effects would mandatory use of electronic on-board hours of service recording devices have on your business (trip scheduling, driver out-of-service rates, administrative activities)?

b. What economic effects would mandatory use of electronic on-board hours of service recording devices have on your business (investment, operating expenses, maintenance expenses)?

c. How would mandatory use of electronic on-board hours of service recording devices affect the overall safety of commercial vehicles?

21. If your company does not currently use electronic on-board recording devices for hours of service recording, briefly state the reasons your company is not using on-board recorders for this function at this time.

Thank you for completing the form. If we may contact you to clarify your responses, please provide your name and telephone number. Study results will be provided to your association and the Federal Highway Administration, but the names of respondents will be kept confidential. Please return this form in the enclosed envelope.

Name: _____ Telephone Number: (____) _____
(please print)

Electronic Recorder Study

The University of Michigan Transportation Research Institute is conducting a study of electronic recorder use in cooperation with trucking industry associations. The study is sponsored by the Federal Highway Administration and addresses the costs and benefits of using interactive, electronic, on-board recording devices to comply with the hours of service (HOS) regulations. The Federal Highway Administration plans to use this information to respond to safety-concerned groups that have petitioned for mandatory use of on-board recorders and as part of their evaluation of a proposed rulemaking to revise the hours of service regulations for drivers.

The objective of the study is to get representative information from all segments of the interstate commercial motor vehicle industry, for-hire and private, fleets and owner-operators, trucks and buses. You have been randomly selected to represent your particular segment of the motor carrier industry. Please take 15 minutes now to complete the form, and return it in the enclosed envelope.

The names of respondents will be kept confidential. Study results will be provided to your association and FHWA, and a summary report will be available to the public. If you have any questions, please contact Ken Campbell at UMTTRI, 1-800-458-5970. Thank you for your assistance.

Instructions: There are two types of questions on this form. Where boxes are shown, please mark an "X" to indicate your answer(s). For questions with blanks, please write one digit per blank. A few questions offer "other" as a response. If you select "other," please write a specific answer in the long blank after "other." Please describe your primary operation during the past year.

Part I: Information about your company and operation.

1. Do your company's trucks cross state lines?

- 1 Yes (interstate)
2 No (intrastate)

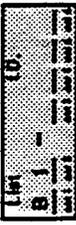
2. How is your fleet best described?

- 1 Private fleet
2 For hire carrier
3 Owner/operator
4 Bus company

3. How are your drivers paid?

- | | | |
|-----------------------|--------------------------|--------------------------|
| | 1 | 2 |
| | Yes | No |
| By the mile (or trip) | <input type="checkbox"/> | <input type="checkbox"/> |
| By the hour | <input type="checkbox"/> | <input type="checkbox"/> |
| Salary | <input type="checkbox"/> | <input type="checkbox"/> |
| Overtime | <input type="checkbox"/> | <input type="checkbox"/> |
| By percent of revenue | <input type="checkbox"/> | <input type="checkbox"/> |
| Other (pound, cube) | <input type="checkbox"/> | <input type="checkbox"/> |

(Specify)



The University of Michigan
Transportation Research Institute
Center for National Truck Statistics

20. Electronic on-board recording devices with hours of service modules typically cost between \$1500 to \$2000 per vehicle.

a. What operational effects would mandatory use of electronic on-board hours of service recording devices have on your business (trip scheduling, driver out-of-service rates, administrative activities)?

b. What economic effects would mandatory use of electronic on-board hours of service recording devices have on your business (investment, operating expenses, maintenance expenses)?

c. How would mandatory use of electronic on-board hours of service recording devices affect the overall safety of commercial vehicles?

21. If your company does not currently use electronic on-board recording devices for hours of service recording, briefly state the reasons your company is not using on-board recorders for this function at this time.

Thank you for completing the form. If we may contact you to clarify your responses, please provide your name and telephone number. Study results will be provided to your association and the Federal Highway Administration, but the names of respondents will be kept confidential. Please return this form in the enclosed envelope.

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The objective of the study is to get representative information from all segments of the interstate commercial motor vehicle industry, for-hire and private, fleets and owner-operators, trucks and buses. You have been randomly selected to represent your particular segment of the motor carrier industry. Please take 15 minutes now to complete the form, and return it in the enclosed envelope.

The names of respondents will be kept confidential. Study results will be provided to your association and FHWA, and a summary report will be available to the public. If you have any questions, please contact Ken Campbell at UMTRI, 1-800-458-5970. Thank you for your assistance.

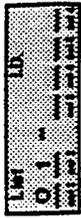
Instructions: There are two types of questions on this form. Where boxes are shown, please mark an "X" to indicate your answer(s). For questions with blanks, please write one digit per blank. A few questions offer "other" as a response. If you select "other," please write a specific answer in the long blank after "other." Please describe your primary operation during the past year.

Part I: Information about your company and operation.

1. Do your company's buses cross state lines?
 - 1 Yes (interstate)
 - 2 No (intrastate)
2. Which type of bus does your fleet operate (please mark only one)?
 - 1 Motor coach
 - 2 Medium buses
 - 3 School buses
 - 4 Vans
3. How is your operation best described (please mark only one)?
 - 1 Intercity
 - 2 Charter/Tour
 - 3 Commuter
 - 4 Other (special services) _____
(Specify)



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 Transportation Research Institute
 Center for National Truck Statistics



20. Electronic on-board recording devices with hours of service modules typically cost between \$1500 to \$2000 per vehicle.

a. What operational effects would mandatory use of electronic on-board hours of service recording devices have on your business (trip scheduling, driver out-of-service rates, administrative activities)?

b. What economic effects would mandatory use of electronic on-board hours of service recording devices have on your business (investment, operating expenses, maintenance expenses)?

c. How would mandatory use of electronic on-board hours of service recording devices affect the overall safety of commercial vehicles?

21. If you do not currently use electronic on-board recording devices for hours of service recording, briefly state the reasons for not using on-board recorders for this function at this time.

Thank you for completing the form. If we may contact you to clarify your responses, please provide your name and telephone number. Study results will be provided to your association and the Federal Highway Administration, but the names of respondents will be kept confidential. Please return this form in the enclosed envelope.

Name: _____ Telephone Number: (____) _____
 (please print)

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The names of respondents will be kept confidential. Study results will be provided to your association and FHWA, and a summary report will be available to the public. If you have any questions, please contact Ken Campbell at UMTRI, 1-800-458-5970. Thank you for your assistance.

Instructions: There are two types of questions on this form. Where boxes are shown, please mark an "X" to indicate your answer(s). For questions with blanks, please write one digit per blank. A few questions offer "other" as a response. If you select "other," please write a specific answer in the long blank after "other." Please describe your primary operation during the past year.

NOTE: Owner-operators leased to a company should respond based on your operation, not the company you are leased to.

Part I: Information about your company and operation.

1. Do you operate across state lines?

- 1 Yes (interstate)
 2 No (intrastate)

2. How is your operation best described?

- 1 Private fleet
 2 For hire carrier
 3 Owner/operator
 4 Bus company

3. How are you (or your drivers) paid?

- | | | |
|-----------------------|--------------------------|--------------------------|
| | 1 | 2 |
| | Yes | No |
| By the mile (or trip) | <input type="checkbox"/> | <input type="checkbox"/> |
| By the hour | <input type="checkbox"/> | <input type="checkbox"/> |
| Salary | <input type="checkbox"/> | <input type="checkbox"/> |
| Overtime | <input type="checkbox"/> | <input type="checkbox"/> |
| By percent of revenue | <input type="checkbox"/> | <input type="checkbox"/> |
| Other (pound, cube) | <input type="checkbox"/> | <input type="checkbox"/> |

(Specify)

Appendix B Data Processing

This appendix includes the editing and data management procedures used to create the three electronic data files. There is a separate data file for each of the three forms (T, O, and B).

Electronic Recorder Study
Editing and Check-editing Procedures
and Electronic File Creation

(January 14, 1997

Revised 2-5-97)

- 1.) Mailing cost sheets attached to incoming surveys should be removed and filed. Any mail returned as "undeliverable" should be kept and sorted by the 11 subgroups (see 4. below).
- 2.) Open each survey and discard (recycle) the envelop. Keep envelop if notes are written on it that pertain to the enclosed survey form. Attach envelop to survey with a paperclip. These notes will be reviewed.
- 3.) Use a **red** pencil for editing. Use a **green** pencil for check-editing. When marking the forms, do not obliterate any answer written by the subjects. Simply draw a line through the subject's answer and write the correct answer next to it (or near the col. number(s) for that answer). Edit and check-edit each survey. Check-editor will write **first initial** in top left corner of **page 1** using a green pencil.
- 4.) Order surveys into the 11 sample subgroups. These are:

<u>Code</u>	<u>Name</u>	<u>Expected Response N</u>	<u>Date Survey Sent</u>
T1	NPTC	420	1-6-97
T2	Large Private Fleets	201	1-8/9-97
T3	Medium Private Fleets	206	1-8/9-97
T4	Small Private Fleets	200	1-8/9-97
T5	Large For Hire	282	1-10-97
T6	Medium For Hire	209	1-10-97
T7	Small For Hire	200	1-10-97
O1	OVIDA (Owner Oper)	450	1-6-97
O2	ITDA (Owner Oper)	30	late Jan.
B1	American Bus Assoc.	140	1-15-97 ?
B2	United Motorcoach	170	1-6-97

2,510 Total

125 With Electronic Recorder (approx. 5%)

(Note: Those "With Electronic Recorder" answer Part II of the survey. Those without an electronic recorder do not answer Part II -- see discussion of Part II for each form below.)

