Evaluation of the National CVISN Deployment Program

Volume 2
Appendices A–C

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APPENDIX A. MOTOR CARRIER SURVEY FINAL REPORT

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1.0 Introduction

This document is the Final Report for the motor carrier survey portion of the national CVISN evaluation. The remainder of this section provides information on the motor carrier survey objectives and hypotheses, and a preview of the organization of this report.

1.1 Evaluation Objectives and Hypotheses

A Test Plan for carrying out the Motor Carrier Survey was submitted to USDOT (2006e). That Test Plan documented the specific data collection and analysis methods that were used to address Goal Area 5 of the CVISN National Deployment Evaluation: ***"Document and analyze the attitudes of motor carriers regarding CVISN deployment."***

The purpose of the motor carrier survey was to identify and gauge the factors affecting motor carriers' decisions to adopt CVISN technologies, such as transponder-based electronic screening (ES) and electronic credentialing (EC). The survey also determined the market barriers to further deployment among motor carriers. As private, for-profit enterprises in a highly competitive and cost-sensitive market, motor carriers may have a different perspective than the state governments toward advanced technology for regulating and improving the efficiency of commercial vehicle operations (CVO). Both carriers and state governments value safe highways and the benefits realized through reductions in crash rates; however, they may have different opinions on the best ways to achieve the benefits. Furthermore, motor carriers are expected to have different attitudes toward participation in particular CVISN programs depending on the carriers' size, business environment, and other operational factors.

Objectives and hypotheses for the motor carrier survey were as follows:

Objective 5.1— Characterize motor carrier attitudes toward CVISN deployment; identify factors affecting motor carrier participation.

> **Hypothesis:** Motor carrier officials are aware of CVISN technologies for electronic credentialing and electronic screening.
>
> **Hypothesis:** Motor carrier officials recognize the potential benefits that CVISN technologies offer to their companies.
>
> **Hypothesis:** Motor carrier officials use factors such as costs, benefits, and institutional issues in deciding whether their companies should participate in CVISN deployment.
>
> **Hypothesis:** After using CVISN technologies in their businesses, motor carrier officials have a high degree of user acceptance of these technologies, as determined by their stated preferences and other measures.
>
> **Hypothesis:** Motor carriers having different characteristics such as size, route type (local, regional, national), business model (owner-operator, lease, private carrier, etc.),

cargo type (tanker, HAZMAT, etc) have different attitudes regarding the adoption of CVISN technologies.

As described in more detail below, these hypotheses will be tested through a survey of motor carriers.

1.2 Organization of the Motor Carrier Survey Report

This report is organized into seven major sections with two sub-appendices:

1. Introduction, with background, objectives, and hypotheses
2. Survey design and methodology
3. Summary of survey procedures
4. Results
5. Comparing National Evaluation Survey Results to those of the CVISN Model Deployment Initiative (MDI) Survey
6. Implications of Findings and Directions for Future Research
7. References

Appendix A.1. Motor Carrier Survey Questionnaire
Appendix A.2. Frequency Tables for All Questionnaire Elements.

Testing the five study hypotheses presented in Section 1.1 was the underlying goal behind every step in this survey process. Since e-credentialing and e-screening are fundamentally different, we felt that each hypothesis would filter through the exploration of the two technologies separately. Thus, when developing the motor carrier questionnaire, we found it better to organize and ask questions separately by technology area rather than following the study hypotheses. A copy of the survey questionnaire is provided in Appendix A.1. The results from the survey, discussed in Section 4, are presented consistent with the organization of the questionnaire. To help tie in the various survey findings to the study hypotheses, a crosswalk table is provided in Section 4 that links the study hypotheses to the specific sections of the report where they are addressed. Also, Section 6 provides an overall summary of the findings with respect to the study hypotheses.

2.0 Survey Design and Methodology

The survey focused on the attitudes, expectations, concerns, and stated preferences of motor carriers and their acceptance of CVISN technologies while also examining the market barriers to further deployment among motor carriers. The survey was designed to obtain measures of these motor carrier behaviors at two levels. First, the attitudes and behaviors of the motor carrier industry were assessed by surveying a nationally representative sample of motor carriers. Second, we evaluated the differences in attitudes among carriers that are participating as well as those that are not participating in CVISN, in states that offer specific levels of CVISN EC and ES services.

We wanted to place the levels of observed motor carrier satisfaction with CVISN initiatives into the context of the national CVO industry. As such, the sample was designed using methods, such as stratification, to help ensure the representativeness of the sample with respect to factors such as motor carrier size, CVISN participation status, and level of state CVISN services offered in a carrier's base state.

The motor carrier survey made use of knowledge concerning the level of CVISN technologies and services being offered across states. This was achieved using self-evaluation reports provided by states that received federal funds to support the deployment of CVISN infrastructure. These reports provided useful information on the level of EC and screening services offered by the states, as well as data on costs, benefits, and lessons learned.

Information from the self-evaluation reports was used to develop the sample frame and design. In particular, the reports provided information about state CVISN offerings that determined the context for carrier attitudes, perceptions, and behaviors relative to different sets of circumstances defined by the level of services offered by states. This information, coupled with state-provided information on which carriers are participating in CVISN services, was used to design a survey that allowed for comparisons to be made between attitudes of CVISN participants and nonparticipants within a more controlled environment.

In the following sections, we outline our approach for developing the sample frame, sample design, and sample size.

2.1 Sample Frame

The target population for this survey was comprised of commercial vehicle motor carriers that are based in the contiguous 48 states. Although the motor carrier industry has been closely regulated by state and federal agencies for a long time, there is no uniform national register of all motor carriers, including those that operate within a single state. A variety of candidate data sources were evaluated based on the relevant data elements they possess, completeness of the data, and quality associated with the data. These data sources included the FMCSA Motor Carrier Management Information System (MCMIS) Census database, and mailing lists from trade associations such as the Owner-Operator Independent Drivers Association, and the National Private Truck Council. Also, commercial motor carrier lists from companies such as Dun & Bradstreet, Harris Info Source, InfoUSA, Alesco, and Hoovers were researched. Finally, a small number of motor carrier registration files maintained by states were examined.

Based on our examination of potential data sources, the best approach to develop a sample frame was to combine the MCMIS Census database with supplemental data on registered carriers from selected states. The MCMIS Census file is the closest approximation of a comprehensive national register of U.S. motor carriers, currently comprising records for about 1 million carriers that are subject to the federal safety and hazardous material regulations.

It was learned that, in some instances, motor carrier registration files maintained by states provided greater coverage of purely intrastate (within-state) carriers. Given that carriers need to register within a state, the current operational status of the carriers and their contact information

were more accurate in state databases. The best benefit of state registration systems, however, was that states have registers of carriers who participate in CVISN services such as EC and ES. This piece of information was helpful in designing a sample where both participants and nonparticipants in CVISN were sampled to make comparisons between the two groups.

Because of the challenges in securing and dealing with disparate data files from a large number of states, we limited the use of state databases to only a few states where we knew the level of CVISN services offered in that state and we were able to get a detailed list of carriers showing their participation in CVISN services. Based on these criteria, three states were chosen as "focus states" for this survey—Kansas, Kentucky, and Washington State. Within these focus states, we evaluated the differences in attitudes and opinions among CVISN participating and nonparticipating carriers.

The sections below provide more detail on each data source used to construct the sample frame.

MCMIS

The FMCSA MCMIS Census file was used as the main source of data to draw the sample for this survey. The MCMIS Census file currently has records for about 1 million active carriers that are subject to the federal safety and hazardous material regulations. Each MCMIS Census record contains more than 50 data elements that identify the carrier, and describe its operations, cargos, number of drivers, and vehicles. MCMIS contains the most comprehensive list of interstate motor carriers and a growing number of intrastate carriers as a result of more states requiring intrastate motor carriers to secure and display a USDOT number on their vehicles.

Excluded from the frame were motor carriers with addresses outside the contiguous 48 states and those in certain specialist categories determined to be largely irrelevant to the credentialing and inspection initiatives. The excluded categories were: federal, state, and local governments; Indian tribes; Migrant; and "Other" classes. We also excluded from consideration any carriers not classified as active, those with inadequate contact information, or those with no power units.

For these latter groups of excluded carriers, analysis was performed to determine if characteristics of these motor carriers were systematically different than carriers included in the frame. Comparisons were made on a few variables such as carrier size, type of carrier, and geographic range (interstate or intrastate). Based on these variables available for comparison, there did not appear to be evidence that a significant systematic bias exists.

The MCMIS Census file was used as the sampling frame for the motor carrier survey conducted in 2000 for the CVISN MDI Evaluation. Since 2000, a number of changes have occurred that helped MCMIS become more complete and more representative of the national motor carrier industry. First, an increasing number of states started to require intrastate motor carriers to secure and display a USDOT number. Currently, over 20 states have such a requirement. This has increased the number of purely intrastate carriers

in MCMIS. Secondly, MCMIS has undergone some technological improvements in the last few years. The improvements were mainly focused on making MCMIS more convenient but also have increased the quality of the data by eliminating inactive carriers more quickly.

Although MCMIS still underrepresents intrastate carriers somewhat, the level of intrastate coverage is vastly improved over the last few years. To test this assertion, the state database for Kansas was compared to the MCMIS Census file. A large percentage of carriers (88%) in the Kansas database were also in MCMIS. Furthermore, most of the intrastate carriers registered in Kansas were also in the MCMIS file. Similar comparisons of the Kentucky and Washington state files could not be conducted, because those state databases lacked a portion of their intrastate registered carriers in the databases they provided. Based on this limited comparison and the research into MCMIS improvements, the MCMIS Census file provided a reasonable frame for this motor carrier survey.

Kansas

The sample frame for Kansas-based motor carriers was drawn from a database of motor carriers provided by the Kansas Corporation Commission (KCC). KCC provided a list of active Kansas-based motor carriers as of December 2006. For each carrier, the file contained address and contact information, number of power units owned, as well as an indicator of which carriers use the Kansas Online Trucking System to perform their e-credentialing activities. The Kansas file contained information for all inter- and intrastate carriers based in Kansas. The file also contained private carriers based in other states that had a large number of trucks registered in Kansas. These carriers were excluded from the frame as well as any with inadequate contact information. Since Kansas uses HELP/PrePass for their e-screening system, Kansas does not know which specific carriers participate in e-screening through PrePass, so e-credentialing status was all the information Kansas could provide on carrier CVISN participation within their state.

Washington

Washington's sample frame was created from three different sources. First, a list of Washington-based motor carriers was provided by the Washington State Department of Licensing. This file had a wealth of information including contact information for the carrier as well as the number of power units owned. However, this file contained only interstate carriers. The Department of Licensing did not have a comparable database for the intrastate carriers. As a result, the file of interstate carriers was supplemented with intrastate-only carriers based in Washington obtained from the MCMIS Census file. Combined, these two files provided a frame for all Washington-based carriers.

Finally, the Washington State Department of Transportation provided a list of motor carriers that participated in the Norpass system in Washington. In addition to Washington-based carriers, this file had vehicles based in other states as well. Records for carriers based outside Washington State were excluded from this file.

The file of Norpass participants was integrated with the file of Washington-based carriers to identify the e-screening participants from those carriers that do not participate. We also excluded from consideration any carriers not classified as active, those with inadequate contact information, or those with no power units. The Department of Licensing also provided a list of 15 large carriers that participate in e-credentialing in Washington. Although there are more than 15 carriers participating in e-credentialing, the remaining carriers do their credentialing through service bureaus, and this information was not readily available for use in the sample frame. Thus, for purposes of the sample design, CVISN participation in Washington was focused on e-screening participation.

Kentucky

Kentucky's sample frame was also created from various sources. First, a list of Kentucky-based motor carriers was provided by the Kentucky Division of Motor Carriers. This file contained detailed records of all active interstate carriers based in Kentucky. In addition, we were also supplied with lists of motor carriers who file their International Fuel Tax Agreement (IFTA), International Registration Plan (IRP), and oversize/overweight (OS/OW) permits through Kentucky's e-credentialing system. Kentucky does not currently have similar information for their intrastate carriers. Although intrastate carriers do perform some credentialing online, it is not part of the state's CVISN e-credentialing system, so most participants in e-credentialing are interstate carriers. Also, Kentucky's interstate database is currently built around the carrier, but the intrastate database is organized according to individual trucks.

The Norpass Service Center provided a list of carriers that participate in the Norpass ES partnership in Kentucky. This file contained both interstate and intrastate carriers.

Since most of the carrier information provided by Kentucky does not include intrastate carriers, the MCMIS Census file was used to supplement the Kentucky-provided information with intrastate carriers based in Kentucky.

Kentucky is the one state where reliable information was obtained on both a carrier's e-credentialing and e-screening status. As a result, the sample frame for CVISN participants was all carriers participating in either electronic service. We excluded from consideration any carriers not classified as active, those with inadequate contact information, or those with no power units.

2.2 Stratification of Sample Frame

The sample frame for the motor carrier survey was stratified by three variables: 1) Level of state CVISN services offered in e-screening and e-credentialing; 2) Carrier size; and 3) Whether or not the carrier is participating in CVISN services (applicable only to the three focus states—Kansas, Kentucky, and Washington). The main reason for stratifying the sample in this manner is that we believed that the opinions and attitudes of motor carriers vary as a function of these

three variables, and we wanted to estimate population parameters associated with CVISN attitudes and opinions for each of these subgroups.

2.2.1 Level of State CVISN Services Offered in E-Credentialing and E-Screening

To help ensure a more representative national sample of motor carrier companies, the states participating in CVISN deployment were divided into several strata. The purpose of this stratification was to draw data from motor carrier companies that are based in or operating in states with varying levels of CVISN deployment. In this way, the sample of motor carriers would be less likely to be concentrated in states with only one kind of CVISN deployment. For example, some states such as Kansas and Kentucky have long-established e-credentialing systems used to process a large proportion of that state's IRP credentials. Other states like Minnesota or Texas may be gearing up now, with only 1 to 2% of IRP credentials being processed electronically in those states.

The primary method of sorting and stratifying the states was to use information from the states' CVISN self-evaluation reports, as of mid-2006. At that time, 22 states had completed a self-evaluation. These states have been populating these reports since late 2003, and the database is available for all states to update at any time. Since not all states have completed their self-evaluation reports, information from other sources, such as the CVISN deployment checklist maintained by FMCSA, ongoing discussions with state officials and FMCSA support organizations [Noblis (formerly Mitretek), Volpe Center, Johns Hopkins University Applied Physics Laboratory], and CVISN-related web sites were used to assign states to various strata.

The criteria according to which states were sorted were as follows:

- For e-credentialing, information on the proportion of motor carrier accounts whose IRP and IFTA credentials are expected to be processed electronically within the next 12 months from the date of reporting. This was taken to be a reasonable measure of the scope or market penetration of CVISN e-credentialing services in a state, regardless of the number of motor carriers or licensed vehicles based in the state.

- For e-screening, the number of roadside weigh/inspection sites currently being used for e-screening in the state. Information from the respective screening programs' web sites was also used to supplement the self-evaluation data, especially for those states whose self-evaluation reports were incomplete.

Table A-1 depicts the results of this sorting of states for both of these CVISN services. Appendix A of the Motor Carrier Survey Test Plan (USDOT 2006e) contains a more detailed explanation of the sorting process, the constituent individual ratings for each of the criteria listed above, and supplementary information available for use in classifying states. Table A-1 shows that, for e-credentialing, some states were not rated because data were not available.

Table A-1. Distribution of States by Level of CVISN Deployment: E-Screening and E-Credentialing

		Electronic Credentialing Scope & Activity			
		Not Rated	**Low**	**Medium**	**High**
Electronic Screening Scope & Activity	**Low**	AK, AL, DE, HI, MA, NC, NH, NV, PA, RI, VT	CT, ME, MN, NE, NJ, SC, SD, TX, WY	ID, MD	MI, ND, NY, WI
	Medium	GA, IA, LA, MS, UT	MT, NM, OK, WA, WV	IN, KS, VA	AR, AZ, TN
	High	CA, OR	IL, MO, OH	KY	CO, FL

Color Key to Final Ratings: Unshaded = Low; Green = Medium; Gold = High

Table A-2 shows the combined rating (Low, Medium, or High) for each state, based on the two-part ratings shown in the table above. Carriers from all three strata were sampled to get as complete a national picture of motor carrier attitudes towards CVISN as possible. Of the three focus states, Kentucky comes from the High stratum while Kansas and Washington reside in the Medium stratum.