Returned surveys will be stored in a file cabinet. Using a computer, electronic data files will be created.

File surveys in a file drawer with hanging folders with labels to reflect the 11 sample subgroups. Will need more than one folder for each group.

Keep track of the number of actual responses received in each subgroup. For **each of the 11 subgroups**, use a red pencil to mark each survey form in the upper right-hand

corner of **page 1** and **page 4** with an **incoming number** in the 4 dashes labeled "I.D." Start with the number "1." The last survey received for each subgroup will equal the total number of returned surveys for each subgroup. **DO NOT Code leading 0's.**

At the end of **each week**, an update on the total number of surveys received in each of the 11 subgroups will be determined using Excel software. Also include the number of surveys that are "undeliverable" for each subgroup (see 1. above).

After the incoming number is written on pages 1 and 4, make a copy of the **last page** (page 4) of each survey. These copies will be forwarded to the trucking associations for further study. Organize these copies by the eleven subgroups and file temporarily in a file folders. Develop a template for the copying.

5.) Only edit and check-edit pages 1, 2, and 3. Page 4 will **not** be done in our office. **DO NOT code leading 0's** for all (numeric) "dash" questions.

6.) There are 5 additional codes possible besides those on the questionnaire. These are:

9 or 99's if the answer is **missing** (leading 9's and ending with 9 if more than one column).

8 or 98's if the answer is **not applicable** (leading 9's ending with 8 if more than one column). The only exception is Part II (see below).

7 or 97's if the answer is "**don't know.**" (The subject actually writes "don't know", "?" or "varies" in the margin or provided dashes.) (Code leading 9's ending with 7 if more than one column.)

96 (or 0) if subject gives a fraction of a year for **Q. 11**. That is, if subject answers **less than 1 year** (i.e., less than 12 months) then code as zero "**0.**" If subject answers with a fraction of **more than 1 year** (e.g. 1.5 years, 2 years and 4 months, 3.25 years, etc.), then code as "**96.**" For **Q.13** and **Q. 19**, if ≥ 1000 , then code as "**996.**" For **Q.18**, if ≥ 100 minutes then code as "**96.**" Actual data will be added later.

9995 if subject writes **OEM** (Original Equipment Manufact.) in **Q12** code as **9995** for cost. If **ECM** (Engine Control Module) is written, mark and this answer will be reviewed.

Written Comments:

If the subject answered a question by marking a box(es) or filling in dashes, plus gives a **written comment**, code what is marked in box(es) or dashes. Read the comment to make sure it is consistent with the marked answer.

7.) Page 4: **Name and /or Telephone Number** at the bottom of Page 4. If subject provided name and/or phone number, code last column in the record as "1." If name/and or phone number is not provided, code last column as "0." **0 = no name/phone 1 = yes name/phone**

Form T: Column 100

Form B: Column 97

Form O: Column 81

8.) Using Raosoft software, create 11 electronic files. One file for each of the 11 subgroups:

Seven for "T" forms, two for "O" forms, and two for "B" forms. This is necessary because the columns are slightly different for each form type. T forms have 100 total columns. O forms have 81 total columns. B forms have 97 total columns. Two datafiles of the 11 subgroups will be created and compared for errors.

The first set of 11 files will be named as follows: T.DAT, T2.DAT, T3.DAT, T4.DAT, T5.DAT, T6.DAT, T7.DAT, O.DAT, O2.DAT, B.DAT, and B2.DAT. Raosoft Survey software will be used to enter data. See RAOSOFT- Data Entry Commands.

The second set of 11 files will be named as follows: TF.DAT, T2F.DAT, T3F.DAT, T4F.DAT, T5F.DAT, T6F.DAT, T7F.DAT, OF.DAT, O2F.DAT, BF.DAT, and B2F.DAT. Raosoft Survey software will be used to enter data. See RAOSOFT- Data Entry Commands.

"T" Form Surveys:

Missing Data:

All subjects should **answer all questions** in Parts I and III. If not answered, then data are missing. (Q 1, 2, 3, 4, 5, 6, 7, 8, 9, 18, and 19)

If subjects answer **Q10.** with a non-zero number in Part II, then all questions not answered are considered as missing. (Q 11, 12, 13, 14, 15, 16, and 17)

When a subject should have marked a box or filled in dashes (the question was applicable to the subject), but did **not** mark a box or fill in dashes, the answers are missing -- fill in 9 or 9's. The exception is if the respondent **has written a comment.** In such cases, mark with a small postit sticky. Such comments may be translated into one of the item categories. Such comments will be reviewed.

Not Applicable Data:

Part I:

Questions 1, 2, 4, 5, 7, 8 and 9 should **not** have 8 or 98's (not applicable) codes.

Questions 3, and 6 may have 8 or 98's codes if they answer one or more parts of the question and leave the remaining parts blank. The blanks should be coded as 8 or 98's.

Coding Specific Questions:

Q1: If a subject marks both code 1 (Yes) and code 2 (No), then code as "1" (Yes).

Q2: Marking 2 or more categories to describe fleet:

Forms T1-T4

If subject marks **2 or more categories**, and one is "Private fleet," then code as "1."

If "Private fleet" is **not** one of the 2 or more categories marked, then code as "5."

Forms T5-T7

If subject marks **2 or more categories**, and one is "For hire carrier," then code as "2." If "For hire carrier" is **not** one of the 2 or more categories marked, then code as "5."

Q6: Total should equal number in Q.5. If not, just code what subject has written.

If subject writes "**100 mile radius rule**" in "Other," and does **not** mark any of the other 3 HOS categories, then write the number of drivers from Q5 in the dashes for the "Other" category.

Q7: If both single average and team average are given, take the **single** average.

Q9: If two answers are marked on either side of a single blank box, select the middle code. If two adjacent codes are marked, flip a coin.

(continued)

Part II:

If subjects “skip” Part II (Questions 10, 11, 12, 13, 14, 15, 16, and 17), they do not have electronic recorders and this section is not applicable for them. All answers are to be coded as **blanks**. If there are written comments in any of these “not applicable” questions, mark and these will be reviewed.

Coding Specific Questions:

Q. 11: Code a **96** or **0** if subject gives a fraction of a year. That is, if subject answers **less than 1 year** (i.e., less than 12 months) then code as zero “**0**.” If subject answers with a fraction of **more than 1 year** (e.g. 1.5 years, 2 years and 4 months, 3.25 years, etc), then code as “**96**.” Actual data will be added later

Q.15 and Q.16: If subjects answer questions in Part II, 8’s should be coded for parts of Questions 15 and 16 that were left blank.

Q.16: Code ranks as subjects code them. If a given rank is used more than once, then code as such (e.g. if two 1’s marked, then code both categories as 1’s, etc.). If subject marks X’s only, then code as all ‘1’s.’ If subject gives a rank higher than “7,” then code as “7.”

Q.17: If subject marked more than one response for performance, code the *highest* code.

If subjects answer Part II, this means they have electronic recorders. Code a “1” in the column 99 for each record if subject has an electronic recorder(s). Code a “0” if the subject does not have an electronic recorder(s) and has skipped Part II.

Form T: Column 99 – 0 = no recorder (s) 1 = yes recorder(s)

Part III:

Questions 18, and 19: if “Not Applicable” box is marked, code as **98** or **998**. If box is not marked, but answer is not applicable (i.e. do not have electronic recorders -- did not answer Part II), also code as **98** or **998**.

Coding Specific Questions:

Q19: If a subject gives a fraction of an hour for “administrative staff hours,” round to the nearest whole number (e.g. If 6.5 through 6.9, then code as 7. If 6.1 through 6.4, then code as 6.)

"O" Form Surveys:

Missing Data:

All subjects should answer all questions in Parts I and III. If not answered, then data are missing. (Q 1, 2, 3, 4, 5, 6, 7, 8, 9, 18, and 19)

If subjects answer Q10. with a non-zero number in Part II, then all questions not answered are considered as missing. (Q 11, 12, 13, 14, 15, 16, and 17)

When a subject should have marked a box or filled in dashes (the question was applicable to the subject), but did not mark a box or fill in dashes, the answers are missing -- fill in 9 or 9's. The exception is if the respondent has written a comment. In such cases, mark with a small postit sticky. Such comments may be translated into one of the item categories.

Not Applicable Data:

Part I:

Questions 1, 2, 4, 5, 6, 7, 8 and 9 should not have 8's or 98's (not applicable) codes.

Question 3 may have 8 codes if they answer one or more parts of the question and leave the remaining parts blank. The blanks should be coded as 8's.

Coding Specific Questions:

Q1: If a subject marks both code 1 (Yes) and code 2 (No), then code as "1" (Yes).

Q2: Marking 2 or more categories to describe fleet:

If subject marks 2 or more categories, and one is "Owner/operator," then code as "3." If "Owner/operator" is not one of the 2 or more categories marked, then code as "5."

Q6: Code "5" if subject marked more than one category for HOS.

If subject writes "100 mile radius rule" in "Other," and does not check the "Other" category, code as "4."

Q9: If two answers are marked on either side of a single blank box, select the middle code. If two adjacent codes are marked, flip a coin.

Part II:

If subjects "skip" Part II (Questions 10, 11, 12, 13, 14, 15, 16, and 17), they do not have electronic recorders and this section is not applicable for them. All answers are to be coded as blanks. If there are written comments in any of these "not applicable" questions, mark with a small postit sticky for will review.

Coding Specific Questions:

Q. 11: Code a 96 or 0 if subject gives a fraction of a year. That is, if subject answers less than 1 year (i.e., less than 12 months) then code as zero "0." If subject answers

with a fraction of **more than 1 year** (e.g. 1.5 years, 2 years and 4 months, 3.25 years, etc.), then code as "96." Actual data will be added later.

Q.15 and Q.16: If subjects answer questions in Part II, 8's should be coded for parts of Questions 15 and 16 that were left blank.

Q.16: Code ranks as subjects code them. If a given rank is used more than once, then code as such (e.g. if two 1's marked, then code both categories as 1's, etc.). If subject marks X's only, then code as all '1's.' If subject gives a rank higher than "7," then code as "7."

Q.17: If subject marked more than one response for performance, code the *highest* code.

If subjects answer Part II, this means they have electronic recorders. Code a "1" in the column 80 for each record if subject has an electronic recorder(s). Code a "0" if the subject does not have an electronic recorder(s) and has skipped Part II.

Form O: Column 80 – 0 = no recorder (s) 1 = yes recorder(s)

Part III:

Questions 18, and 19: if "Not Applicable" box is marked, code as 98 or 998. If box is not marked, but answer is not applicable (i.e. do not have electronic recorders -- did not answer Part II), also code as 98 or 998.

Coding Specific Questions:

Q19: If a subject gives a fraction of an hour for "administrative staff hours," round to the nearest whole number (e.g. If 6.5 through 6.9, then code as 7. If 6.1 through 6.4, then code as 6.)

"B" Form Surveys:

Missing Data:

All subjects should **answer all questions** in Parts I and III. If not answered, then data are missing. (Q 1, 2, 3, 4, 5, 6, 7, 8, 9, 18, and 19)

If subjects answer **Q10.** with a non-zero number in Part II, then all questions not answered are considered as missing. (Q 10, 11, 12, 13, 14, 15, 16, and 17)

When a subject should have marked a box or filled in dashes (the question was applicable to the subject), but did **not** mark a box or fill in dashes, the answers are missing -- fill in 9 or 9's. The exception is if the respondent **has written a comment.** In such cases, mark with a small postit sticky. Such comments may be translated into one of the item categories.

Not Applicable Data:

Part I:

Questions **1, 2, 3, 5, 6, 8, and 9** should not have 8 or 98's (not applicable) codes.

Questions **4 and 7** may have 8 or 98's codes if they answer one or more parts of the question and leave the remaining parts blank. The blanks should be coded as 8 or 98's.

Coding Specific Questions:

Q1: If a subject marks both code 1 (Yes) and code 2 (No), then code as "1" (Yes).

Q2: Marking 2 or more categories to describe fleet:

If subject marks **2 or more categories**, code as "5."

Q3: Marking 2 or more categories to describe operation:

If subject marks **2 or more categories**, code as "5."

If subject wrote "interstate" in code 4, code as "1." -

Q7: Total should equal number in Q.6. If not, just code what subject has written.

If subject writes "**100 mile radius rule**" in "Other," and does **not** mark any of the other 3 HOS categories, then write the number of drivers from Q6 in the dashes for the "Other" category.

Part II:

If subjects "**skip**" Part II (Questions 10, 11, 12, 13, 14, 15, 16, and 17), they do not have electronic recorders and this section is not applicable for them. All answers are to be coded as **blanks**. If there are written comments in any of these "not applicable" questions, mark with a small postit sticky for review.

Q. 11: Code a **96 or 0** if subject gives a fraction of a year. That is, if subject answers **less than 1 year** (i.e., less than 12 months) then code as zero "**0.**" If subject answers with a fraction of **more than 1 year** (e.g. 1.5 years, 2 years and 4 months, 3.25 years, etc.), then code as "**96.**" Actual data will be added later.

Q.15 and Q.16: If subjects answer questions in Part II, 8's should be coded for parts of Questions 15 and 16 that were left blank.

Q.16: Code ranks as subjects code them. If a given rank is used more than once, then code as such (e.g. if two 1's marked, then code both categories as 1's, etc.). If subject marks X's only, then code as all '1's.' If subject gives a rank higher than "7," then code as "7."

(continue)

Q.17: If subject marked more than one response for performance, code the *highest* code.

If subjects answer Part II, this means they have electronic recorders. Code a "1" in the column 96 for each record if subject has an electronic recorder(s). Code a "0" if the subject does not have an electronic recorder(s) and has skipped Part II.

Form B: Column 96 – 0 = no recorder (s) 1 = yes recorder(s)

Part III:

Questions 18, and 19: if "Not Applicable" box is marked, code as 98 or 998. If box is not marked, but answer is not applicable (i.e. do not have electronic recorders -- did not answer Part II), also code as 98 or 998.

Coding Specific Questions:

Q19: If a subject gives a fraction of an hour for "administrative staff hours," round to the nearest whole number (e.g. If 6.5 through 6.9, then code as 7. If 6.1 through 6.4, then code as 6.)

Appendix C Cover Letters

This appendix includes the cover letters that accompanied copies of the form sent to selected companies. Each of the five associations drafted and mailed a separate letter to their membership. The NPTC also mailed letters and forms to the three OMC private truck strata. UMTRI mailed forms to the remaining three OMC for-hire strata. Cover letters did not accompany the OMC for-hire forms.

NATIONAL PRIVATE TRUCK COUNCIL

66 Canal Center Plaza, Suite 600, Alexandria, VA 22314 • Phone: 703-683-1300 • Fax: 703-683-1217

January 6, 1996

Dear NPTC Member:

Enclosed is an important study that should be of prime interest to all members of the National Private Truck Council. The study addresses "The Mandatory Use of Electronic Interactive Onboard Recording Devices in Lieu of the Drivers Log". It is designed to define your private fleet operations, to capture your thoughts and opinions, and to provide a cost/benefit assessment of such a mandate.

At the request of the Federal Highway Administration (FHWA) we have agreed to participate in this research effort being led by the University of Michigan Transportation Research Institute (UMTRI).

As indicated in the study cover letter the FHWA plans to use this information to respond to groups that have petitioned for mandatory use of on-board computers to record driver's hours of service. These groups believe that the mandatory use of onboard computers would "reduce the widespread hours-of-service abuses that contribute to fatigue-related trucks crashes". Additionally, FHWA plans to utilize the information collected by UMTRI and other data to determine if a proposed rulemaking to mandate the use of onboard computers to track drivers' hours of service is warranted.

It is my job to keep you apprised of the regulatory and administrative actions affecting the operations of private fleets. Now is your opportunity to express your opinion directly to the FHWA on an important subject for everyone whose fleet operations require the use of a driver's daily log. Your response will also be utilized by NPTC as part of our response to FHWA's request for comments on their proposed rulemaking on hours of service for drivers.

Please take the time necessary to complete this survey and return it in the enclosed self-addressed envelope. If you have any questions, please contact Dave Barry or Jim York at 703-683-1300. Thank you for your assistance.

Regards,



Jim Galligan
Acting Executive Director





Private Carrier

NATIONAL PRIVATE TRUCK COUNCIL

66 Canal Center Plaza, Suite 600, Alexandria, VA 22314 • Phone: 703-683-1300 • Fax: 703-683-1217

January 6, 1997

Dear Private Fleet Manager/Operator:

Enclosed is an important study that should be of prime interest to all individuals who manage or operate a private fleet. The study addresses "The Mandatory Use of Electronic Interactive Onboard Recording Devices in Lieu of the Drivers Log". It is designed to define your private fleet operations, to capture your thoughts and opinions, and to provide a cost/benefit assessment of such a mandate.