Table A-2. Combined Rating of Level of CVISN Services: E-Screening and E-Credentialing

Low	Medium		High
Alabama	**Connecticut**[a]	**Nevada**[a]	**Arizona**
Alaska[b]	Georgia	**New Mexico**	Arkansas
Delaware	Iowa	New York	California
Hawaii[b]	**Idaho**	**North Carolina**[a]	**Colorado**
Maine	Illinois	North Dakota	Florida
Massachusetts	Indiana	**Ohio**	**Kentucky**
Minnesota	Kansas	Oklahoma	Oregon
New Hampshire	Louisiana	Utah	**Tennessee**
New Jersey	**Maryland**	**Virginia**	
Pennsylvania	Michigan	**Washington**	
Rhode Island	Mississippi	West Virginia	
South Carolina	Missouri	**Wisconsin**	
South Dakota	**Montana**		
Texas	**Nebraska**[a]		
Vermont			
Wyoming			

All states that had completed CVISN Core Deployment by mid-2006 are shown in **boldface.**

a. Four states, Connecticut, Nebraska, Nevada, and North Carolina, were reclassified from Low to Medium because they have completed CVISN Core Deployment.
b. Alaska and Hawaii were included in the rating system but were not eligible for selection because the frame was restricted to the 48 contiguous states

The decision rules for cases of conflicting ratings within a single state were as follows: When a state had different ratings for each CVISN function (e.g., Idaho, which was Low for screening and Medium for credentialing), the combined rating was rounded upward. Likewise, when a state was Low in one function and High in the other, that state's combined rating was set at Medium. When a state had a combination of "Not Rated" and any other rating, the "Not Rated" value was disregarded (e.g., California, which was not rated for credentialing but had a High rating for screening, received a High combined rating).

FMCSA has defined a set of CVISN capabilities as constituting Core Deployment, formerly known as Level 1 Deployment. This achievement was taken into account in stratifying states for the motor carrier survey in the CVISN National Deployment Evaluation. Four states, Connecticut, Nebraska, Nevada, and North Carolina, were originally rated as Low, but they had completed Core Deployment as of August 2006 and therefore were classified as Medium states instead of Low for this analysis. All other Core Deployment states were already in the Medium or High rating column. These Core Deployment states are shown in boldface in Table A-2.

2.2.2 Carrier Size

In commercial vehicle operations, as in many other industries, the distribution of firms by size is highly skewed. No matter which measure of size is adopted (gross revenues, ton miles of freight carried, number of power units operated), it is likely that a relatively small proportion of the carriers is responsible for a very large proportion of the total economic activity. With such a skewed distribution by size, we stratified motor carriers into several size classes and designed a sufficiently large sample within each stratum so that the results could be presented separately by stratum. This is particularly appropriate when the behavior or attitudes under study may be expected to vary significantly with carrier size, as is the case here.

The carriers within a state were stratified according to four size categories: small, medium, large, and giants. From examination of the size distribution of motor carrier companies, the boundaries for the four strata were as follows:

- "Giants" operate 250 or more power units. They account for only 0.2% of the firms nationally, but 45% of the total power units. While this group was treated as a separate explicit stratum for sample design purposes, the number of these firms sampled was not sufficiently large to present separate results—the data for the "giants" were aggregated with that of the "large" firms.
- "Large" firms operate between 100 and 249 power units (0.3% of all firms but 7% of the power units).
- "Medium" firms operate between 10 and 99 power units (almost 6% of firms, 22% of the power units).
- "Small" firms, with fewer than 10 power units, constitute almost 94% of firms operating 26% of the power units.

2.2.3 CVISN Participation

One of the goals of the study was to compare the attitudes and perceptions of CVISN participating and nonparticipating carriers to the specific CVISN services offered by the state. For purposes of this report, "CVISN participation" is defined as obtaining one or more credentials electronically or using transponders to legally bypass inspection stations through a program such as HELP/PrePass, Norpass, or Oregon Green Light.

Since the total number of motor carriers who participate in CVISN is low relative to the total number of motor carriers in the country, sampling alone would not have captured enough of the participating carriers to be able to gather their opinions or make any comparisons. As such, in Kansas, Kentucky, and Washington, the sample was further stratified into carriers that do and do not participate in CVISN services such as ES and EC.

Kansas has a very strong e-credentialing program. The Kansas Online TruckingKS System (www.truckingks.org) provides motor carriers in Kansas the ability to perform many credentialing and permitting functions online involving IFTA, IRP, KCC and single state authorities. It also offers ES through PrePass. Both Kentucky and Washington participate in the Norpass partnership for ES of commercial vehicles as well as offer EC to motor carriers within their states.

This stratification of the sample by CVISN participation as well as motor carrier size occurred within each state. The following section discusses how the sample of motor carriers was selected given these levels of stratification.

2.3 Sample Selection

As discussed in the previous section, the sample design was selected based on an interlacing of three "Level of CVISN services" strata with four "firm size strata" as well as two "CVISN participation" strata for three states. The assumption here was that states within strata defined by level of CVISN services are more homogeneous in terms of their opinions and attitudes toward CVISN than a random sampling of states would be. This stratification approach also ensured that comparisons of attitudes and opinions could be made across state-defined strata. A two-stage cluster sampling approach was utilized, with the states serving as primary sampling units (PSUs), and motor carriers within the state serving as secondary sampling units (SSUs).

Stage 1—Selection of States (PSUs)

Table A-3 shows the number of states in each stratum defined by their level of CVISN services as defined in Section 2.2, as well as the number of states that were selected. In all, 31 states were sampled. In selecting the number of states to sample, it was decided to cover a larger number of states with each state having fewer motor carriers surveyed. This was advantageous because (1) a larger state representation is achieved; and (2) keeping the number of motor carriers surveyed per state smaller reduced the variance inflation factor caused due to the clustering of motor carriers within a state. It was not crucial to have a large number of motor carriers surveyed per state since the goal of the study was not to get statistically reliable estimates of motor carriers' attitudes and

opinions at the state level (with the exception of the few states chosen with certainty—these states will have a larger sample sufficient to allow such estimates, as described below).

The number of states sampled within each stratum was chosen proportionally based on the total number of states in the stratum. To ensure that national estimates of the attitudes and opinions of carriers could be calculated, states were also selected from the strata where the level of CVISN services and/or CVO activity is not completely known. In this way, every state had a non-zero probability of selection.

Table A-3. Number of Selected States per CVISN Services Stratum

	Level of CVISN Services/CVO Activity		
	High	**Medium**	**Low**
Number of Eligible States in Stratum	8	26	14
Number of States Selected	5	16	10

The first step in selecting states was to note that Kansas, Kentucky, and Washington were chosen with certainty (probability of selection equal to 1). These states are referred to as focus states throughout the remainder of this document. These states were able to provide detailed information concerning motor carrier participation in CVISN technologies within their state databases. We wanted to ensure that both participants and nonparticipants were in the sample so that comparisons could be made between motor carriers' attitudes and opinions relative to their participation.

For the other 28 states that remained, the first step was to determine the number of motor carriers registered within each state. Within each stratum, the states were then selected with probability proportional to the percentage of motor carriers registered within the state. In this manner, states with a higher population of motor carriers were more likely to be selected for the sample. This methodology helped ensure that states with large motor carrier populations would be included in the survey in an effort to better represent the true motor carrier population with the sample.

Table A-4 shows the 31 states selected for the motor carrier survey broken down by the level of state CVISN services. States in bold were selected with probability equal to one.

Table A-4. States Selected in Stage 1 Sampling for Motor Carrier Survey

Low	**Medium**		**High**
Alabama	Georgia	New York	California
Delaware	Iowa	North Carolina	Colorado
Maine	Illinois	North Dakota	Florida
Massachusetts	Indiana	Ohio	**Kentucky**
Minnesota	**Kansas**	Oklahoma	Tennessee
New Jersey	Michigan	**Washington**	
Pennsylvania	Missouri	Wisconsin	
South Carolina	Montana		
Texas	Nebraska		
Vermont			

Stage 2—Selection of Motor Carriers

The procedure for selecting the issued sample of motor carriers was as follows. First, the motor carriers were stratified by size category within each state and also by CVISN participation for Kansas, Kentucky, and Washington.

The sample frame of carriers was then randomly sorted by sample cell (each level of state/carrier size/CVISN participant*combination), and within each cell a random selection of carriers was taken based on the sample sizes needed for the survey.

2.4 Sample Size

The resources available for design, data collection, and analysis for the Motor Carrier Survey were such that the target number of achieved surveys was on the order of 600. This number was adequate to provide a national view of motor carrier attitudes and opinions toward CVISN technologies, while also allowing for more specific comparisons among smaller sample segments.

Originally, 3,040 total motor carriers (in 5 replicates of 608) were selected from the sample frame consisting of the MCMIS Census file and the respective Kansas, Kentucky, and Washington State databases. Due to higher than anticipated response rates, two of the replicates were not needed, resulting in 1,824 motor carriers being released for use by the telephone interviewers. Roughly half of these carriers (900) were allocated to the three focus states: Kansas, Kentucky, and Washington, while the other 924 were distributed among the other 28 states in the sample.

The sample for the focus states was inflated so that analyses could be performed comparing the attitudes and opinions of both participating and nonparticipating carriers toward CVISN services. Since the total number of motor carriers who participate in CVISN is low relative to the total number of motor carriers in the country, sampling alone would not have captured enough of the participating carriers to be able to make any comparisons. Therefore, we controlled the sample allocated to both participants and nonparticipants so that statistical comparisons could be made. The actual number of carriers sampled within each focus state was chosen such that statistical tests of hypotheses on differences in carrier attitudes and opinions across strata could be made with sufficient statistical power. More details on the sample size can be found in the Motor Carrier Survey Test Plan (USDOT 2006e). In addition to these focus state comparisons, the samples allocated to Kansas, Kentucky, and Washington were used in conjunction with the sample allocated to the remaining 28 states to generate results at a national level. The difference in state sample sizes between the focus states and the other 28 states was accounted for through the sample weighting process.

Figure A-1 illustrates the breakdown of the total sample based on the size of the carrier and compares this distribution with the distribution of the entire motor carrier population by carrier size. In addition, Figure A-1 indicates the percentage of power units each size category contributes to the total population of commercial vehicles.

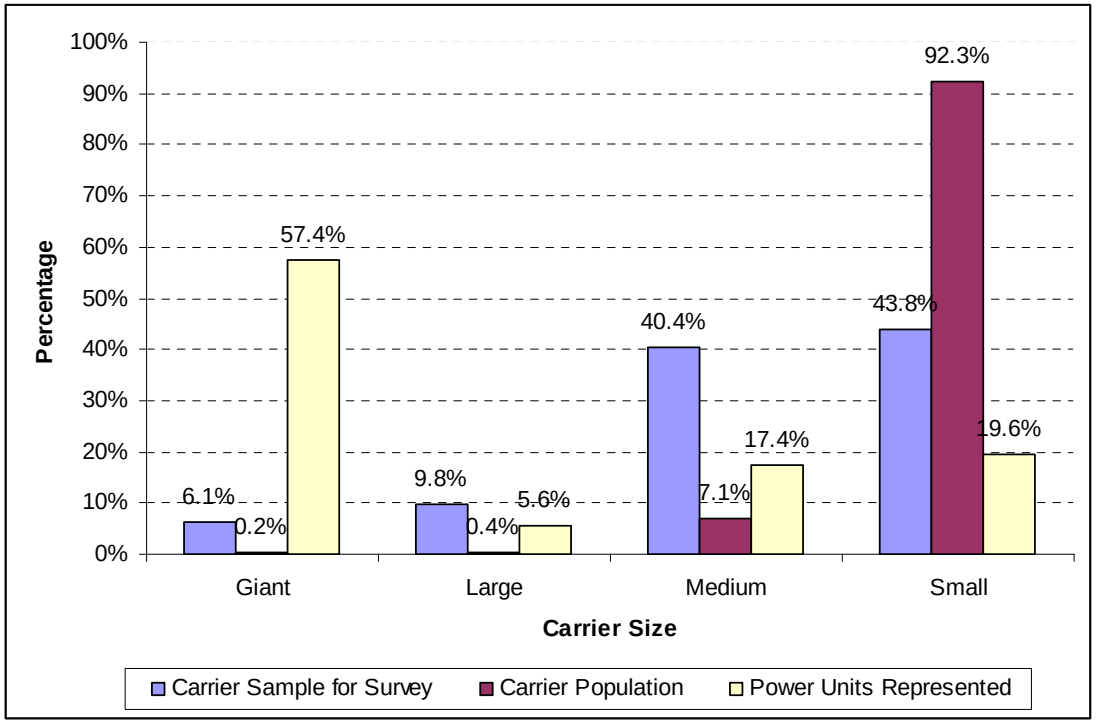


Figure A-1. Comparing the Motor Carrier Survey Sample with the Population of Motor Carriers

Giant carriers represent only 0.2% of all motor carrier companies in the United States. However, they account for approximately 57% of the nation's power units. On the other end of the spectrum, most carriers are considered small (92% of population) but they represent only about 20% of the power units. Because of this disparity in carrier size, the allocation of the sample across carrier size was not proportional to the percentage of total carriers within each size class. If allocation were done proportional to size, very few giant or large carriers would have been sampled. Since comparisons of carrier attitudes and opinions were desired across carrier size classes, a sample based proportional to size would not have provided enough information on larger carriers. Although not proportional, the number of giant, large, medium, and small carriers selected for the sample was more favored towards medium and small carriers, since there were not enough giant or large carriers available in some states.

Table A-5 shows the allocation of the sample for the non-focus states by the two stratification variables: Level of state CVISN services and carrier size.

Table A-5. Structure of the National Sample

	Level of State CVISN Services		
Carrier Size	**High (4 states)**	**Medium (14 states)**	**Low (10 states)**
Giant	12	42	30
Large	12	42	30
Medium	48	168	120
Small	60	210	150
Total	132	462	330

Approximately the same number of carriers was selected from each state. Deviations from this plan occurred when a particular state did not have enough carriers of a particular size class (usually Giant or Large). The primary rule was to ensure that the distribution of carriers by size class was met within the level of state CVISN services strata.

Table A-6 illustrates the sample allocation for the three focus states.

Table A-6. Structure of the Sample for Focus States

	CVISN Participation (E-Screening and/or E-Credentialing)					
	Kansas (E-Credentialing)		**Kentucky (Both ES & EC)**		**Washington (E-Screening)**	
Carrier Size	**Participant**	**Non-Participant**	**Participant**	**Non-Participant**	**Participant**	**Non-Participant**
Giant	3	1	6	6	6	6
Large	17	1	21	18	16	21
Medium	67	85	60	63	65	60
Small	63	63	63	63	63	63
Total	150	150	150	150	150	150

As in the national sample, the distribution of motor carriers by size was more favored towards the medium and smaller size carriers. Any difference between the allocations among the three states is due to the amount of Giant and Large carriers available in the state's sample frame. Roughly the same number of CVISN participants and nonparticipants were sampled at the state level.

Within each focus state, CVISN participants comprised half of the sample. Based on carrier information in the sample frame, the true percentage of motor carriers participating in CVISN technologies varies. According to the sample frame, the true percentage of Kentucky carriers participating in either e-screening or e-credentialing is under 10%, while about 16% of Washington carriers participate in e-screening. Kansas, where only e-credentialing information was available, had almost 70% of its carriers using the Kansas Online TruckingKS System for some form of e-credentialing. Participation within the Kansas sample frame was defined as any carrier that conducted a transaction on the Kansas Online TruckingKS System in the past year. This was used as a proxy for CVISN participation. As discussed in the next section, weighting factors were assigned to each responding carrier to account for the differing probabilities of selection of states and motor carriers within states. As such, the differences in levels of CVISN participation were accounted for.

2.5 Survey Weights

This section discusses the development of the survey weights. The final analysis weight reflects all non-response and post-stratification adjustments and is the weight that was used for the analysis of the data. The sampling weight, which represents the inverse of the probability of selection, is the starting point for the calculation of the analysis weight.

The analysis weight was developed using the following steps:

- Calculation of the base weight
- Adjustment for eligibility
- Adjustment for non-response
- Post-stratification adjustment to the target population.

The product of all of the above quantities represents the final analysis weight.

2.5.1 Calculation of the Base Weight

The first step in weighting the sample was to calculate the sampling weight for each motor carrier. Since the sampling was performed in two stages, this weight was also calculated in two steps.

Stage 1—Weights associated with selection of states

The first stage weight represents the inverse of the first stage selection of probability assigned to a sampled state. The design required that, within each stratum defined by the level of state CVISN services (High, Medium, Low), state selection probabilities be proportional to the number of motor carriers based in each state. The basic first stage weight for the jth sampled state was thus defined as

$$W_{s1}(h_j) = \frac{C_{h+}}{m_h * C_{hj}}$$

where:

- C_{h+} is the total number of carriers based in stratum h
- C_{hj} is the number of carriers based in state j within stratum h
- m_h is the number of states being selected within stratum h
- h refers to the level of state CVISN services (High, Medium, Low).

Since Kansas, Kentucky, and Washington were selected with certainty,

$W_{s1} = 1$ for these three states.

Stage 2—Weights associated with selection of motor carriers

The next step in weighting the sample was to calculate the sampling weight associated for each sampled motor carrier. This second stage weight represents the inverse of the probability of selection for a motor carrier within a state stratified by size or:

$$W_{s2}(ij) = \frac{N_j}{n_j}$$

where:

- N_j is the total number of carriers based in state j
- n_j is the number of carriers selected based in state j.

The final sampling weight is the product of the sampling weights at the two stages of sampling or:

$$W_s(h_j i) \;\; = \frac{C_{h+}}{m_h * C_{hj}} * \frac{N_j}{n_j}.$$

This sampling weight is referred to as W_S throughout the rest of this section.

2.5.2 Adjustment for Eligibility

The next step was to adjust for the fact that the MCMIS frame, like all sampling frames, has an inherent reporting lag, and motor carriers included on the frame may have become ineligible for the survey after the sample has been drawn.

Motor carriers could be ineligible because they could no longer be in the trucking business or did not utilize commercial vehicles that would be affected by CVISN technologies (e.g., bus fleets or taxi services). The eligibility adjustment adjusted the sample weights to account for these cases as well as those sampled cases for which eligibility could not be determined. For non-focus states, the adjustment was done according to the stratification variables: level of state CVISN services and carrier size. For focus states, adjustments were done by carrier size and CVISN participation.

The non-response eligibility adjustment factor was calculated as follows:

$$ADJ_{EL} = \frac{\sum_{i=1}^{n_{cs}} W_S(i)}{\sum_{i=1}^{n_{cs}} \delta_{EL}(i) * W_S(i)}$$

where

$W_S(i)$ is the weight for carrier i

$\delta_{EL}(i)$ is equal to 1 for those cases where carrier eligibility could be determined and 0 otherwise

n_{cs} is the sample size for each combination of level of state CVISN services and carrier size.

For carriers in the focus states of Kansas, Kentucky, and Washington, the eligibility adjustment was calculated in the exact fashion with the exception that n_{cs} is replaced with n_{ps}, the number of sample carriers for each participation category (p) and carrier size (s) combination.

The eligibility non-response adjusted weight (W_{EL}) is the product of the sampling weight (W_S) and the non-response adjustment factor (ADJ_{EL}) within each level of state CVISN service/carrier size combination (or level of participation/carrier size combination for focus states). For carriers whose eligibility could not be determined, $W_{EL} = 0$.

2.5.3 Adjustment for Non-Response

The next step was to adjust for non-response in completing the survey. This non-response adjustment was made using the same stratification variables as for the eligibility adjustment, except that ineligible carriers were not included in the adjustment. The non-response questionnaire completion adjustment factor was calculated as follows for eligible carriers:

$$ADJ_{NR} = \frac{\sum_{i=1}^{n_{cs}} W_{EL}(i)}{\sum_{i=1}^{n_{cs}} \delta_{QC}(i) * W_{EL}(i)}$$

where

$W_{EL}(i)$ is the eligibility adjusted weight for carrier i

$\delta_{QC}(i)$ is equal to 1 for those cases where the questionnaire was completed and 0 otherwise.

For ineligible carriers, $ADJ_{NR} = 1$.

For carriers in the focus states of Kansas, Kentucky, and Washington, the non-response completion adjustment was calculated in the exact fashion with the exception that n_{cs} was replaced with n_{ps}, the number of sample carriers for each participation category (p) and carrier size (s) combination.

The weight adjusted for eligibility and completion non-response (W_{ELNR}) is the product of the eligibility adjusted sampling weight (W_{EL}) and the non-response adjustment factor (ADJ_{NR}) within each level of state CVISN service/carrier size combination (or level of participation/carrier size combination for focus states).

2.5.4 Post-Stratification Adjustment to Target Population

For the non-focus state sample, a post-stratification adjustment was made to the weights so that they agreed with the MCMIS motor carrier population counts within the cross-classification of carrier size and level of state CVISN Services. For focus states, a similar post-stratification adjustment was made to the weights so that they agreed with the motor carrier population counts within the cross-classification of carrier size and level of CVISN participation. Adjusting weights in this fashion can compensate for different response rates within levels of the stratification variables, increase the precision of survey estimates, and reduce the bias present in the estimates resulting from non-response.

For both identified eligible and ineligible motor carriers, the post-stratification adjustment was defined as:

$$ADJ_{POST} = \frac{N_{cs}}{\sum_{i=1}^{n_{cs}} W_{ELNR}}$$

where N_{cs} is the motor carrier population within the cross-classification of carrier size and level of CVISN participation.

For carriers in the focus states of Kansas, Kentucky, and Washington, the post-stratification adjustment was calculated in the exact fashion with the exception that:

1. n_{cs} is replaced with n_{ps}, the number of sample carriers for each participation category (p) and carrier size (s) combination

2. N_{cs} is replaced with N_{ps}, the number of population carriers for each participation category (p) and carrier size (s) combination.

The final analysis weight was calculated as follows:

$$W_{final} = W_{ELNR} * ADJ_{POST}$$

This is the weight that was used to weight the survey data in all analyses.

2.6 Response Rates

The procedures for response rate calculation are based on the guidelines established by the Council of American Survey Research Organizations (CASRO) in defining a response rate. The final response rate for the survey was obtained using the following formula:

$$\text{Response Rate} = \frac{\text{Completed Carrier Interviews}}{\left(\text{Carriers in Scope} + \left[\text{Scope Undertermined} * \frac{\text{Carriers in Scope}}{\text{Carriers in \& Out of Scope}}\right]\right)}$$

Table A-7 presents the distribution of motor carriers by disposition categories. The number of motor carrier cases in each category was then used in the above formula to calculate an overall response rate of approximately 52%.

Table A-7. Distribution of Motor Carrier Cases by Disposition Code

Category	Frequency	
Motor Carriers Released	1824	
Pending Cases	0	
Carrier Cases Worked	1824	
Out of Scope Carriers (Ineligible)		134
No Contact (Scope Undetermined)		506
Carriers in Scope	1184	
Completed Surveys		848
Partially Completed Surveys		13
Language Problem		12
Refusal		302
Unavailable During Study Period		9
Motor Carrier Survey Response Rate	51.80%	

A total of 848 completed interviews were obtained from the list of carriers contacted, representing an overall response rate for the survey of 52%. The goal of 600 completed surveys was surpassed due to the higher than expected response rate.

Table A-8 presents a summary of response rates by various subgroups.

Table A-8. Summary of Response Rates by Population Subgroups

Subgroup	Response Rate
Sample Group	
Non-Focus States	49%
Kansas	59%
Kentucky	49%
Washington	56%
Level of CVISN Services	
High	48%
Medium	55%
Low	46%
Carrier Size	
Giant and Large	60%
Medium	56%
Small	44%
Overall	52%

Response rates did vary among subgroups defined by the stratification variables, but not significantly. Small carriers (less than 10 power units) had the lowest response rate. This was due to the fact that over time smaller carriers have a higher probability of going out of business or changing their operating status compared to larger carriers. As a result, carrier operating status and contact information contained in the MCMIS Census file as well as state registration databases can often times be out of date or inaccurate. Thus, fewer small carriers were reached to complete surveys. To account for the varying response rates, the final analysis weight included both a response rate and post-stratification adjustment. The post-stratification adjustment helps reduce the bias associated with non-response by adjusting the weights to known motor carrier populations totals.

2.7 Data Analysis

This section briefly describes the methodology used in analyzing the data that were collected as part of the motor carrier survey. More detail is found in the Motor Carrier Survey Test Plan (USDOT 2006e). The information collected through the motor carrier survey was analyzed to address the main objectives of the study:

- Characterize motor carrier attitudes toward CVISN deployment
- Identify factors affecting motor carrier participation in EC and screening.

The fundamental approach was to rely upon a combination of descriptive statistics, contingency tables, and graphical representations of the motor carrier responses to characterize the data collected as well as provide insight into the relationships between motor carriers' decisions to adopt CVISN technologies and the factors or barriers that may be affecting these decisions. Summary statistics such as means, standard deviations, five-number summaries (minimum, maximum, median, and first and third quartiles of the data) were used for continuous variables. Categorical data were represented by frequency or cross frequency tables.

Based on the results of this exploratory statistical analysis, estimates of population parameters were estimated and a corresponding confidence interval calculated through the use of stratified sampling techniques. Specifically, data were analyzed to formally test the evaluation hypotheses presented in Section 1.1. The following paragraphs briefly describe the analyses that were performed for each hypothesis.

Hypothesis 1: Motor carrier officials are aware of CVISN technologies for EC and ES.

The percentage of motor carriers within the population who are aware of EC was estimated using stratified sampling techniques based on results from the survey. The same was done for ES awareness. In addition, the percentage of those carriers who have heard of e-credentialing that thought the service was available in their state was also estimated.

Hypothesis 2: Motor carrier officials recognize the potential benefits that CVISN technologies offer to their companies.

This hypothesis was tested using a few criteria. First, the percentage of motor carriers within the population who are participating in EC (screening) was estimated based on the results of the survey. The assumption here is that carriers who have decided to participate have decided to do so because they recognize value to their company through participation. This assumption was validated by examining the percentage of participating carriers who have recognized specific benefits related to the CVISN technologies and the importance carriers place on those various benefits.

Hypothesis 3: Motor carrier officials use factors such as costs, benefits, and institutional issues in deciding whether their companies should participate in CVISN deployment.

The survey results were analyzed to determine the main factors that motor carriers use when deciding to participate in CVISN technologies and the importance each factor weighed in their decision. Motor carriers were asked to rate on a 10-point scale from 1 ("Not Important at All") to 10 ("Highest Importance") how important they found various factors when making their participation decision. Regression models were used to model the mean importance rating against the independent variables carrier size, level of state CVISN services, and the specific factor for participation. Statistical tests were performed to identify those participation factors that carriers found to have the most influence in their decision making process. Also, tests were performed to see if the participation factors differed across levels of carrier size or level of state CVISN services. Specific attention was also paid to identifying barriers to further deployment among motor carriers.

Hypothesis 4: After using CVISN technologies in their businesses, motor carrier officials have a high degree of user acceptance of these technologies, as determined by their stated preferences and other measures.

User acceptance of CVISN technologies was measured by the importance motor carriers placed on the benefits they realized. Motor carriers were asked to rate the importance on a 10-point scale from 1 (Not important) to 10 (highly important) of each benefit they realized through their

participation in e-credentialing and/or e-screening. The assumption here is that the degree to which carriers have found the benefits they have received through participation important directly relates to their degree of acceptance of the technologies. These benefit importance ratings, along with the percentage of carriers who achieved the benefit, were used to identify the key factors that led to user acceptance.

Regression models were used to model the mean importance rating to determine those benefits that were of the most importance to carriers. The importance rating provided by the carrier served as the dependent variable in the regression model while independent variables included: 1) the individual carrier benefits; 2) carrier size; and 3) level of state CVISN services. Statistical tests were performed to identify those benefits that carriers found to have the most importance. Also, tests were performed to see if the importance of benefits differed across levels of carrier size or level of state CVISN services.

Hypothesis 5: Motor carriers having different characteristics such as size, route type (local, regional, national), business model (owner-operator, lease, private carrier, etc), cargo type (tanker, hazmat, etc) have different attitudes regarding the adoption of CVISN technologies.

Evaluation of this hypothesis involved calculating several of the same parameters estimated in examining the first four hypotheses by different characteristics associated with the motor carrier. Specifically, estimates were generated for various cells defined by the stratification variables (carrier size, level of CVISN services, CVISN participation). Once all the relevant estimates at the various levels were generated from the motor carrier population, formal statistical tests were then conducted to determine whether any significant differences in these estimates of motor carrier opinions and behaviors exist across the various levels of the stratification variables. Logistic regression techniques were used to model the motor carrier respondent data that took a binary form (aware of e-credentialing or not, participating in e-screening or not). Linear regression models were used to model motor carrier data that took an ordinal form. For example, carrier ratings on the importance of various e-screening and e-credentialing benefits as well as carrier ratings on the influence of factors that contributed to carriers participating or not participating in CVISN technologies were modeled against carrier size and level of state CVISN services.

Estimates and standard errors from the models were used to perform formal statistical tests using the analysis weights described in Section 2.5 Multiple pairwise comparisons were performed between all combinations of the stratification variables to test whether differences exist. If significant differences in motor carrier opinions or behaviors were found to be statistically significant between groups of carriers, odds ratios were generated to quantify this difference in the logistic regression models.

All exploratory statistical analysis was performed in SAS® (ver. 9.1). SUDAAN®, a specialized sample survey software package, was used for the estimation of population parameters and their standard errors as well as for all the statistical modeling. SUDAAN takes into account four common characteristics of sample survey data in its estimation methodology, all of which are present in this survey of motor carriers: 1) unequal probability selection of observations; 2) clustering of observations; 3) stratification; and 4) nonresponse and other adjustments.

3.0 SUMMARY OF SURVEY PROCEDURES

This section describes the procedures undertaken to conduct the survey, including the data collection schedule, specific interview procedures, quality control procedures and reporting, and data cleaning. Telephone surveys were used as the sole data collection mechanism in the interest of increasing the response rate. This approach was chosen because it is easy to administer, can target specific individuals, provides better interpretation of responses, and will result in a higher response rate than mail or internet surveys. Surveying via telephone helped to ensure that the survey questions got to the appropriate person in an organization, a key need in order to make sure that the responses received were from those individuals whose opinions matter most and who are the intended focus of the survey. Telephone surveys also are more likely to result in immediate responses, thereby increasing the response rate.

3.1 Data Collection Schedule

Data collection began on December 29, 2006, and continued until March 19, 2007. Calls were placed between 8:00 a.m. and 5:00 p.m. local time in all regions of the country. All calls were initiated from phone centers in St. Louis, Missouri, and Seattle, Washington. A total of 848 completed interviews were obtained from the list of 1,824 carriers released to the telephone centers.

3.2 Interview Procedures

3.2.1. Pretest

Prior to the start of actual data collection, a pretest was conducted to test the usability of the survey instrument. Qualified, experienced data collection and data preparation staff performed this pretest by first reviewing the questionnaire and then using it in simulated data collection situations. They looked for vague or confusing instructions, inconsistent questions or answer categories; incomplete or redundant sections; and problems with the pace, tone, flow, and format of questions. They also tested the interview length and determined that the survey questionnaire could be administered in approximately 12 minutes.