At the request of the Federal Highway Administration (FHWA) the National Private Truck Council agreed to participate in this research effort being led by the University of Michigan Transportation Research Institute (UMTRI). You have been selected at random as a private fleet manager/operator to participate in this study.

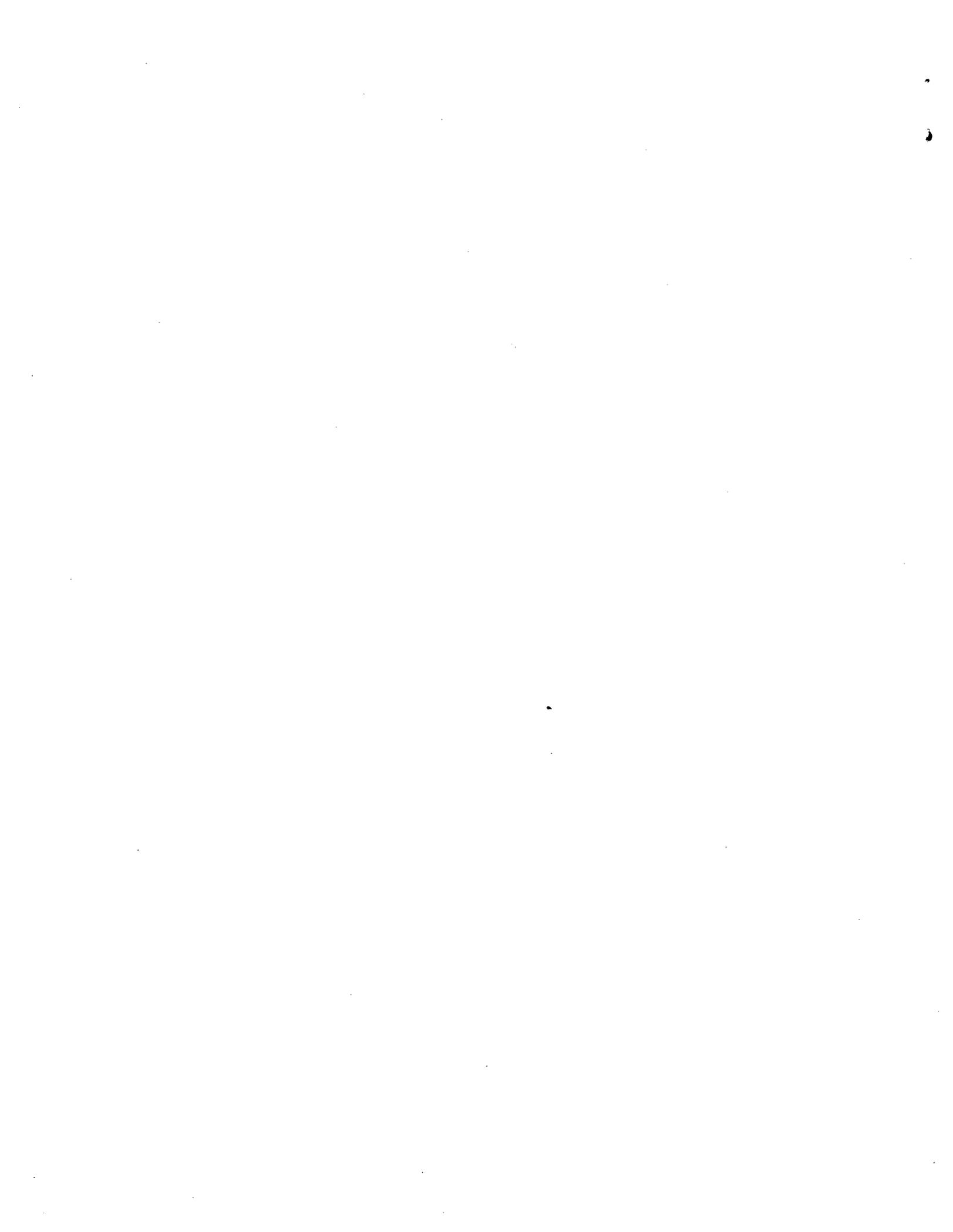
As indicated in the study cover letter the FHWA plans to use this information to respond to groups that have petitioned for mandatory use of on-board computers to record driver's hours of service. These groups believe that the mandatory use of onboard computers would "reduce the widespread hours-of-service abuses that contribute to fatigue-related trucks crashes". Additionally, FHWA plans to utilize the information collected by UMTRI and other data to determine if a proposed rulemaking to mandate the use of onboard computers to track drivers' hours of service is warranted.

Now is your opportunity to express your opinion directly to the FHWA on an important subject for everyone whose fleet operations require the use of a driver's daily log. Please take the time necessary to complete this survey and return it in the enclosed self-addressed envelope.

If you have any questions, please contact Jim York or myself at 703-683-1300. Thank you for your assistance.

Regards,

Dave Barry
Director, Research Programs



Independent Truckers & Drivers Association

1109 PLOVER DRIVE

BALTIMORE, MARYLAND 21227

January 17, 1997

Dear ITDA Member:

Enclosed is an important study that should be of prime interest to all owner-operators and drivers. The study addresses "The Mandatory Use of Electronic Interactive Onboard Recording Devices In Lieu of Drivers Log." It is designed to capture your thoughts and opinions on the subject and to provide some information on the cost of such a requirement.

The study is being conducted by University of Michigan Transportation Research Institute, at the request of the Federal Highway Administration (FHWA). The FHWA plans to use the information it gathers from this study to respond to groups that have petitioned the government to require the trucking industry to use on-board computers to record drivers' hours of service. These groups believe the mandatory use of onboard computers would "reduce the widespread hours-of-service abuses that contribute to atigue-related truck crashes."

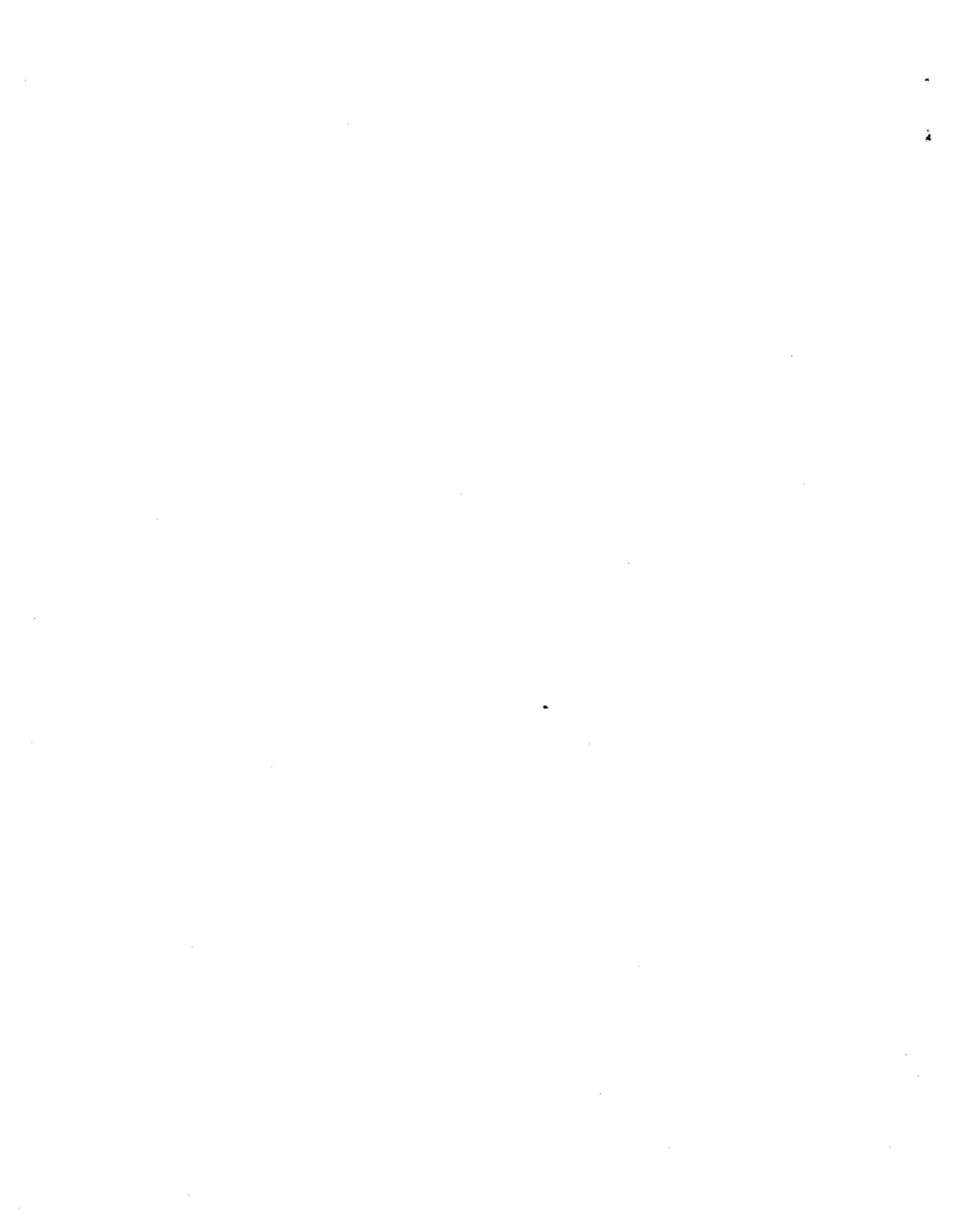
FHWA also plans to use the information and other data to determine whether it should propose a regulation change to require the use of onboard computers to track drivers' hours of service is warranted.