3.2.2 Interviewer Training

Experienced interviewers played an essential role in encouraging respondents to participate and ensuring overall data quality. Approximately 15 experienced interviewers were trained for the study. All interviewers completed study-specific training before data collection began. Interviewers received 2 hours of training to cover the required data collection procedures, followed by hands-on practice with test cases. The training was held over a 1-day period at each telephone center. The purposes of the training activities were to:

- Provide interviewers with an overview of the study, its purpose, and context
- Standardize the data collection techniques and procedures from the outset

- Ensure the accuracy, quality, and relevance of data collected
- Provide explicit, nonjudgmental procedures for the data collection staff to follow
- Prepare interviewers to respond to frequently asked questions, thus increasing participation levels.

Topics included in the training were: study overview, respondent selection, refusal avoidance/conversion, question-by-question specifications, and administrative procedures. The training sessions were structured to ensure that each interviewer acquired sufficient background knowledge of the study, fully comprehended all techniques, and successfully demonstrated the skills required for this project. Each interviewer was required to complete a series of test interviews using a variety of possible scenarios. Interviewers were not allowed to perform any data collection for the study until they demonstrated to the study manager that they were able to perform their duties at the highest level of competence.

3.2.3 Scheduling Calls and Tracking Cases

All survey data were collected using Blaise, a computer assisted telephone interviewing (CATI) program. A proprietary telephone center tracking software was used to schedule and track cases.

The telephone center tracking system was programmed to release motor carrier phone numbers for calling based on standard and project-specific scheduling algorithms. Calls were scheduled based on optimal calling patterns, and dispersed over different times of the day. Calls also were prioritized based upon their case status. For example, a telephone number for a motor carrier where a respondent had already agreed to participate was given higher priority in the scheduler than a number where no contact had been made.

Due to the short field period, no maximum call attempts were established for this study. Cases with repeated unsuccessful attempts were assigned to supervisor review. Cases were closed by the supervisor as "maximum calls" based on interviewer notes, as well as number of calls, when further calling appeared unlikely to be productive.

Motor carrier contact information for this survey came from the MCMIS Census File or state motor carrier databases received from Kansas, Kentucky, and Washington State. It was possible that incorrect contact information for motor carriers was stored in these files or that motor carrier contact information changed since the files were obtained from their respective sources. As such, attempts were made to determine the correct contact information for the carrier. If interviewers encountered an incorrect or out-of-date phone number, the motor carrier company was placed in a tracing process. Experienced tracers checked daily for cases assigned to tracing. Tracers used Internet White Page searches, such as www.555-1212.com and ReferenceUSA.com, to locate new phone numbers. Searches were done by company name and address to ensure that the correct company was identified. New contact information was entered by the tracer and the case was reactivated in the call center. Variations in the listed name of the company or the address reported were common. In such cases, interviewers were instructed to verify that they were calling the correct company. In all, 366 (20%) of the 1824 motor carriers released for calling required tracing. New contact information was identified for approximately 67% of those traced.

3.2.4 Interviewing

Once contact was made with an individual at the motor carrier company, interviewers briefly explained the purpose of the study and asked for the appropriate person at the company to speak with about credentialing and ES activities. It was also determined at this point if the motor carrier company was eligible to participate in the survey. Examples of companies deemed not to be eligible were ones that no longer were in the trucking business, did not utilize commercial vehicles that would be affected by CVISN technologies (e.g., bus fleets or taxi services), or contracted out their trucking. If the carrier was determined to be eligible and the respondent was available, the interviewer immediately attempted to complete the interview. If the respondent was not available, the interviewer asked for a good time to call back. If the respondent had questions or was hesitant to participate, the interviewer answered any questions the respondent raised. If the respondent needed further information or reassurance, the interviewer provided the name and telephone number of the study manager and offered to fax a letter from the Federal Motor Carrier Safety Administration to further reinforce the legitimacy of the study. Several participants did call the study manager or request the letter before agreeing to participate.

Once the interviewer reached the respondent, interviews were completed in one telephone call. For all carriers who completed a questionnaire, a single carrier representative answered all the survey questions. If a respondent started, but refused to complete an interview in one phone call, the session was broken off and the interview was coded as a refusal/partially complete. No attempts were made to weight these data or use them in any subsequent analysis.

No incentives were offered to respondents for completing the interview, and the survey was conducted only in English. If the motor carrier refused the interview, the interviewer recorded the reason for refusal. The average length of each completed interview was approximately 12 minutes.

3.3 Quality Control Procedures and Reporting

Interviewer performance was evaluated on the basis of production reports and routine on-line monitoring. Interviewer conduct during interviews was evaluated primarily by supervisory monitoring of actual calls, supplemented by review of interviewer notes maintained in the CATI system.

The telephone centers used for this survey each contain supervisor stations equipped with monitoring systems for the purpose of monitoring and validating interviewers' work. These systems allow supervisors to listen to both the interviewer and the respondent while the interview is in progress. Monitoring is an important element in the quality control process. In addition to the actual recorded answers, supervisors assessed interviewers on interviewing elements including following the prescribed interviewing routine exactly, reading each question verbatim, probing without leading, and not missing or falsifying any responses. Interviewers also were assessed on their ability to hold the subject's attention without being too cold or too empathetic.

3.4 Summary of Data Cleaning

One of the most important advantages of computer-assisted surveys is that errors can be identified and averted during the interview by building logic, range, and consistency checks into the program. Thus, the CATI system enforced questionnaire logic strictly as the interviews were conducted. The CATI system permits interviewers to back up and correct erroneous answers to previous questions without violating instrument logic. An interview could not be coded as complete until all appropriate questions had either been answered or assigned an acceptable non-response value, and until the data record for each interview was consistent with the instrument logic.

A program was written to export the instrument responses into SAS. Analysis files were then prepared in SAS, and additional edits performed. The additional edits included checks on the number of missing values, review and cleaning of "other, specify" responses, assignment of additional non-response values, and creation of constructed variables. After data cleaning activities were completed, the SAS analysis files containing all the necessary survey information were provided to the data analysts.

4.0 Results

This section presents the main findings and results related to the main objective of this motor carrier survey; namely to document and analyze the attitudes of motor carriers regarding CVISN deployment. The section is organized into three major sections that follow the organization of the survey questionnaire presented in Appendix A.1:

4.1 Characteristics of Survey Respondents

4.2 Electronic Credentialing
- 4.2.1 Motor Carrier Awareness of E-Credentialing
- 4.2.2 Motor Carrier Participation in E-Credentialing
- 4.2.3 Factors Influencing Motor Carrier Participation in E-Credentialing
- 4.2.4 Motor Carrier Benefits from E-Credentialing

4.3 Electronic Screening
- 4.3.1 Motor Carrier Awareness of E-Screening
- 4.3.2 Motor Carrier Participation in E-Screening
- 4.3.3 Factors Influencing Carrier Participation in E-Screening
- 4.3.4 Motor Carrier Benefits from E-Screening.

Section 4.1 covers the characteristics of the motor carriers who responded to the survey. Sections 4.2 and 4.3 present the results of the survey as they relate to e-credentialing and e-screening respectively. Within each subsection in 4.2 and 4.3, results are first presented at a national level using all motor carriers that responded to the survey. For some survey questions where it is appropriate, analysis is also presented based on the survey results broken down by the levels of two stratification variables: carrier size and CVISN participation status. Specific attention was

paid to these breakdowns if there were significant differences in survey results between the various levels of these stratification variables.

Comparisons of survey results between carriers participating in and not participating in CVISN technologies was performed at the national level for the most part. Because of the over sampling involved with the focus states, about 38% of the sampled carriers who participate in e-screening were from Kansas, Kentucky, or Washington. Similarly, 38% of the sampled carriers who participate in e-credentialing were from one of the focus states. However, there were sufficient CVISN-participating carriers from the remainder of the states to warrant including carriers from both Focus and Non-Focus states when comparing results between participants and nonparticipants. Sample weighting accounted for the high proportion of carriers from the Focus states when calculating results.

In an effort to ensure a more representative national sample of motor carrier companies, the sample of motor carriers was stratified by the level of CVISN services offered by that state. The purpose of this stratification was to draw data from motor carrier companies that are based in or operating in states with varying levels of CVISN deployment. In the course of analyzing data from the survey, it became apparent that motor carrier responses did not vary significantly based on the levels of state CVISN services. Therefore, for the most part this section does not present nor discuss results broken down by the level of state CVISN services. Analyses based on stratification levels are confined to carrier size and CVISN participation.

Tables showing the marginal frequency distributions for each survey question are included in Appendix A.2. The appendix includes national distributions as well as distributions by the various levels of the stratification variables. Included in the appendix are breakdowns by the level of state CVISN services stratification variable for reference, even though in most instances the motor carrier opinions and attitudes did not vary across levels of this variable.

Table A-9 lists the five study hypotheses and maps them to the section of this report where findings for the hypothesis are addressed.

Table A-9. Study Hypotheses and Section of Report Detailing Findings

Study Hypothesis	Section of Report
Hypothesis 1: Motor carrier officials are aware of CVISN technologies for electronic credentialing and electronic screening.	4.2.1, 4.3.1
Hypothesis 2: Motor carrier officials recognize the potential benefits that CVISN technologies offer to their companies.	4.2.4, 4.3.4
Hypothesis 3: Motor carrier officials use factors such as costs, benefits, and institutional issues in deciding whether their companies should participate in CVISN deployment.	4.2.3, 4.3.3
Hypothesis 4: After using CVISN technologies in their businesses, motor carrier officials have a high degree of user acceptance of these technologies, as determined by their stated preferences and other measures.	4.2.2, 4.3.2, 4.2.4, 4.3.4
Hypothesis 5: Motor carriers having different characteristics such as size, route type (local, regional, national), business model (owner-operator, lease, private carrier, etc), cargo type (tanker, hazmat, etc) have different attitudes regarding the adoption of CVISN technologies.	Throughout Section 4

Throughout this section, results and findings are given based on all motor carriers who responded to the survey unless otherwise indicated. For example, if it is reported that 19% of motor carriers use an outside firm (such as a service bureau or permitting/credentialing broker) to obtain at least one form of credential, the 19% represents the weighted percentage of all motor carriers in the population who answered this question.

4.1 Characteristics of Survey Respondents

This section presents some information on the motor carriers who responded to the survey. There were 848 completed surveys. Figure A-2 shows the distribution of these surveys by the various geographic samples in the survey. Consistent with the design of the sample, about half (53%) of the completed surveys came from the focus states, whereas the rest were from other parts of the country.

Responding motor carriers were asked to describe their type of business. Table A-10 shows the breakdown of carriers by business type for both the entire sample as well as for the three focus states combined. A majority of the carriers in both samples described themselves as private carriers.

It was hypothesized that carriers that are local or that never leave their home state may view CVISN technologies differently than interstate carriers. One goal of the survey design was to include a variety of carriers in terms of their geographic range. Historically, sample frames of motor carriers such as the MCMIS Census File have tended to underrepresent the intrastate carrier population. However, with the advent of PRISM, more states now are requiring all motor carriers, including intrastate carriers, to register with FMCSA to obtain a USDOT number, which would place them in the MCMIS Census file. Although MCMIS still underrepresents intrastate carriers somewhat, the level of intrastate coverage has vastly improved over the last few years. Figure A-3 breaks down the responding motor carriers by geographic range traveled.

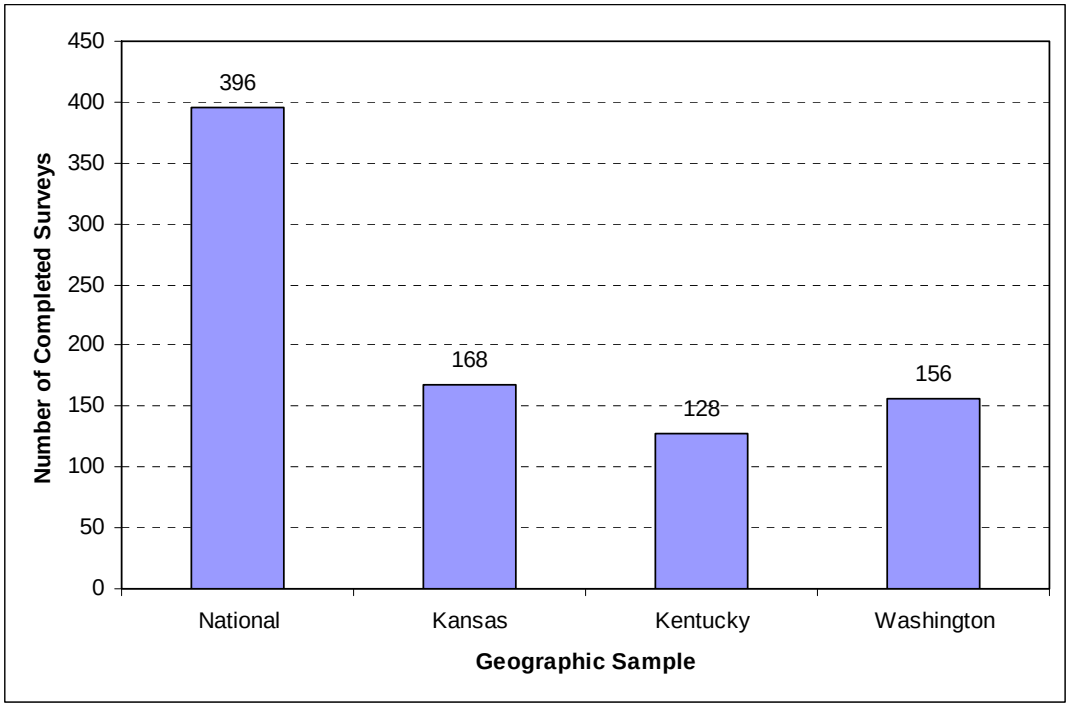


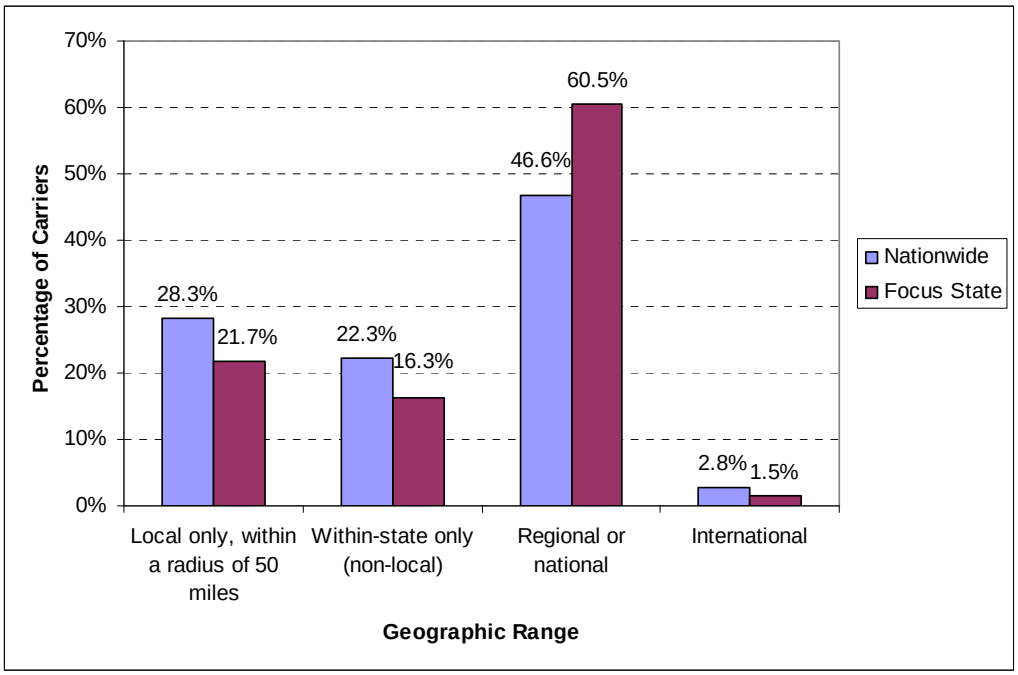
Figure A-2. Completed Surveys by Geographic Sample

Table A-10. Classification of Responding Motor Carriers

	All Carriers		Focus State Carriers	
	Number	**Weighted Percent**	**Number**	**Weighted Percent**
For-hire truckload carrier	280	14.4%	155	23.8%
For-hire less-than-truckload carrier	26	0.8%	16	1.9%
For-hire owner/operator	125	26.2%	72	17.1%
Private Carrier (not for hire)	409	58.6%	203	57.2%

Source: Survey Question 2.1

Nationally, 28% of carriers reported they traveled only within a 50 mile radius (sometimes traveling across state lines, sometimes not) while another 22% of the weighted sample travels within state but includes trips beyond a 50 mile radius. As such, the survey respondents cover a range of geographic business models. The MCMIS Census File used in the national sample frame contained a much larger percentage of intrastate carriers than was present for the CVISN MDI Evaluation Motor Carrier Survey conducted in 2000 (USDOT 2002), resulting in the larger intrastate and local representation in this survey. The focus states, however, contained a higher percentage of responding carriers who were classified as regional or national.



Source: Survey Question 2.3

Figure A-3. Geographic Range of Responding Motor Carriers

The attitudes and opinions of motor carriers toward CVISN technologies were thought to vary by the size of the carrier. As discussed in Section 2.2, the sample was stratified by carrier size where carrier size was defined by the number of power units operated by the carrier.

Table A-11 shows the breakdown of the sample by carrier size for both the national and focus state samples.

Table A-11. Breakdown of Sample by Carrier Size

	All Carriers		Focus State Carriers	
Carrier Size	**Number**	**Weighted Percent**	**Number**	**Weighted Percent**
Small	376	86.2%	220	86.8%
Medium	321	12.8%	175	12.2%
Giant/Large	151	1.0%	57	0.9%
Total	848	100%	452	100%

The allocation of samples across carrier size was not exactly proportional to the percentage of total carriers within each size class because nationally small carriers comprise about 86% of all carriers. If allocation were done proportional to size, very few giant or large carriers would have been sampled. Since comparisons of carrier attitudes and opinions were desired across carrier size classes, a sample based proportional to size would not have provided enough information on larger carriers. Although not proportional, the number of giant, large, medium, and small carriers responding to the survey was more favored toward medium and small carriers, since there were not enough giant or large carriers available in some states.

In any survey, it is important to compare characteristics of the survey respondents and nonrespondents to determine if any sort of bias exists in the survey results due to major differences between respondents and nonrespondents. Comparisons were made between respondents and nonrespondents in terms of carrier size, type of carrier, and geographic range. As discussed in Section 2.6, smaller carriers had a lower response rate than larger carriers. To account for any potential nonresponse bias, the final analysis weight included both a response rate and post-stratification adjustment. There were no significant differences in the distribution of type of carrier or geographic range between respondents and nonrespondents. Based upon these variables available for comparison, there does not appear to be evidence that a systematic non-response bias exists.

4.2 Electronic Credentialing

4.2.1 Motor Carrier Awareness of E-Credentialing

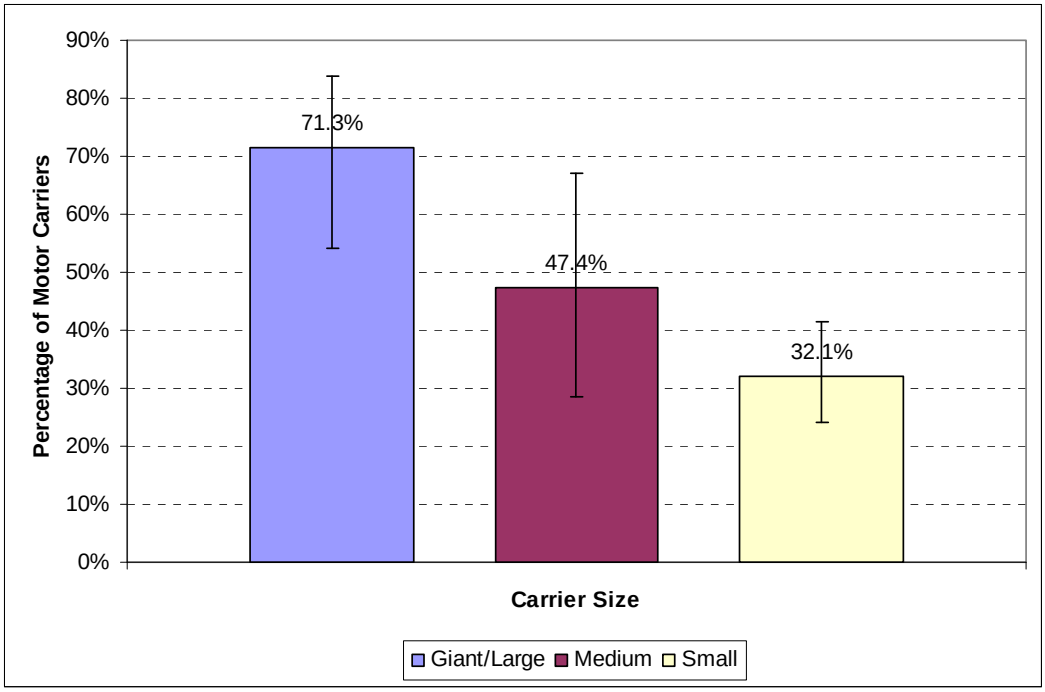
About 19% of motor carriers use an outside firm (such as a service bureau or permitting/credentialing broker) to help obtain at least one form of credential. Outside firms are used more heavily by large and giant carriers and to a lesser degree by medium size carriers. The remaining 81% of carriers utilize their own staff to handle all of the credential processing.

Survey respondents were told that

> "Electronic credentialing allows motor carriers to apply for, pay for, and receive operating credentials, such as IRP and IFTA among others, from their base state remotely, using a computer-based interface. Carriers send their information to their state via computer for processing rather than manually filling out paper forms and mailing them to the state. These services are commonly referred to as e-credentialing."

About one third of motor carriers (35%) are aware of the ability to obtain and pay for credentials electronically. Of these carriers that have heard of EC, about 63% reported that EC was available to them through their base states. The degree of motor carrier awareness of EC and their perception of its availability varies by the size of the carrier. Figure A-4 shows the results by carrier size.

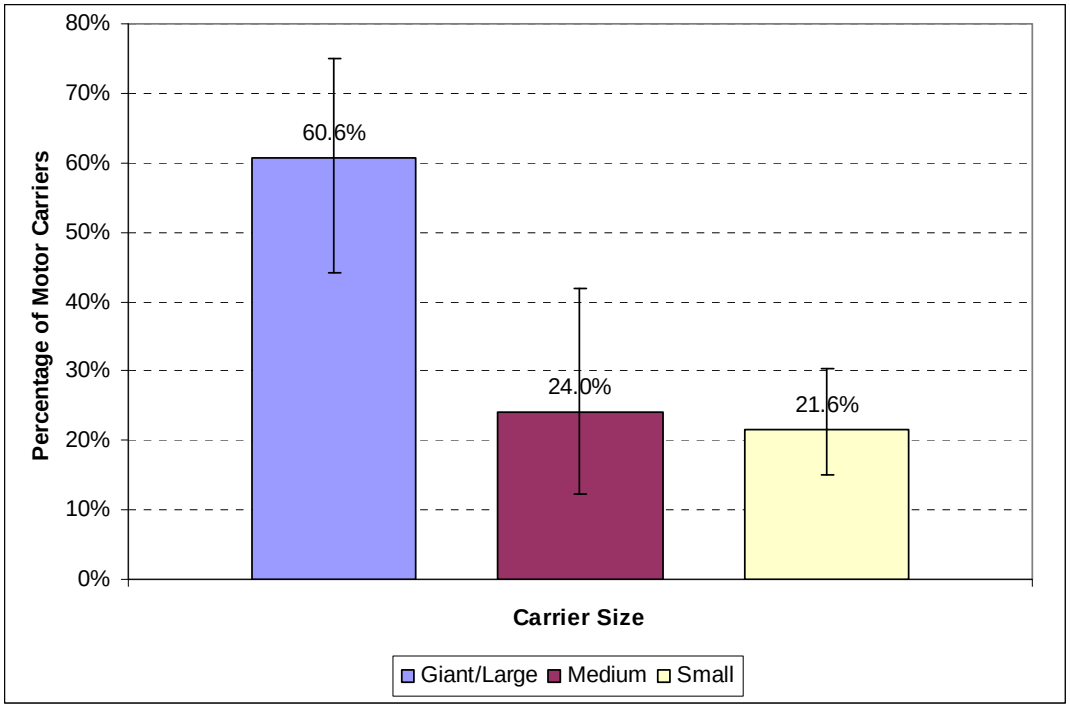
A larger percentage, roughly 71%, of giant and large carriers, is aware of EC compared to 47% of medium carriers and 32% for small carriers. The difference in awareness between giant/large and small carriers is statistically significant.



Source: Survey Question 3.2

Figure A-4. Percent of All Carriers Aware of Electronic Credentialing by Carrier Size with 95% Confidence Intervals

Carrier size also was highly correlated with the perception of e-credentialing availability in the carrier's base state, as shown in Figure A-5. Only about 22% of smaller carriers and 24% of medium carriers who have heard of e-credentialing perceive that e-credentialing is available to them in their base state compared to about 61% for giant/large carriers. A carrier had to have heard of e-credentialing to be included in the analysis shown in Figure A-5.



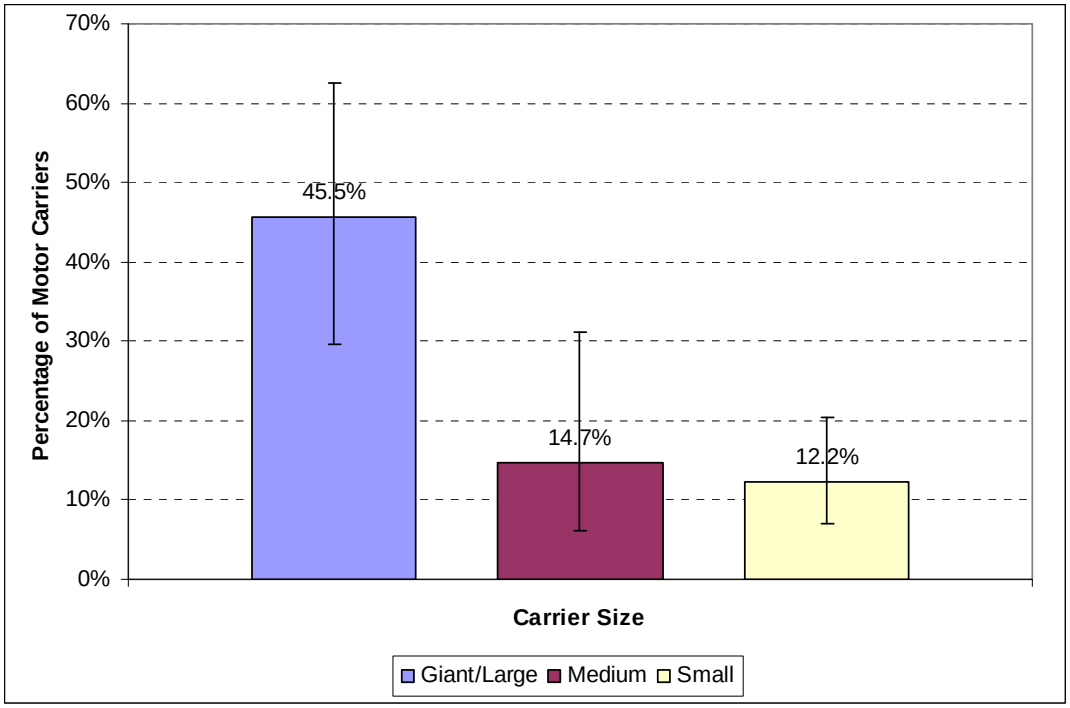
Source: Survey Question 3.3

Figure A-5. Percent of Carriers Who Perceive that E-Credentialing is Available by Carrier Size with 95% Confidence Intervals
(Base: all carriers who have heard of e-credentialing)

4.2.2 Motor Carrier Participation in E-Credentialing

Nationally, 13% of all motor carriers in the population participated in e-credentialing within the past 12 months in one or more states. Of motor carriers who were aware of e-credentialing and who believed it was available, 57% have recently used or are currently using e-credentialing. Larger carriers make up a higher percentage of e-credentialing users. Figure A-6 shows the degree of e-credentialing participation by carrier size.

About 46% of giant/large carriers have participated in e-credentialing in the past 12 months compared to roughly 15% and 12% for medium and small carriers, respectively. The participation rate amongst giant/large carriers is statistically different from the other two size categories.

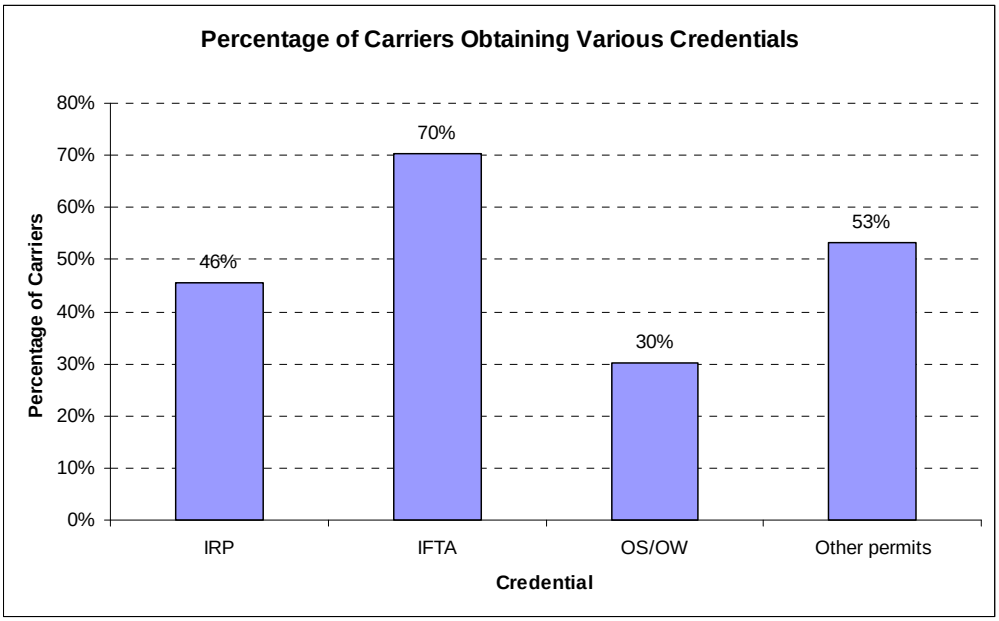


Source: Survey Question 3.4

Figure A-6. Motor Carrier Participation in E-Credentialing by Carrier Size
(Base: All Carriers)

One factor influencing the different e-credentialing awareness and participation rates among carrier size categories is the individual state deployment philosophies. Washington State, for instance, targets its e-credentialing program to only the largest motor carriers in an effort to capture the majority of the trucks registered in Washington. Washington acknowledges that their system is currently not equipped to handle every carrier in the state nor is that the goal. Kansas, on the other hand, has a more wide-ranging e-credentialing program that allows motor carriers of any size to obtain various credentials and permits through its Kansas Online TruckingKS System. Because e-credentialing systems are state-based, the involvement of carriers of different sizes in the program will in part be influenced by differences in individual state practices.

A number of credentials/permits are available through e-credentialing. The exact numbers and types of permits available vary by state. Carriers participating in e-credentialing were asked which permits they obtained electronically. Focus was centered on the most common credentials and permits such as IFTA, IRP, and overdimension (oversize/overweight, or OS/OW) although carriers were also asked which other permits they acquired electronically. Figure A-7 shows the incidence of EC experience (by permit type) for those carriers that participate in e-credentialing.