This is your opportunity to express your opinion directly to the FHWA on an important subject for everyone who drives a truck and must keep a daily log. Please take time to complete this survey and return it in the enclosed self-addressed envelope.

Thanks for your willingness to help out with this important project.

Sincerely,


Rita Bontz
President, ITDA





**Owner Operator Independent Drivers Association
Foundation**

311 R.D. Mize Road
Post Office Box L
Grain Valley, Missouri 64029

January 06, 1997

Charles R Stocker
Po Box 84
Newcomerstown, OH 438320084

Dear Charles,

This letter accompanies an important study that should be of prime interest to all members of OOIDA. The topic of this study is, "Mandatory Use of Electronic Interactive Onboard Recording Devices in Lieu of the Driver's Log." Your input on the cost/benefit of such a mandate is needed for the Federal Highway Administration (FHWA) to determine if a proposed rulemaking to mandate the use of onboard computers to track hours of service is warranted.

The University of Michigan Transportation Research Institute (UMTRI) is conducting this study for the FHWA with the cooperation of the National Private Truck Council (NPTC) and OOIDA.

For the past nine years, the FHWA has been petitioned by the Insurance Institute for Highway Safety and five other groups (Advocates for Highway and Auto Safety, Families Against Speeding Trucks, National Association of Governors' Highway Safety Representatives, Parents Against Tired Truckers, and Public Citizen) to mandate the use of onboard computers to record hours of service. These groups feel that onboard computers would "reduce the widespread hours-of-service abuses that contribute to fatigue-related truck crashes."

This study gives you an opportunity to inform the Federal Highway Administration of how you feel the cost/benefit of such a mandate would affect your trucking operation. We will also use your responses as a part of our response to FHWA's request for comments on their advanced notice of rulemaking for updating the hours-of-service regulations. This study, however, is asking about the effect automated reporting devices would have under the current hours-of-service regulations.

Please take the time to complete this study and return it in the enclosed, postage paid, self-addressed envelope. If you have any questions, please contact me at 1(800) 444-5791. Thank you for your assistance.

Regards,

John H. Siebert
Project Manager
OOIDA Foundation, Inc.

January 10, 1997

Dear UMA Member:

One day, computers on board your coaches could carry the complete responsibility for logging of driver hours, eliminating the complex and controversial manual logging which takes place in all commercial motor carriers today. The question is, however, should that technology be made **mandatory**?

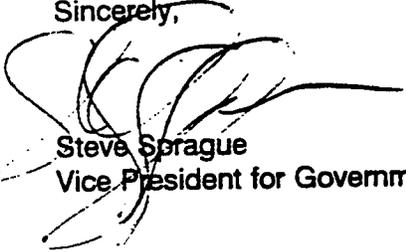
Within a Notice of Proposed Rulemaking (NPRM) concerning hours of service issued late last year by the Federal Highway Administration (FHWA), the issue of *mandatory* computerization of commercial driver hour logs surfaced as a very real possibility. Advocates for mandatory computerization have insisted that only technology can prevent driver hour cheating. Today, we're asking you to voice *your* opinion about the *mandatory* aspect of that question.

As an active member of the Intelligent Transportation Society of America (ITSA) Commercial Vehicle Operations Committee (CVO), the United Motorcoach Association works on a variety of projects to help identify the benefits of electronic devices for our member vehicles. We also cooperate with other ITSA partners in research needed to answer some of these questions of electronic uses. The survey form which accompanies this letter is a part of that cooperative effort. *We urge you* to take a few minutes to complete the enclosed survey from the University of Michigan, created in harmony with UMA. Return envelopes are enclosed.

Though it won't take long to fill out this questionnaire, your answers will help ITSA, FHWA and other interested parties to understand exactly how you feel about the promises of electronic benefits in commercial vehicles and about their *mandatory* inclusion in federal rules. Please fill it out and send it back today, before it's set aside on your desk and forgotten.

Thanks for your help. If we can help you at all, please call us at 1-800-424-8262.

Sincerely,



Steve Sprague
Vice President for Government Affairs



113 South West Street, 4th Floor
Alexandria, VA 22314-2824
Phone: 703-838-2929 Toll-Free: 1-800-424-8262
FAX: 703-838-2950
<http://www.uma.org>





1100 New York Avenue, N.W. • Suite 1050 • Washington, D.C. 20005-3934
(202) 842-1645 • (800) 283-2877 • Fax: (202) 842-0850

January 8, 1997

RE: FHWA HOURS OF SERVICE PROPOSED RULEMAKING

Dear ABA Member:

As reported in the December 1996 issue of SCAN, you will find enclosed a survey form which addresses the *possible mandatory use* of onboard computers to track hours of service. ABA, in conjunction with the National Private Truck Council's Private Fleet Management Institute and the University of Michigan Transportation Research Institute, is conducting the survey for the Federal Highway Administration. *Members are strongly urged to respond to this important survey.* The issue of requiring onboard computers or other technical means to track hours of service is one element in FHWA's recently published advance notice of proposed rulemaking on hours of service. Survey responses will provide guidance as ABA prepares comments on the issue.

As indicated in the study cover, the FHWA plans to use this information to respond to advocacy groups that have petitioned for mandatory use of on-board computers to record driver's hours of service. These groups believe that the mandatory use of on-board computers would -- "reduce the widespread hours of service abuses that contribute to fatigue related commercial vehicle crashes." Additionally, FHWA plans to use the information to draw its own conclusions as to whether there is a need to mandate this expensive technology.

It is my job to keep you appraised of the regulatory or administrative actions that may affect your operations. You have the opportunity to express your opinion directly to the FHWA on this very important topic. Please take the time now to fill out and send back the completed form or have the most knowledgeable individual in your organization with respect to this issue respond on your behalf. Do not hesitate to call me at 800-283-2877 or my direct line 202-218-7246 should you have any questions. Thank you for your assistance.

Yours truly,

A handwritten signature in black ink, appearing to read 'Norm Littler', is written over a white background.

Norm Littler

Director

Operations & Regulatory Affairs



The Trade Organization of the Intercity Bus Industry

Appendix D

Univariates

This appendix includes univariate frequencies, and univariate statistics for T, O, and B companies. For each company type, results for questions in Parts I and III of the form are shown for all returns. In addition, results for questions in Parts II and III are shown for companies with electronic recorders.

National Electronic Recorder Study 1997
 T-Form Returns-- Total N=574 (T1 ... T7)
 T Interstate --No Buses --N=535

Q2: HOW IS FLEET BEST DESCRIBED?

FLEET	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Private	314	58.8	314	58.8
For Hire	220	41.2	534	100.0

Frequency Missing = 1

Q3a: Recode PAID BY THE MILE?

PAYA	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	220	41.5	220	41.5
Yes	310	58.5	530	100.0

Frequency Missing = 5

Q3b: Recode PAID BY THE HOUR?

PAYB	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	252	47.5	252	47.5
Yes	278	52.5	530	100.0

Frequency Missing = 5

Q3c: Recode PAID A SALARY?

PAYC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	490	92.5	490	92.5
Yes	40	7.5	530	100.0

Frequency Missing = 5

Q3d: Recode PAID OVERTIME?

PAYD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	379	71.5	379	71.5
Yes	151	28.5	530	100.0

Frequency Missing = 5

Q3e: Recode PAID BY % REVENUE?

PAYE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	428	80.8	428	80.8
Yes	102	19.2	530	100.0

Frequency Missing = 5

Q3f: Recode PAID BY OTHER?

PAYF	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	491	92.6	491	92.6
Yes	39	7.4	530	100.0

Frequency Missing = 5

Q6 HOS Groups Based on % Dist of ea. HOS

HOS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Logbook	395	74.8	395	74.8
Timecard	77	14.6	472	89.4
Recorder	37	7.0	509	96.4
Other	11	2.1	520	98.5
Mixed	8	1.5	528	100.0

Frequency Missing = 7

Q9a: VEHICLE MILES DRIVEN SCALE: ROUTES

SROUTES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Regular	77	16.2	77	16.2
Most Regular	168	35.4	245	51.6
50/50	67	14.1	312	65.7
Most Irregular	85	17.9	397	83.6
All Irregular	78	16.4	475	100.0

Frequency Missing = 60

Q9b: VEHICLE MILES DRIVEN SCALE: SCHED.

SSCHED	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Regular	55	12.4	55	12.4
Most Regular	152	34.2	207	46.5
50/50	72	16.2	279	62.7
Most Irregular	80	18.0	359	80.7
All Irregular	86	19.3	445	100.0

Frequency Missing = 90

Q9c: VEHICLE MILES DRIVEN SCALE: CARGO

SCARGO	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Truckload	122	28.0	122	28.0
Most Truckload	143	32.8	265	60.8
50/50	65	14.9	330	75.7
Most <Truckload	71	16.3	401	92.0
All <Truckload	35	8.0	436	100.0

Frequency Missing = 99

Q9d: VEH. MILES DRIVEN SCALE: DISTANCE

STRIP	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Long	70	16.4	70	16.4
Most Long	129	30.1	199	46.5
50/50	89	20.8	288	67.3
Most Local	89	20.8	377	88.1
All Local	51	11.9	428	100.0

Frequency Missing = 107

COMPANY HAS ELECTRONIC RECORDERS?

RECORDER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	398	74.4	398	74.4
Yes	137	25.6	535	100.0

Variable	Label	N	Mean
NUNITS2	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	532	301.3
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	529	188.4
NLHOS2	Q6a: Recode No. LOGBOOKS, NA=0	528	107.7
NTHOS2	Q6b: Recode No. TIMECARDS, NA=0	530	53.5
NEHOS2	Q6c: Recode No. ELECT. HOS, NA=0	529	19.5
NOHOS2	Q6d: Recode No. OTHER HOS, NA=0	530	3.1
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	521	87094.1
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	399	(Cents)120.8
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	509	22.6
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	526	1.8
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	494	76.1
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	517	5.1

Variable	Label	Std Dev
NUNITS2	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	3558.9
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	710.5
NLHOS2	Q6a: Recode No. LOGBOOKS, NA=0	320.0
NTHOS2	Q6b: Recode No. TIMECARDS, NA=0	440.2
NEHOS2	Q6c: Recode No. ELECT. HOS, NA=0	94.3
NOHOS2	Q6d: Recode No. OTHER HOS, NA=0	33.7
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	42881.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	57.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	16.3
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	7.2
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	262.4
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	24.8

Variable	Label	Minimum
NUNITS2	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	1.0
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	0.0
NLHOS2	Q6a: Recode No. LOGBOOKS, NA=0	0.0
NTHOS2	Q6b: Recode No. TIMECARDS, NA=0	0.0
NEHOS2	Q6c: Recode No. ELECT. HOS, NA=0	0.0
NOHOS2	Q6d: Recode No. OTHER HOS, NA=0	0.0
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	60.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	0.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	0.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	0.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.0

Variable	Label	Maximum
NUNITS2	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	81000.0
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	13000.0
NLHOS2	Q6a: Recode No. LOGBOOKS, NA=0	4000.0
NTHOS2	Q6b: Recode No. TIMECARDS, NA=0	9000.0
NEHOS2	Q6c: Recode No. ELECT. HOS, NA=0	1100.0
NOHOS2	Q6d: Recode No. OTHER HOS, NA=0	600.0
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	350000.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	717.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	96.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	97.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	5000.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	320.0

National Electronic Recorder Study 1997
 T-Form Returns-- Total N=574 (T1 ... T7)
 T Interstate --No Buses --N=535
 T Fleets With Electronic Recorders-- N=137

Q14: CO. WILL/HAS RECOVERED INVESTMENT

INVEST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Yes, <=1yr	15	11.3	15	11.3
Yes, 1-3yrs	61	45.9	76	57.1
Yes, >3yrs	24	18.0	100	75.2
No	13	9.8	113	85.0
Dont Know	20	15.0	133	100.0

Frequency Missing = 4

Q15a: Recode ENGINE FUNCTIONS

FENGINE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	48	35.0	48	35.0
Yes	89	65.0	137	100.0

Q15b: Recode VEH. STATUS FUNCTIONS

FSTATUS2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	17	12.4	17	12.4
Yes	120	87.6	137	100.0

Q15c: Recode VEH. LOCATION FUNCTIONS

FLOCATE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	100	73.0	100	73.0
Yes	37	27.0	137	100.0

Q15d: Recode COMMUNICATIONS FUNCTIONS

FCOMMUN2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	104	75.9	104	75.9
Yes	33	24.1	137	100.0

Q15e: Recode REG. COMPLIANCE FUNCTIONS

FCOMPLY2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	58	42.3	58	42.3
Yes	79	57.7	137	100.0

Q15f: Recode DRIVER HOS FUNCTIONS

FHOS2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	59	43.1	59	43.1
Yes	78	56.9	137	100.0

Q15g: Recode OTHER FUNCTIONS

FOTHER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	103	75.2	103	75.2
Yes	34	24.8	137	100.0

Q16a: HOURS OF SERVICE RANK

RHOS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	36	26.3	36	26.3
2	15	10.9	51	37.2
3	15	10.9	66	48.2
4	7	5.1	73	53.3
5	12	8.8	85	62.0
6	10	7.3	95	69.3
Lowest Rank 7	3	2.2	98	71.5
Not Applicable 8	39	28.5	137	100.0

Q16b: TAXES/FEES RANK

RTAXES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	10	7.3	10	7.3
2	19	13.9	29	21.2
3	24	17.5	53	38.7
4	20	14.6	73	53.3
5	19	13.9	92	67.2
6	6	4.4	98	71.5
Lowest Rank 7	3	2.2	101	73.7
Not Applicable 8	36	26.3	137	100.0

Q16c: OPERATING COST RANK

RVOC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	48	35.0	48	35.0
2	37	27.0	85	62.0
3	15	10.9	100	73.0
4	12	8.8	112	81.8
5	6	4.4	118	86.1
Lowest Rank 7	1	0.7	119	86.9
Not Applicable 8	18	13.1	137	100.0

Q16d: BUSINESS MANAGE. RANK

RMAN	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	14	10.2	14	10.2
2	20	14.6	34	24.8
3	21	15.3	55	40.1
4	22	16.1	77	56.2
5	16	11.7	93	67.9
6	7	5.1	100	73.0
Lowest Rank 7	2	1.5	102	74.5
Not Applicable 8	35	25.5	137	100.0

Q16e: MAINTENANCE RANK

RENGINE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	12	8.8	12	8.8
2	22	16.1	34	24.8
3	16	11.7	50	36.5
4	14	10.2	64	46.7
5	31	22.6	95	69.3
6	7	5.1	102	74.5
Lowest Rank 7	3	2.2	105	76.6
Not Applicable 8	32	23.4	137	100.0

Q16f: REAL-TIME VEHICLE RANK

RREAL	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	36	26.3	36	26.3
2	5	3.6	41	29.9
3	1	0.7	42	30.7
4	6	4.4	48	35.0
5	8	5.8	56	40.9
6	38	27.7	94	68.6
Lowest Rank 7	6	4.4	100	73.0
Not Applicable 8	37	27.0	137	100.0

Q16g: OTHER RANK

ROTHER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	8	5.8	8	5.8
2	3	2.2	11	8.0
3	2	1.5	13	9.5
5	2	1.5	15	10.9
Lowest Rank 7	5	3.6	20	14.6
Not Applicable 8	117	85.4	137	100.0

Q17: PERFORMANCE RATE -ELECT. RECORDER

PERFORM	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Trouble Free	29	21.5	29	21.5
Occasional	96	71.1	125	92.6
Frequent	10	7.4	135	100.0

Frequency Missing = 2

Variable	Label	N	Mean
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	137	157.4
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	136	5.0
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	126	\$2033.4
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	111	\$271.4
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	129	22.1
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	129	7.1
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	122	126.1
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	120	22.1

Variable	Label	Std Dev
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	292.1
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	3.8
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	1035.9
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	319.3
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	18.4
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	13.3
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	490.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	47.9

Variable	Label	Minimum
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	2.0
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	0.0
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	0.0
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	0.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	0.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	0.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.0

Variable	Label	Maximum
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	1850.0
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	20.0
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	4500.0
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	1458.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	90.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	97.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	5000.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	320.0

National Electronic Recorder Study 1997
 O-Form Returns-- Total N=389 (O1 and O2)
 O Interstate --No Buses --N=372

Q2: HOW IS FLEET BEST DESCRIBED?

FLEET	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Private	13	3.5	13	3.5
For Hire	48	12.9	61	16.4
Owner/Oper	310	83.6	371	100.0

Frequency Missing = 1

Q3a: Recode PAID BY THE MILE?