Source: Survey Question 4.1

Figure A-7. Breakdown of Permits Obtained Electronically in Last 12 Months by E-Credentialing Participating Carriers

IFTA was the most frequent permit obtained electronically (70% of participants). Roughly half of participating carriers obtained their IRP credentials electronically, while 30% obtained their oversize/overweight permits this way. Over half of participating carriers also obtained other state specific permits related to size, weight, or state taxing. The most frequent credentials cited include the New York State Highway Use Tax, Kansas Single State Registration, and various hazardous waste and single trip permits.

The existence of EC and the degree to which it is deployed vary by state. Some states have very established, sophisticated systems, whereas others are more basic and still in development. As such, not all credentials are available electronically in all states. E-credentialing participating carriers were asked whether IRP, IFTA, and OS/OW credentials were available in their area, and if not, which they would like to be made available. Table A-12 displays these results.

Table A-12. Availability of Credentials

Credential/ Permit	% of Participating Carriers For Which Credential Is Available Electronically	% of Participating Carriers who Would Like Credential to be Available if Currently Unavailable
IRP	68%	34%
IFTA	89%	31%
OS/OW	90%	59%

Source: Survey Questions 4.1a, 4.1b

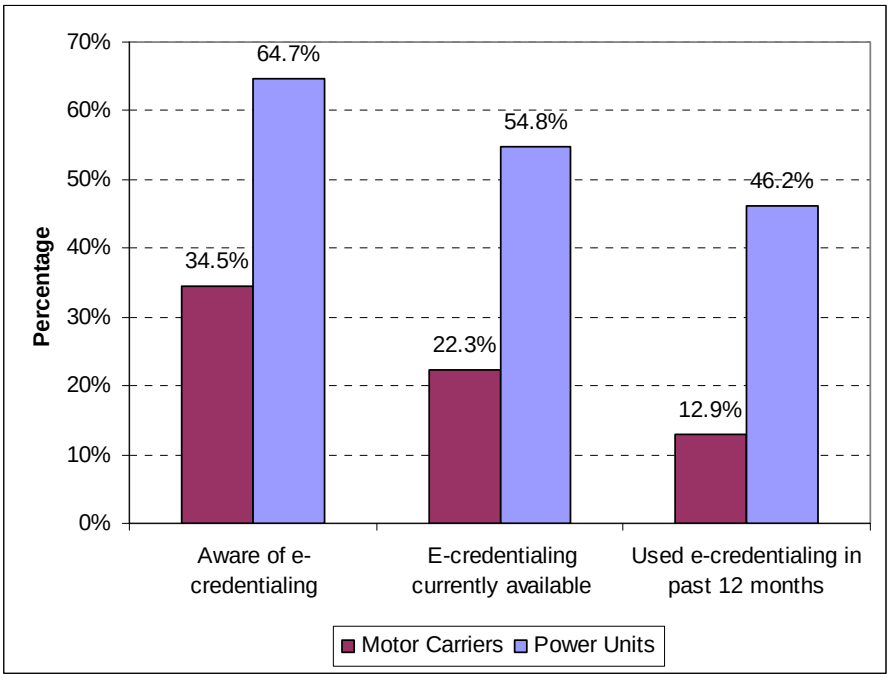
A significant percentage of e-credentialing participating carriers wanted to have additional credentials made available to them electronically. For instance, electronic IRP filing is available

to 68% of carriers participating in e-credentialing. Of the 32% of carriers that do not have IRP available electronically, over one third of them would like to see it be made available. Similar results were seen with IFTA and a larger percentage of carriers wanted electronic access to OS/OW permitting. These findings indicate a strong show of support for e-credentialing among motor carriers. A significant percentage of motor carriers that use e-credentialing for some permits are sufficiently satisfied with the program to want to see it expanded to other credentials.

The results presented thus far have focused on the awareness of and participation in e-credentialing from a motor carrier perspective. For purposes of this survey, the number of trucks or power units that a motor carrier operates defines the size of the carrier. Furthermore, as presented earlier in this section, e-credentialing awareness and participation increase with the size of the carrier. Thus, it makes sense to view e-credentialing awareness and participation from a truck perspective as well. Figure A-8 displays the percentage of trucks operated by carriers that are aware of and participate in e-credentialing along with the percentage of trucks whose carriers have it available. The awareness, participation, and availability percentages for motor carriers are provided again as a reference. The number of power units operated by a motor carrier was used in counting the number of trucks operated by a motor carrier. Here, power units and trucks are used synonymously.

To estimate the number of trucks in the population for each category, the power unit count for each carrier was multiplied by the analysis weight assigned to the motor carrier. This number was then divided by the total number of power units in the sample frame to obtain a percentage. This methodology assumes that every power unit belonging to a carrier behaves the same in terms of e-credentialing. For instance, an e-credentialing participating carrier is assumed to obtain electronic credentials for all trucks in its fleet and not just a subset.

The carriers aware of e-credentialing represent roughly 65% of all trucks on the road. Slightly more than half of the trucks (55%) belong to carriers that have e-credentialing services available in their states. A little less than half of all trucks (46%) are operated by carriers who used e-credentialing within the past 12 months to obtain one or more of their credentials. Efforts to increase awareness and participation of e-credentialing have been very successful over the past several years to a point where—among the population responding to this survey—almost half of all trucks belong to carriers that have obtained credentials electronically.



Source: Survey Questions 3.2, 3.3, 3.4

Figure A-8. Percentage of All Motor Carriers (and representative power units) Aware of and Participating in E-Credentialing

4.2.3 Factors Influencing Carriers' Participation in E-Credentialing

A variety of factors may play a role in a carrier's decision to apply for, pay for, and receive operating credentials electronically. To help understand those factors that most influence a carrier's decision, carriers were asked to rate on a 10-point scale from 1 ("Not Important at All") to 10 ("Highest Importance") how important they found various factors when making their participation decision. Both e-credentialing participating and nonparticipating carriers were asked this question.

The results for e-credentialing participating carriers overall and by carrier size are shown in Table A-13. Each of the 44 mean importance scores in Table A-13 was individually tested to see if it was significantly greater than 5. An importance score significantly greater than 5 indicates that the factor has a high level of importance in a carrier's decision to participate in e-credentialing. Cells with an asterisk (*) represent mean importance scores that are significantly greater than 5. Each of the 44 cells in the table was tested individually at a confidence level of 99.5%. Thus, these tests were collectively performed at an overall confidence level of 80%[1]. The importance factors with the highest three mean scores are shaded in each column.

[1] Each of these 44 tests was performed individually with a confidence level of about 99.5% (i.e. there is a 0.5% chance that the test will incorrectly conclude that the mean score is larger than 5 when in fact it is not). When

Table A-13. Mean Importance Score (with Standard Error) For E-Credentialing Carrier Participation Factors (1=Low; 10=High) (E-Credentialing Participants Only)

	Mean Importance Score (with Standard Error)				
Importance Factor in Deciding to Participate in E-Credentialing	**All E-Credentialing Carriers**	**Giant/Large**	**Medium**	**Small**	**Statistical Comparison Between Levels of Carrier Size****
Size of company	4.10 (0.67)	6.40 (0.48) *	5.71 (0.96)	3.71 (0.73)	Giant/large mean score higher than small
Cost of using e-credentialing	4.84 (0.70)	6.12 (0.66)	3.24 (0.98)	5.09 (0.81)	
Potential dollar cost savings	6.47 (0.64) *	6.44 (0.33) *	7.36 (0.43) *	6.31 (0.78)	No significant difference
Potential staff time savings	8.34 (0.49) *	8.54 (0.27) *	8.73 (0.62) *	8.27 (0.58) *	No significant difference
Convenience of obtaining credentials	9.06 (0.30) *	9.07 (0.29) *	9.68 (0.15) *	8.94 (0.36) *	No significant difference
Increased accuracy of registration information	7.46 (0.50) *	8.21 (0.43) *	6.72 (0.80)	7.56 (0.60) *	No significant difference
Getting trucks into service more quickly	7.89 (0.68) *	8.63 (0.36) *	8.69 (0.61) *	7.69 (0.85) *	No significant difference
Time required to learn new system	5.01 (0.68)	4.44 (0.55)	3.17 (1.03)	5.37 (0.77)	
Existence or lack of technology at your company	4.28 (0.80)	2.19 (0.28)	2.61 (0.87)	4.68 (0.94)	
Existence or lack of trained, available staff to use system	3.78 (0.70)	2.89 (0.40)	2.46 (0.75)	4.05 (0.84)	
Concern about privacy/security of company data	5.90 (0.96)	5.23 (0.66)	5.28 (0.53)	6.04 (1.17)	

Source: Survey Question 3.5

* Importance factor mean score was statistically significantly greater than 5 with an overall confidence level of 80% across the 44 tests. The test-specific confidence level was therefore about 99.5%.
** Statistical tests of pairwise carrier size comparisons were only performed for factors found to be significantly greater than 5.

For e-credentialing participants, the three factors garnering greatest importance when considering their participation status were convenience of obtaining credentials, potential staff time savings, and getting trucks into service more quickly. These three factors had the highest mean importance score across all levels of carrier size. There was also a significant level of

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performing multiple statistical tests, it is desirable to control the simultaneous confidence level in addition to the confidence level of each individual test.

The simultaneous confidence level for all 44 tests together is (99.5%)^44 or about 80%. This means that there is at most a 20% chance that at least one individual test will conclude the mean importance score is above 5 when in fact it is not.

importance placed on the increased accuracy of registration information and potential dollar cost savings. For carriers overall, the only statistical difference among these significantly important factors was that the importance placed on the convenience of obtaining credentials was significantly higher than the potential for dollar cost savings. This is an interesting finding in that carriers seem to value convenience in their operations slightly more than saving money. However, this may be a bit misleading in that some of the potential benefits are closely related. For instance, if e-credentialing leads to more convenience, staff time savings, and getting trucks into service more quickly, it stands to reason that cost savings will also follow from these benefits. Statistically, less importance was placed on concerns about the cost of using e-credentialing and the size of the company as compared to the significant factors.

For factors with mean importance scores significantly above 5 either overall or for a specific level of carrier size, pairwise comparisons were made across all carrier size levels to determine if any differences in mean importance scores were statistically significant. For each concern factor, the overall confidence level for the three comparisons was 95%. Giant/large carriers did rate company size as an important factor in deciding to participate as compared to medium and small carriers. The mean importance score of 6.40 for giant/large carriers is significantly different from that of the small carriers. This is not surprising given the volume of paperwork and time to obtain credentials for a large fleet of trucks. Apart from this difference, no other statistically significant differences in importance scores were found between the levels of carrier size when looking at factors with importance scores significantly above 5. Thus, carriers of all sizes have similar reasons for adopting e-credentialing, namely convenience, saving staff time, getting trucks on the road more quickly, increased accuracy of registration information, and potential dollar cost savings.

It is also important to understand the reasons carriers choose not to participate in e-credentialing. Motor carriers not participating in e-credentialing were presented the same participation factors as e-credentialing participants and were asked what factors they found most important in deciding not to participate. The percentage of carriers that rated an importance factor greater than 5 was calculated for each importance factor. A rating higher than 5 represents a strong degree of importance for that factor in deciding not to participate. Table A-14 shows some importance factors and the percentage of carriers who rated them higher than 5.

Table A-14. Factors Influencing Carriers not to Participate in E-Credentialing

Importance Factor	Percent of Non E-Credentialing Carriers Who Rated Factor > 5			
	Overall	Giant/Large	Medium	Small
Concern about privacy/security of company data	73.9%	10.2%	81.9%	73.9%
Lack of technology at company	38.0%	9.4%	9.5%	42.8%
Time required to learn new system	35.5%	20.9%	20.8%	38.2%
Lack of trained, available staff to use system	28.6%	12.2%	22.3%	30.0%

Source: Survey Question 3.5

Roughly three quarters of nonparticipating carriers cited concern about privacy/security of company data as a significant factor affecting their decision not to participate. Privacy concerns

were expressed mainly by the medium and small carriers, as only about 10% of giant/large nonparticipating carriers rated privacy concerns as a significant factor in affecting their decision not to participate. Larger carriers are likely more accustomed to performing regular business transactions electronically as compared to medium and small carriers. As such, this familiarity with using electronic data may translate to a higher level of acceptance of e-credentialing technologies. Much of the concern about privacy/security of company data from smaller companies may stem from a lack of understanding of how e-credentialing or electronic business transactions in general operate. Educational programs by FMCSA or state agencies may help in this area.

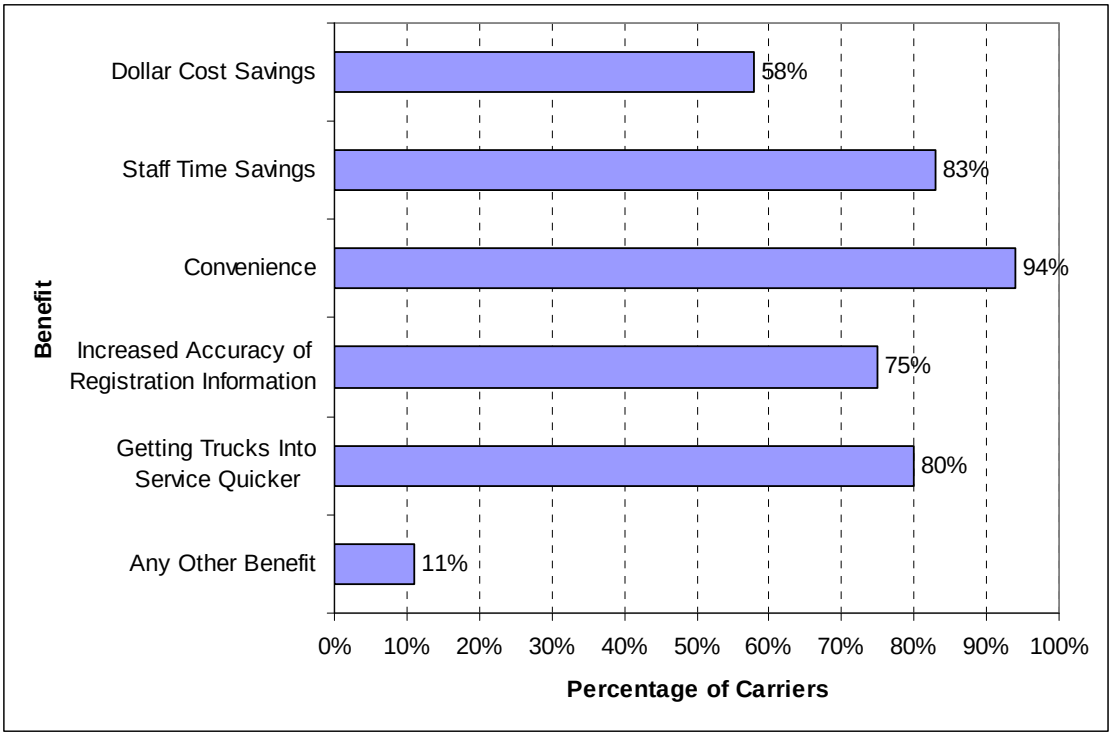
Lack of technology resources was rated above 5 by about 38% of nonparticipating carriers and was mainly an issue with small carriers. Lack of staff resources also was a significant factor in deciding not to participate with about 36% of nonparticipating carriers. An approach to try to expand e-credentialing usage would be to modify the deployment program to remove or reduce the technology barriers that medium- and small-size motor carriers perceive. One example would be to increase the ease of use for centralized computer interfaces, so that smaller carriers—who might not have in-house information technology or programming staff—can more readily assign general administrative staff to perform the carrier-side credentialing and screening functions.

4.2.4 Motor Carrier Benefits from E-Credentialing

Motor carriers may achieve a variety of benefits through the use of e-credentialing. Given a list of potential benefits, carriers were asked to indicate which benefits they have realized through participation in e-credentialing. Figure A-9 illustrates the percent of e-credentialing carriers achieving various benefits.