PAYA	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	219	59.7	219	59.7
Yes	148	40.3	367	100.0

Frequency Missing = 5

Q3b: Recode PAID BY THE HOUR?

PAYB	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	353	96.2	353	96.2
Yes	14	3.8	367	100.0

Frequency Missing = 5

Q3c: Recode PAID A SALARY?

PAYC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	349	95.1	349	95.1
Yes	18	4.9	367	100.0

Frequency Missing = 5

Q3d: Recode PAID OVERTIME?

PAYD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	366	99.7	366	99.7
Yes	1	0.3	367	100.0

Frequency Missing = 5

Q3e: Recode PAID BY % REVENUE?

PAYE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	133	36.2	133	36.2
Yes	234	63.8	367	100.0

Frequency Missing = 5

Q3f: Recode PAID BY OTHER?

PAYF	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	332	90.5	332	90.5
Yes	35	9.5	367	100.0

Frequency Missing = 5

Q6: PRIMARY METHOD OF MONITORING HOS

HOS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Logbook	363	98.1	363	98.1
Timecard	3	0.8	366	98.9
Other	4	1.1	370	100.0

Frequency Missing = 2

Q9a: VEHICLE MILES DRIVEN SCALE: ROUTES

SROUTES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Regular	11	3.7	11	3.7
Most Regular	62	20.7	73	24.4
50/50	49	16.4	122	40.8
Most Irregular	51	17.1	173	57.9
All Irregular	126	42.1	299	100.0

Frequency Missing = 73

Q9b: VEHICLE MILES DRIVEN SCALE: SCHED.

SSCHED	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Regular	8	2.9	8	2.9
Most Regular	34	12.4	42	15.3
50/50	47	17.2	89	32.5
Most Irregular	54	19.7	143	52.2
All Irregular	131	47.8	274	100.0

Frequency Missing = 98

Q9c: VEHICLE MILES DRIVEN SCALE: CARGO

SCARGO	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Truckload	90	32.1	90	32.1
Most Truckload	112	40.0	202	72.1
50/50	49	17.5	251	89.6
Most <Truckload	18	6.4	269	96.1
All <Truckload	11	3.9	280	100.0

Frequency Missing = 92

Q9d: VEH. MILES DRIVEN SCALE: DISTANCE

STRIP	Frequency	Percent	Cumulative Frequency	Cumulative Percent
All Long	139	43.8	139	43.8
Most Long	91	28.7	230	72.6
50/50	49	15.5	279	88.0
Most Local	27	8.5	306	96.5
All Local	11	3.5	317	100.0

Frequency Missing = 55

COMPANY HAS ELECTRONIC RECORDERS?

RECORDER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	358	96.2	358	96.2
Yes	14	3.8	372	100.0

Variable	Label	N	Mean
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	369	2.5
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	367	2.8
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	362	99664.7
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	293	(Cents)72.7
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	349	23.6
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	369	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	327	6.1
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	367	0.0

Variable	Label	Std Dev
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	9.8
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	12.1
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	35856.7
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	32.7
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	17.3
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.8
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	17.6
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.1

Variable	Label	Minimum
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	1.0
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	1.0
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	120.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	10.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	0.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	0.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.0

Variable	Label	Maximum
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	120.0
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	172.0
NMILES	Q7: AVE NUMBER OF MILES PER POWER UNIT	250000.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	500.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	90.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	15.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	175.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	2.0

National Electronic Recorder Study 1997
 O-Form Returns-- Total N=389 (O1 and O2)
 O Interstate --No Buses --N=372
 O Fleets With Electronic Recorders-- N=14

Q14: CO. WILL/HAS RECOVERED INVESTMENT

INVEST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Yes, 1-3yrs	3	21.4	3	21.4
No	4	28.6	7	50.0
Dont Know	7	50.0	14	100.0

Q15a: Recode ENGINE FUNCTIONS

FENGINE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	5	35.7	5	35.7
Yes	9	64.3	14	100.0

Q15b: Recode VEH. STATUS FUNCTIONS

FSTATUS2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	4	28.6	4	28.6
Yes	10	71.4	14	100.0

Q15c: Recode VEH. LOCATION FUNCTIONS

FLOCATE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	7	50.0	7	50.0
Yes	7	50.0	14	100.0

Q15d: Recode COMMUNICATIONS FUNCTIONS

FCOMMUN2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	6	42.9	6	42.9
Yes	8	57.1	14	100.0

Q15e: Recode REG. COMPLIANCE FUNCTIONS

FCOMPLY2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	9	64.3	9	64.3
Yes	5	35.7	14	100.0

Q15f: Recode DRIVER HOS FUNCTIONS

FHOS2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	12	85.7	12	85.7
Yes	2	14.3	14	100.0

Q15g: Recode OTHER FUNCTIONS

FOTHER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	14	100.0	14	100.0

Q16a: HOURS OF SERVICE RANK

RHOS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	1	8.3	1	8.3
6	3	25.0	4	33.3
Not Applicable 8	8	66.7	12	100.0

Frequency Missing = 2

Q16b: TAXES/FEES RANK

RTAXES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	1	8.3	1	8.3
2	1	8.3	2	16.7
5	2	16.7	4	33.3
Not Applicable 8	8	66.7	12	100.0

Frequency Missing = 2

Q16c: OPERATING COST RANK

RVOC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	2	16.7	2	16.7
2	1	8.3	3	25.0
3	1	8.3	4	33.3
4	1	8.3	5	41.7
Not Applicable 8	7	58.3	12	100.0

Frequency Missing = 2

Q16d: BUSINESS MANAGE. RANK

RMAN	Frequency	Percent	Cumulative Frequency	Cumulative Percent
2	2	16.7	2	16.7
4	1	8.3	3	25.0
5	1	8.3	4	33.3
Not Applicable 8	8	66.7	12	100.0

Frequency Missing = 2

Q16e: MAINTENANCE RANK

RENGINE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	1	8.3	1	8.3
2	1	8.3	2	16.7
3	3	25.0	5	41.7
Not Applicable 8	7	58.3	12	100.0

Frequency Missing = 2

Q16f: REAL-TIME VEHICLE RANK

RREAL	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	7	58.3	7	58.3
3	1	8.3	8	66.7
4	1	8.3	9	75.0
Not Applicable 8	3	25.0	12	100.0

Frequency Missing = 2

Q16g: OTHER RANK

ROTHER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	2	15.4	2	15.4
Not Applicable 8	11	84.6	13	100.0

Frequency Missing = 1

Q17: PERFORMANCE RATE -ELECT. RECORDER

PERFORM	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Trouble Free	7	50.0	7	50.0
Occasional	7	50.0	14	100.0

Variable	Label	N	Mean
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	14	1.1
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	13	2.2
COSTIN2	Q13: ANNL OPER COST PER VEH OEM=0,DK=.	11	\$2198.6
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	9	\$385.6
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	13	21.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	11	1.4
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	9	12.3
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	9	0.2

Variable	Label	Std Dev
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	0.3
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	2.4
COSTIN2	Q13: ANNL OPER COST PER VEH OEM=0,DK=.	1322.8
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	393.8
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	14.4
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	4.5
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	33.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.7

Variable	Label	Minimum
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	1.0
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	0.0
COSTIN2	Q13: ANNL OPER COST PER VEH OEM=0,DK=.	0.0
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	0.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	0.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	0.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.0

Variable	Label	Maximum
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	2.0
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	9.0
COSTIN2	Q13: ANNL OPER COST PER VEH OEM=0,DK=.	4075.0
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	960.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	45.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	15.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	100.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	2.0

National Electronic Recorder Study 1997
 B-Form Returns-- Total N=282 (B1 and B2)
 B Interstate --No Buses --N=279

Q2: HOW IS FLEET BEST DESCRIBED?

FLEETB	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Motorcoach	245	87.8	245	87.8
Medium Buses	2	0.7	247	88.5
School Buses	2	0.7	249	89.2
Vans	1	0.4	250	89.6
Multiple	29	10.4	279	100.0

Q3: HOW IS OPERATION BEST DESCRIBED?

OPER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Intercity	14	5.0	14	5.0
Charter/Tour	245	87.8	259	92.8
Commuter	3	1.1	262	93.9
Other	2	0.7	264	94.6
Multiple	15	5.4	279	100.0

Q4a: Recode PAID BY THE MILE?

PAYA	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	128	46.4	128	46.4
Yes	148	53.6	276	100.0

Frequency Missing = 3

Q4b: Recode PAID BY THE HOUR?

PAYB	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	99	35.9	99	35.9
Yes	177	64.1	276	100.0

Frequency Missing = 3

Q4c: Recode PAID A SALARY?

PAYC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	259	93.8	259	93.8
Yes	17	6.2	276	100.0

Frequency Missing = 3

Q4d: Recode PAID OVERTIME?