About 94% of participating carriers found e-credentialing a more convenient way to obtain credentials. Over 80% of participating carriers realized savings in staff time worked. A smaller percentage of carriers (58%) achieved cost savings through the use of e-credentialing. This is interesting given the other benefits cited. Convenience, staff time savings, and getting trucks into service more quickly all imply a financial savings. Perhaps the benefit of saving money is included in, and thus confounded with, these other benefits. Participating carriers indicate that the increased speed and accuracy of the process has significantly reduced the frustration level at companies and has made it easier to fix any mistakes made in the process.

It is interesting to note that the benefits actually achieved by motor carriers who are doing their credentialing electronically track fairly closely with the reasons those carriers give for deciding to participate originally (Table A-13). This seems to imply that e-credentialing has led to few surprises for carriers who chose to take part although additional research would need to be conducted to validate this idea as carrier responses for reasons to participate are likely to have been influenced by actual benefits achieved.



Source: Survey Question 4.2

Figure A-9. Percentage of E-Credentialing Carriers Achieving Various Benefits Through Use of E-Credentialing

Although data quality and timeliness have been persistent concerns since the CVISN deployment began, the perceived increase in data accuracy afforded by e-credentialing was one of the top-rated benefits named by motor carriers. Accuracy, at 75%, was the fourth-ranked behind convenience, staff time savings, and getting trucks into service more quickly.

Motor carriers were then asked to comment on the importance of e-credentialing benefits. Using a scale that ranges from 1 to 10 where 1 means the benefit was not important at all and 10 means the highest importance, carriers were asked to rate the importance of each benefit their company has realized through participation in e-credentialing. Table A-15 shows the mean importance score and standard error expressed overall and by each carrier size level for each of the five major benefits. Cells with an '*' represent mean importance scores that are significantly greater than 5. A mean importance score significantly above 5 indicates strong importance for the benefit. These tests were collectively performed with an overall confidence level of 90%. Therefore, the test-specific confidence level was about 99.5%.

Table A-15. Mean Importance Score (with Standard Error) For E-Credentialing Benefits (1=Low; 10=High) (E-Credentialing Participants Only)

	Mean Importance Score (with Standard Error)			
Benefit	**All E-Credentialing Carriers**	**Giant/Large**	**Medium**	**Small**
Dollar cost savings	8.76 (0.60) *	7.75 (0.70) *	9.48 (0.37) *	8.52 (0.87) *
Staff time savings	9.21 (0.48) *	8.98 (0.39) *	9.79 (0.12) *	9.09 (0.60) *
Convenience	9.72 (0.17) *	8.89 (0.39) *	9.88 (0.06) *	9.73 (0.21) *
Increased accuracy of registration information	9.48 (0.38) *	8.40 (0.63) *	9.89 (0.07) *	9.45 (0.49) *
Getting trucks into service more quickly	9.08 (0.53) *	9.17 (0.48) *	9.80 (0.16) *	8.93 (0.67) *

Source: Survey Question 4.2a

* Importance factor mean score was statistically significantly greater than 5 with an overall confidence level of 90% across the 20 tests. The test-specific confidence level was therefore about 99.5%.

The results indicate that each of these benefits associated with e-credentialing is extremely important to motor carriers. The mean importance scores for all benefits were significantly above 5 both overall and within each level of carrier size. Although mean importance scores for each benefit were very high for all levels of carrier size, giant/large carriers placed slightly more importance on getting trucks into service more quickly and savings in staff time. Medium and smaller carriers placed a heavier importance on convenience and increased accuracy of credential information. However, these differences were not statistically significant.

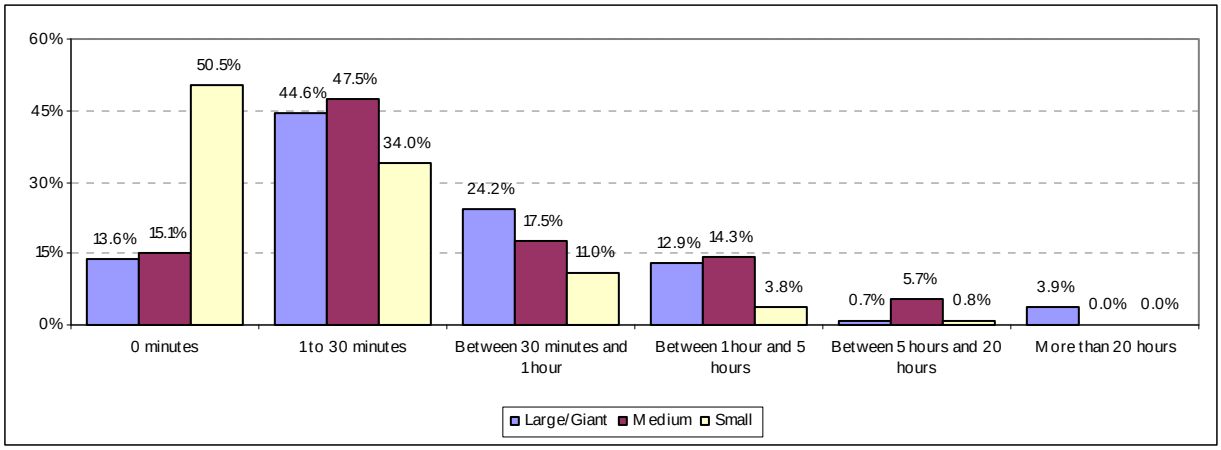
Looking across the level of carrier size, medium carriers had the highest mean importance score for all but one of the benefits. Pairwise comparisons of mean importance scores were performed for each benefit across the level of carrier size. For each benefit, the overall confidence level for the three comparisons was 95%. No statistical differences were found between the carrier size levels for any of the benefits.

4.3 Electronic Screening

4.3.1 Motor Carrier Awareness of E-Screening

Motor carriers were asked how many minutes per week their company's average truck spends waiting in line or stopping at weigh and inspection stations. About 82% of all carriers reported that their average wait time per truck was less than 30 minutes. This large percentage of carriers with small wait times is due mainly to the fact that over one half of small carriers reported that they never or very rarely stop at weigh stations. These carriers were mainly local carriers and

reported that there were no weigh stations on their normal routes. These results imply that most small carriers would not see much of a benefit from a time savings perspective by participating in an e-screening program. Figure A-10 shows the distribution of wait times by carrier size.



Source: Survey Question 5.3

Figure A-10. Distribution of Truck Wait Times at Inspection Stations by Carrier Size

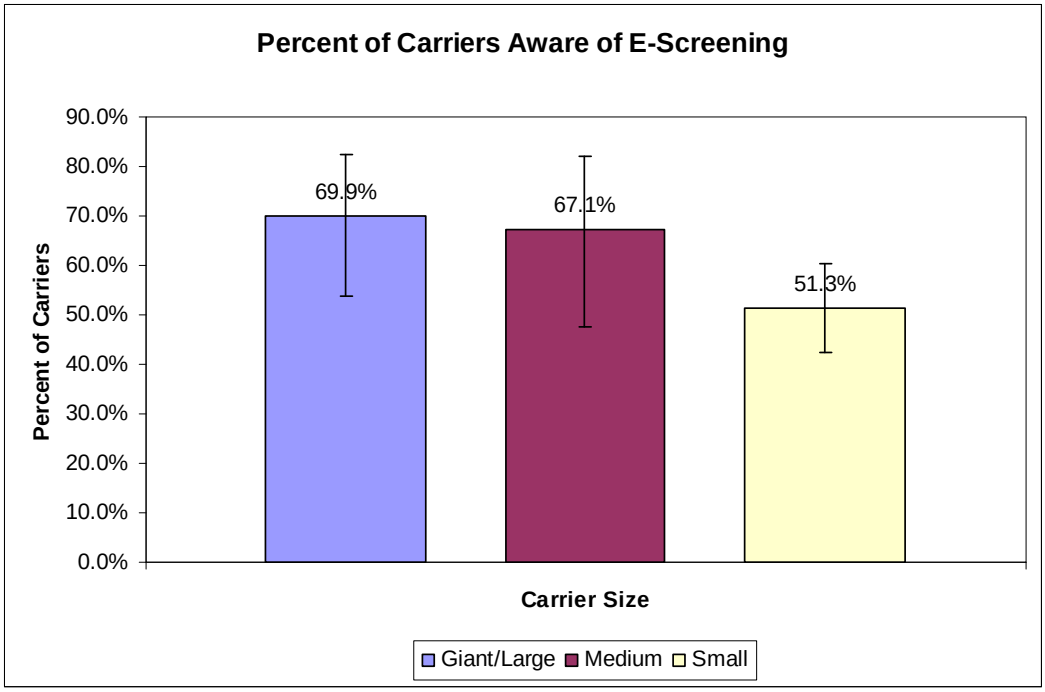
Roughly 42% of giant/large carriers and 38% of medium carriers experience average waiting times per truck exceeding 30 minutes per week as compared to the 16% of small carriers. Overall 6% of carriers had average weekly wait times per truck of over one hour. Again, a higher percentage of giant/large and medium carriers had wait times over one hour, about 18% of giant/large carriers and 20% of medium carriers.

Survey respondents were told that

> "Some states are using a method of roadside screening that is sometimes called ES or electronic clearance. This is where an electronic transponder on board the vehicle allows a computer program or enforcement officials to detect, identify, and weigh vehicles as they travel along the road at highway speeds. Vehicles operated by carriers with good safety records could be given a green light in the cab to bypass static weight and inspection stations if electronic records and vehicle weights for that carrier are in order."

Over half (54%) of carriers said that have heard about e-screening. Awareness increased with the size of the carrier. Figure A-11 shows the breakdown of e-screening awareness by carrier size.

About 70% of giant/large carriers and 67% of medium carriers are aware of e-screening. A lower percentage of small carriers, 51%, are aware of e-screening. There is a statistically significant difference in e-screening awareness between giant/large and small carriers.

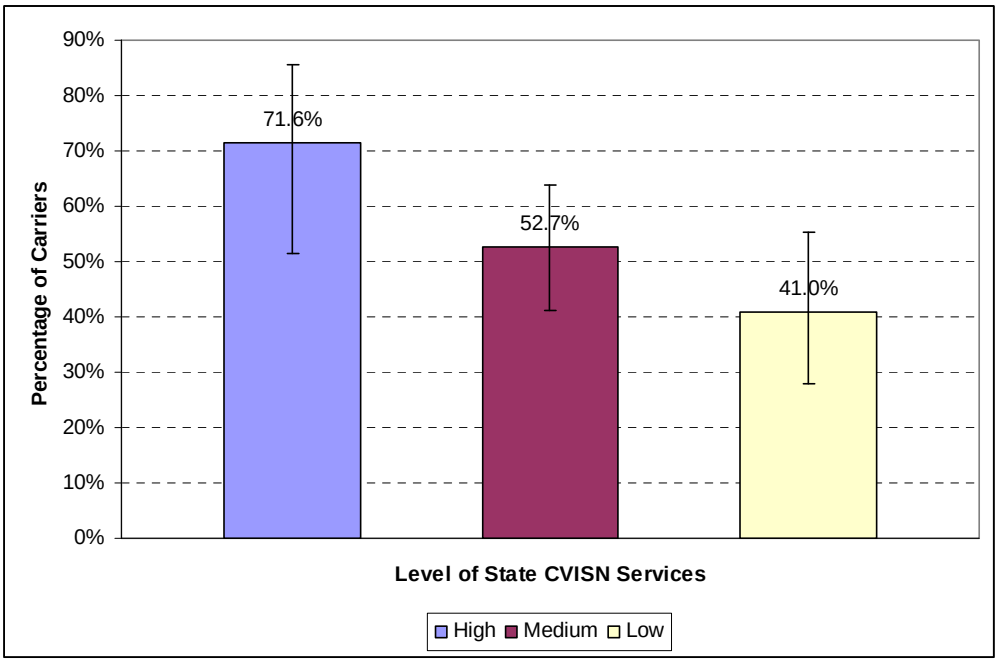


Source: Survey Question 5.1

Figure A-11. Percentage of All Motor Carriers Aware of E-Screening by Carrier Size

E-Screening awareness also varied by the level of state CVISN services offered by the carrier's base state. Figure A-12 shows the distribution of e-screening awareness by level of state CVISN services.

About 72% of carriers in the "high level" states have heard of e-screening as compared to 41% for the "low level" states. From an e-screening perspective, high level states are defined by the number of inspection stations using e-screening within the state, so this result is not unexpected. Carriers operating in states without a large number of e-screening options are less likely to have heard of the technology.

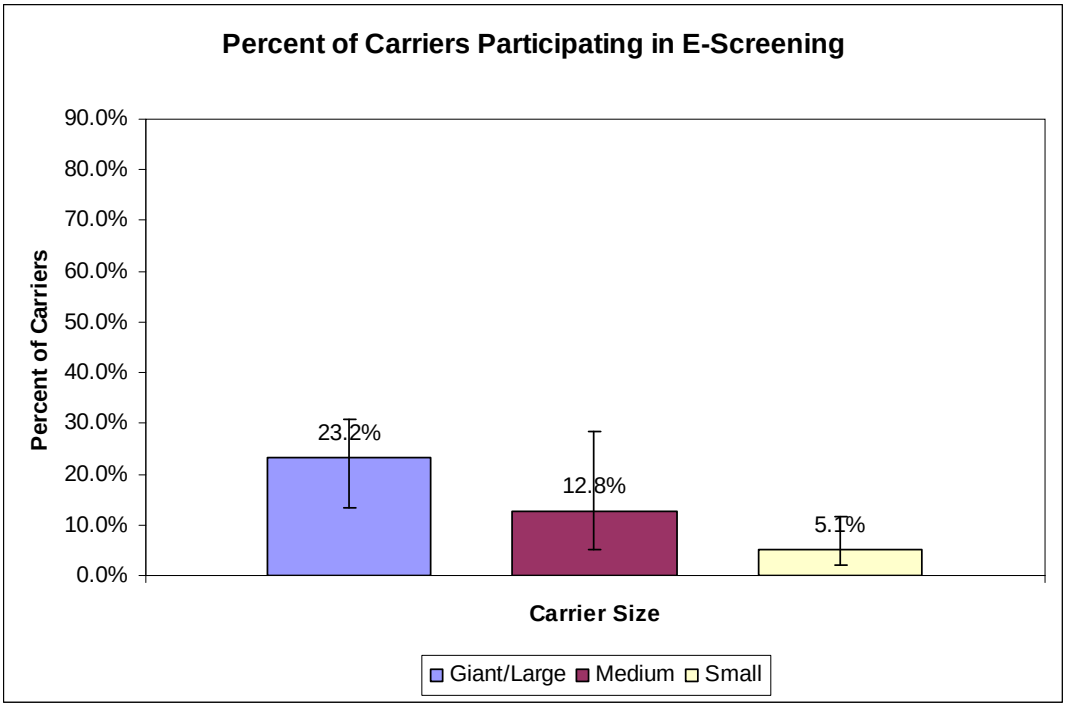


Source: Survey Question 5.1

Figure A-12. Percentage of All Motor Carriers Aware of E-Screening by Level of State CVISN Services

4.3.2 Motor Carrier Participation in E-Screening

Overall, only 6.3% of motor carriers are currently using e-screening or have used it in the past 12 months. As was discovered in regard to a company's awareness of e-screening, e-screening participation increased with the size of the carrier. As illustrated in Figure A-13, about 23% of giant/large carriers participate in e-screening compared to a participation rate of roughly 13% for medium carriers and 5% for small carriers. The difference between giant/large and small carriers is statistically significant.



Source: Survey Question 5.2

Figure A-13. Percentage of All Motor Carriers Participating in E-Screening

The results of Figure A-13 are consistent with the findings concerning average wait times presented in Figure A-10. Fewer small carriers are participating because there is less of a time-savings benefit with about 85% of small carriers spending under 30 minutes per week on average waiting at inspection stations. The same argument can be made for medium carriers relative to giant/large carriers.