PAYD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	263	95.3	263	95.3
Yes	13	4.7	276	100.0

Frequency Missing = 3

Q4e: Recode PAID BY % REVENUE?

PAYE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	243	88.0	243	88.0
Yes	33	12.0	276	100.0

Frequency Missing = 3

Q4f: Recode PAID BY OTHER?

PAYF	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	266	96.4	266	96.4
Yes	10	3.6	276	100.0

Frequency Missing = 3

Q7 HOS Groups Based on % Dist of ea. HOS

HOS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Logbook	256	92.8	256	92.8
Timecard	14	5.1	270	97.8
Recorder	1	0.4	271	98.2
Other	5	1.8	276	100.0

Frequency Missing = 3

COMPANY HAS ELECTRONIC RECORDERS?

RECORDER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
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No	255	91.4	255	91.4
Yes	24	8.6	279	100.0

Variable	Label	N	Mean
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	279	47.6
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	277	77.3
NLHOS2	Q7a: Recode No. DRIVERS USING LOGBOOKS	276	61.2
NTHOS2	Q7b: Recode No. DRIVERS USING TIMECARDS	276	20.2
NEHOS2	Q7c: Recode No. DRIVERS USING ELECT. HOS	276	0.1
NOHOS2	Q7d: Recode No. DRIVERS USING OTHER HOS	276	0.5
NMILESR	Q8: AVE NO. MILES PER POWER UNIT DK=.	267	59039.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	196	(Cents)155.7
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	265	19.2
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	274	0.1
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	260	200.2
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	274	0.2

Variable	Label	Std Dev
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	246.5
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	389.6
NLHOS2	Q7a: Recode No. DRIVERS USING LOGBOOKS	341.3
NTHOS2	Q7b: Recode No. DRIVERS USING TIMECARDS	196.0
NEHOS2	Q7c: Recode No. DRIVERS USING ELECT. HOS	1.8
NOHOS2	Q7d: Recode No. DRIVERS USING OTHER HOS	4.5
NMILESR	Q8: AVE NO. MILES PER POWER UNIT DK=.	40580.1
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	56.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	11.9
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.9
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	1994.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	1.9

Variable	Label	Minimum
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	1.0
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	1.0
NLHOS2	Q7a: Recode No. DRIVERS USING LOGBOOKS	0.0
NTHOS2	Q7b: Recode No. DRIVERS USING TIMECARDS	0.0
NEHOS2	Q7c: Recode No. DRIVERS USING ELECT. HOS	0.0
NOHOS2	Q7d: Recode No. DRIVERS USING OTHER HOS	0.0
NMILESR	Q8: AVE NO. MILES PER POWER UNIT DK=.	7300.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	18.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	0.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	0.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.0

Variable	Label	Maximum
NUNITS	Q4: NUMBER OF POWER UNITS IN FLEET DK=.	3000.0
NDRIVER	Q5: NUMBER OF DRIVERS DK=.	4000.0
NLHOS2	Q7a: Recode No. DRIVERS USING LOGBOOKS	4000.0
NTHOS2	Q7b: Recode No. DRIVERS USING TIMECARDS	3200.0
NEHOS2	Q7c: Recode No. DRIVERS USING ELECT. HOS	30.0
NOHOS2	Q7d: Recode No. DRIVERS USING OTHER HOS	55.0
NMILESR	Q8: AVE NO. MILES PER POWER UNIT DK=.	49400.0
COSTPMR	Q8: OPER COST PER MI/POWER UNIT-DK=.	573.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	80.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	15.0

HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	22800.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	20.0

National Electronic Recorder Study 1997
 B-Form Returns-- Total N=282 (B1 and B2)
 B Interstate --No Buses --N=279
 B Fleets With Electronic Recorders-- N=24

Q14: CO. WILL/HAS RECOVERED INVESTMENT

INVEST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Yes, <=1yr	3	12.5	3	12.5
Yes, 1-3yrs	3	12.5	6	25.0
Yes, >3yrs	4	16.7	10	41.7
No	6	25.0	16	66.7
Dont Know	8	33.3	24	100.0

Q15a: Recode ENGINE FUNCTIONS

FENGINE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	3	13.0	3	13.0
Yes	20	87.0	23	100.0

Frequency Missing = 1

Q15b: Recode VEH. STATUS FUNCTIONS

FSTATUS2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	3	13.0	3	13.0
Yes	20	87.0	23	100.0

Frequency Missing = 1

Q15c: Recode VEH. LOCATION FUNCTIONS

FLOCATE2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	23	100.0	23	100.0

Frequency Missing = 1

Q15d: Recode COMMUNICATIONS FUNCTIONS

FCOMMUN2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	22	95.7	22	95.7
Yes	1	4.3	23	100.0

Frequency Missing = 1

Q15e: Recode REG. COMPLIANCE FUNCTIONS

FCOMPLY2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	19	82.6	19	82.6
Yes	4	17.4	23	100.0

Frequency Missing = 1

Q15f: Recode DRIVER HOS FUNCTIONS

FHOS2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	20	87.0	20	87.0
Yes	3	13.0	23	100.0

Frequency Missing = 1

Q15g: Recode OTHER FUNCTIONS

FOTHER2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	22	95.7	22	95.7
Yes	1	4.3	23	100.0

Frequency Missing = 1

Q16a: HOURS OF SERVICE RANK

RHOS	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	2	8.7	2	8.7
3	2	8.7	4	17.4
4	2	8.7	6	26.1
5	3	13.0	9	39.1
6	3	13.0	12	52.2
Not Applicable 8	11	47.8	23	100.0

Frequency Missing = 1

Q16b: TAXES/FEES RANK

RTAXES	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	2	8.7	2	8.7
2	3	13.0	5	21.7
3	2	8.7	7	30.4
4	3	13.0	10	43.5
5	2	8.7	12	52.2
Not Applicable 8	11	47.8	23	100.0

Frequency Missing = 1

Q16c: OPERATING COST RANK

RVOC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	10	43.5	10	43.5
2	6	26.1	16	69.6
3	1	4.3	17	73.9
4	1	4.3	18	78.3
Not Applicable 8	5	21.7	23	100.0

Frequency Missing = 1

Q16d: BUSINESS MANAGE. RANK

RMAN	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	4	17.4	4	17.4
2	2	8.7	6	26.1
3	3	13.0	9	39.1
4	3	13.0	12	52.2
5	2	8.7	14	60.9
Not Applicable 8	9	39.1	23	100.0

Frequency Missing = 1

Q16e: MAINTENANCE RANK

RENGINE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	9	39.1	9	39.1
2	6	26.1	15	65.2
3	4	17.4	19	82.6
5	1	4.3	20	87.0
Not Applicable 8	3	13.0	23	100.0

Frequency Missing = 1

Q16f: REAL-TIME VEHICLE RANK

RREAL	Frequency	Percent	Cumulative Frequency	Cumulative Percent
2	1	4.3	1	4.3
3	2	8.7	3	13.0
4	1	4.3	4	17.4
5	1	4.3	5	21.7
6	6	26.1	11	47.8
Not Applicable 8	12	52.2	23	100.0

Frequency Missing = 1

Q16g: OTHER RANK

ROTHER	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highest Rank 1	6	26.1	6	26.1
Lowest Rank 7	1	4.3	7	30.4
Not Applicable 8	16	69.6	23	100.0

Frequency Missing = 1

Q17: PERFORMANCE RATE -ELECT. RECORDER

PERFORM	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Trouble Free	12	50.0	12	50.0
Occasional	10	41.7	22	91.7
Frequent	2	8.3	24	100.0

Variable	Label	N	Mean
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	24	13.5
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	24	4.8
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	20	\$1229.8
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	16	\$127.2
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	23	20.5
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	19	0.9
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	23	28.9
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	19	3.3

Variable	Label	Std Dev
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	14.1
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	7.2
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	1053.5
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	153.6
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	12.9
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	3.4
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	28.4
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	6.8

Variable	Label	Minimum
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	1.0
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	0.0
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	0.0
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	0.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	0.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	0.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	0.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	0.0

Variable	Label	Maximum
NRECORD	Q10: NO. OF UNITS W/ ELECTRONIC RECORDER	55.0
NYEARS	Q11: NO. OF YRS USING ELECT. RECORDER	30.0
COSTIN2	Q13: ANNUAL OPER COST PER VEH OEM=0,DK=.	4300.0
COSTOP2	Q12: COST PER VEH. FOR ELECT. REC. DK=.	500.0
HOSDP4	Q18a: DRIVER HOS -PAPER LOGS O=NA DK=.	60.0
HOSDE4	Q18b: DRIVER HOS -ELECT. LOGS O=NA DK=.	15.0
HOSAP4	Q19a: ADMIN. HOS -PAPER LOGS O=NA DK=.	110.0
HOSAE4	Q19b: ADMIN. HOS -ELECT. LOGS O=NA DK=.	20.0