There are three major organizations or partnerships offering ES currently: HELP (Heavy Vehicle Electronic License Plate) PrePass, Norpass (North American Preclearance and Safety System), and Oregon's Green Light. Table A-16 shows the percentage of carriers using e-screening that are participating in the three programs. Carriers can enroll in more than one program.

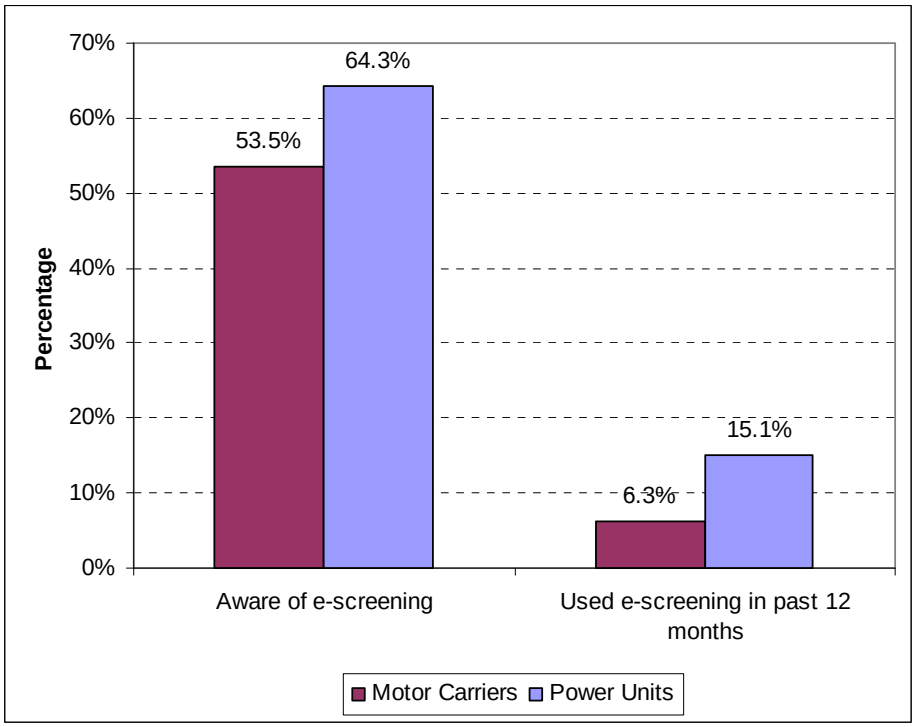
Table A-16. Percent of E-Screening Carriers Participating in Various Screening Programs

Program	Percent of E-Screening Carriers Participating
HELP/PrePass	88.8%
Norpass	12.1%
Oregon Green Light	9.8%

Source: Survey Question 6.1

Most e-screening carriers (89%) participate in PrePass, which is operational at 269 sites across 27 states as of January, 2007. Norpass, operational in five states, and Oregon's Green Light program have significantly less participation among e-screening carriers.

The results presented thus far in this section have focused on the awareness of and participation in e-screening from a motor carrier perspective. The number of trucks or power units that a motor carrier operates is defined by the size of the carrier. Furthermore, as presented in this section, e-screening awareness and participation increase with the size of the carrier. Thus, it makes sense to view e-screening awareness and participation from a truck perspective as well. Figure A-14 displays the percentage of trucks operated by carriers aware of and participating in e-screening. The awareness and participation percentages for motor carriers are provided again as a reference. The number of power units operated by a motor carrier was used in counting the number of trucks operated by a motor carrier. Here, power units and trucks are used synonymously.



Source: Survey Question 5.1, 5.2

Figure A-14. Percentage of All Motor Carriers (and representative power units) Aware of and Participating in E-Screening

The carriers aware of e-screening represent roughly 64% of all trucks in the population. About 15% of all trucks are operated by carriers who used e-screening within the past 12 months.

To estimate the number of trucks in the population for each category, the power unit count for each carrier was multiplied by the analysis weight assigned to the motor carrier. This number was then divided by the total number of power units in the sample frame to obtain a percentage. This methodology assumes that every power unit belonging to a carrier behaves the same in terms of e-screening. In other words, an e-screening participating carrier is assumed to enroll all of their power units in one of the e-screening programs as opposed to having some that are

enrolled and some that are not. For some carriers, this assumption may not be valid. As a result, the estimated 15% of trucks participating in e-screening may serve more as an upper bound depending on the validity of this assumption.

ES deployment rates among motor carriers have been slower than those of e-credentialing. Even though awareness rates are very comparable for e-credentialing and e-screening (about 65% of all power units represented in the current survey), the participation rates are very different. Despite similar awareness among carriers, the institutional, business, procedural, or other barriers to adoption appear to be greater for e-screening than e-credentialing.

4.3.3 Factors Influencing Carriers' Participation in E-Screening

A variety of factors may play a role in a carrier's decision to use or not use e-screening. To help understand those factors that most influence a carrier's decision, carriers were asked to rate on a 10-point scale from 1 ("Not Important at All") to 10 ("Highest Importance") how important they found various factors when making their participation decision. Both participating and nonparticipating carriers in e-screening were asked this question. The results for e-screening participating carriers are shown in Table A-17. Cells with an '*' represent means that are significantly greater than 5. A score significantly greater than 5 indicates a strong level of importance for the factor. These tests were collectively performed with an overall confidence level of 80% across the 36 tests. Thus, the test-specific confidence level is about 99.4%. The importance factors with the highest three mean scores are shaded in each column.

Table A-17. Mean Importance Score (with Standard Error) For E-Screening Carrier Participation Factors (1=Low; 10=High) (E-Screening Participants Only)

	Mean Importance Score (with Standard Error)			
Importance Factor in Deciding to Participate in E-Screening	**All E-Screening Carriers**	**Giant/Large**	**Medium**	**Small**
Availability of E-screening in states you drive	7.95 (0.84)*	7.79 (0.43) *	9.15 (0.46) *	7.54 (1.16)
Potential labor cost saving	7.46 (0.73)*	7.48 (0.49) *	8.10 (0.35) *	7.23 (1.04)
Convenience or efficiency	8.23 (0.96)*	8.59 (0.29) *	9.29 (0.39) *	7.83 (1.33)
Potential for reduced delays or turnaround time for shipments	8.43 (0.50)*	8.28 (0.43) *	8.26 (0.28) *	8.49 (0.71) *
Cost of participation	6.76 (1.03)	6.20 (0.55)	7.29 (0.46) *	6.59 (1.46)
Concerns about the privacy of your data	5.56 (1.19)	5.02 (0.48)	4.61 (0.90)	5.93 (1.58)
Management opposition at your company	2.60 (0.97)	3.09 (0.48)	1.92 (0.56)	2.81 (1.30)
Management support at your company	7.59 (1.25)*	8.15 (0.46) *	8.97 (0.59) *	7.07 (1.74)
Potential for improved working conditions for drivers	6.11 (0.98)	8.08 (0.42) *	7.84 (0.45) *	5.39 (1.29)

Source: Survey Question 6.2

* Importance factor mean score was statistically significantly greater than 5 with an overall confidence level of 80% across the 36 tests. The test-specific confidence level was therefore about 99.4%.

The most important factors that play a role in carriers' decisions to participate in e-screening are the potential for reduced delays or turnaround time for shipments, the convenience or efficiency provided by e-screening, and the ability of e-screening in states where the carrier operates. Management support for e-screening was also a key factor for giant/large and medium carriers. The management structure at small carriers is fundamentally different than larger carriers since most small carriers only have a few employees or are owner/operators. Thus, it stands to reason that management support is also crucial to a small carrier participating. A potential savings in labor cost and the cost of participation in e-screening were also highly influential factors in the decision making process. Although Table A-17 identifies the top three factors for each size class through the shading of cells, there is no statistical difference between any of the significant importance factors. Concerns about privacy of company data were not as important for participants; their mean importance scores were not significantly above 5 overall or for any of the carrier size categories.

The table also illustrates how the expressed importance score varied between the levels of carrier size. For factors found to be significantly above 5, pairwise comparisons were made across carrier size levels to determine if any differences were statistically significant. For each concern

factor, the three pairwise tests were collectively performed with an overall confidence level of 95%. There were no statistical differences between the importance factor scores between levels of carrier size. However, one comparison was close to being significant. The score for availability of e-screening in states where carriers operate was higher (although not statistically) for medium carriers than giant/large carriers. Giant/large carriers tend to have a larger range of geographic travel than medium carriers and thus there is a higher probability that e-screening exists in a portion of the larger carriers' travels. Medium carriers, on the other hand, may only travel in a few states so the availability of e-screening in those states is more important to them in deciding to adopt e-screening.

It is also important to understand the reasons carriers choose not to participate in e-screening. Motor carriers not participating in e-screening were presented the same participation factors as e-screening participants and were asked what factors they found most important in deciding not to participate. In this analysis, the percentage of carriers that rated an importance factor greater than 5 was calculated for each importance factor. A rating higher than 5 represents a strong degree of importance for that factor in deciding not to participate. Table A-18 shows some importance factors and the percentage of carriers who rated them higher than 5.

Table A-18. Factors Influencing Carriers not to Participate in E-Screening

	Percent of Non E-Screening Carriers Who Rated Factor > 5			
Importance Factor	**Overall**	**Giant/Large**	**Medium**	**Small**
Cost of participation	58.8%	49.6	79.8	52.7
Concerns about privacy of carrier data	45.0%	34.3	52.4	42.9
Management opposition	30.9%	24.3	69.0	19.3
Availability of e-screening in states carrier drives	27.9%	39.5	36.1	25.1

Source: Survey Question 6.2

Roughly 59% of nonparticipating carriers cited cost of participation as a significant factor affecting their decision not to participate. A larger percentage of medium nonparticipating carriers (almost 80%) cited cost as a significant factor. Concerns about privacy of carrier data was mentioned by about 45% of nonparticipating carriers. Management opposition and availability of e-screening in states where the carrier operates were mentioned by about 30% of nonparticipating carriers. Management opposition was rated higher by more medium sized carriers.

Carrier Concerns about Participating in E-Screening

ES systems use historical safety, credential, and other data from a carrier to determine whether a specific transpondered truck from that carrier can bypass a weigh and inspection station. To understand carriers' concerns with the use of data about their company, vehicles, and/or drivers in making real-time e-screening decisions at the roadside, carriers currently participating in e-screening were asked to rate on a 10-point scale from 1 ("No Concern") to 10 ("Highest Concern") how concerned they were with five different factors related to e-screening. Table A-19 shows the mean score and standard error expressed overall and by each carrier size level for each of the five factors. Cells with an '*' represent means that are significantly greater than 5. A score significantly greater than 5 indicates a strong level of concern for the factor. These tests

were collectively performed with an overall confidence level of 90%. The test-specific confidence level was therefore about 99.5%.

Table A-19. Mean Score (with Standard Error) For E-Screening Carrier Concerns (1=Low; 10=High) (E-Screening Participants Only)

	Mean Score (with Standard Error)			
E-Screening Concern Factor	**All E-Screening Carriers**	**Giant/Large**	**Medium**	**Small**
Accuracy of data in safety or credentialing databases	6.59 (1.02)	6.93 (0.52) *	7.60 (0.44) *	6.17 (1.46)
Timeliness or freshness of data	6.36 (1.03)	7.03 (0.49) *	5.70 (0.56)	6.57 (1.47)
Misuse of company-private data by competitors	5.17 (1.42)	5.40 (0.68)	3.89 (1.37)	5.62 (1.89)
Misuse of company-private data by government agencies	5.23 (1.42)	4.75 (0.66)	4.65 (1.72)	5.46 (1.89)
Over-regulation	6.01 (1.34)	4.67 (0.46)	5.31 (1.99)	6.33 (1.70)

Source: Survey Question 6.4

* Concern factor mean score was statistically significantly greater than 5 with an overall confidence level of 90% across the 20 tests. The test-specific confidence level was therefore about 99.5%.

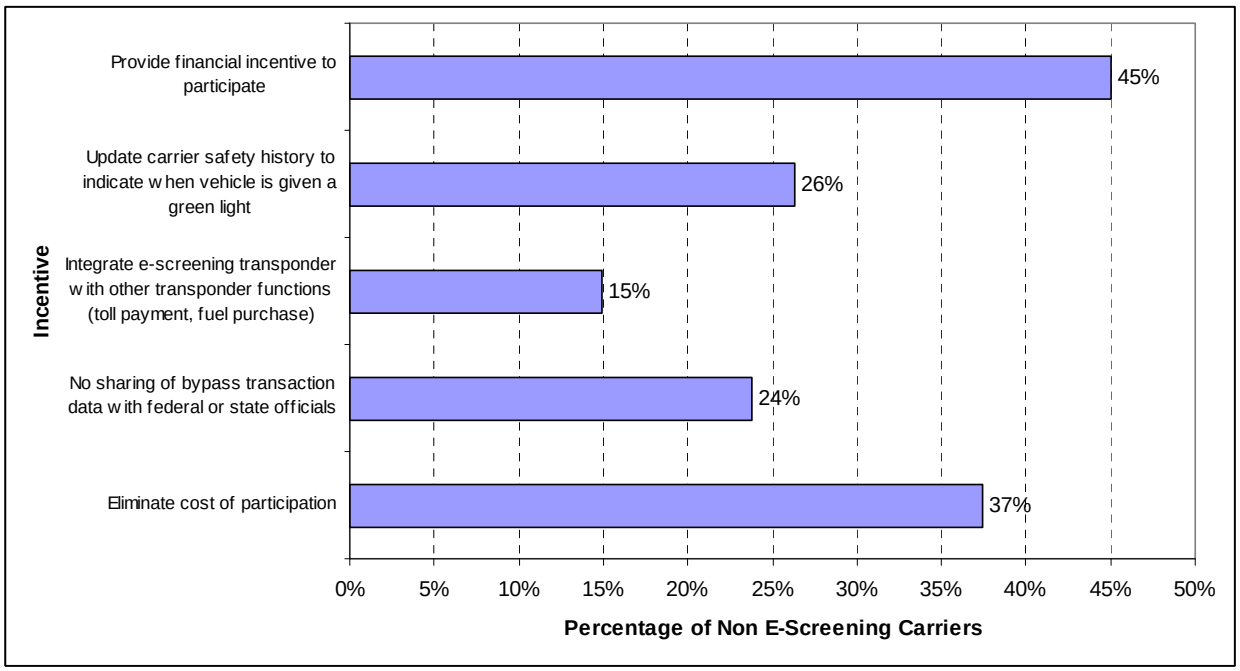
For the full set of carriers participating in e-screening, timeliness of data as well as accuracy of data in safety and credentialing databases draw the most concern from motor carrier companies. The mean scores for all five factors are above 5 on the 10-point scale; however none of them are statistically larger than 5 indicating that they may not represent large areas of concern for carriers who have already made the commitment to e-screening. What is interesting but unknown is whether the lack of concern shown by the participating carriers for these factors is due to their positive experience with e-screening or that they were never concerned with these factors to begin with. The lowest rated factors overall were misuse of company data by competitors and government agencies although there were no differences in mean scores for any of the factors when looking at all e-screening carriers.

The table also illustrates how the expressed concern scores varied by carrier size. Within carrier size, concern factors scores were first analyzed to determine if any mean scores were significantly larger than 5. Then, pairwise comparisons were made across carrier size levels for each factor to determine if any differences were statistically significant. For each concern factor, the overall confidence level for the three comparisons was 95%.

Mean scores for accuracy of data were significantly larger than 5 for both giant/large and medium size carriers while the mean score for timeliness of data also was significant for giant/large carriers. Based on mean scores, giant/large carriers appeared to be slightly more concerned with the timeliness of the data and less concerned with government over-regulation. However, there were no statistically significant differences in mean scores for any of the factors across carrier size.

Barriers to E-Screening Participation

Carriers not currently participating in e-screening were asked what steps e-screening programs or partnerships could take in the future to encourage them to participate. Figure A-15 illustrates the results. Carriers were allowed to select more than one incentive.



Source: Survey Question 7.1

Figure A-15. Percent of Nonparticipating E-Screening Carriers That Would Consider Participation Given Certain Incentives

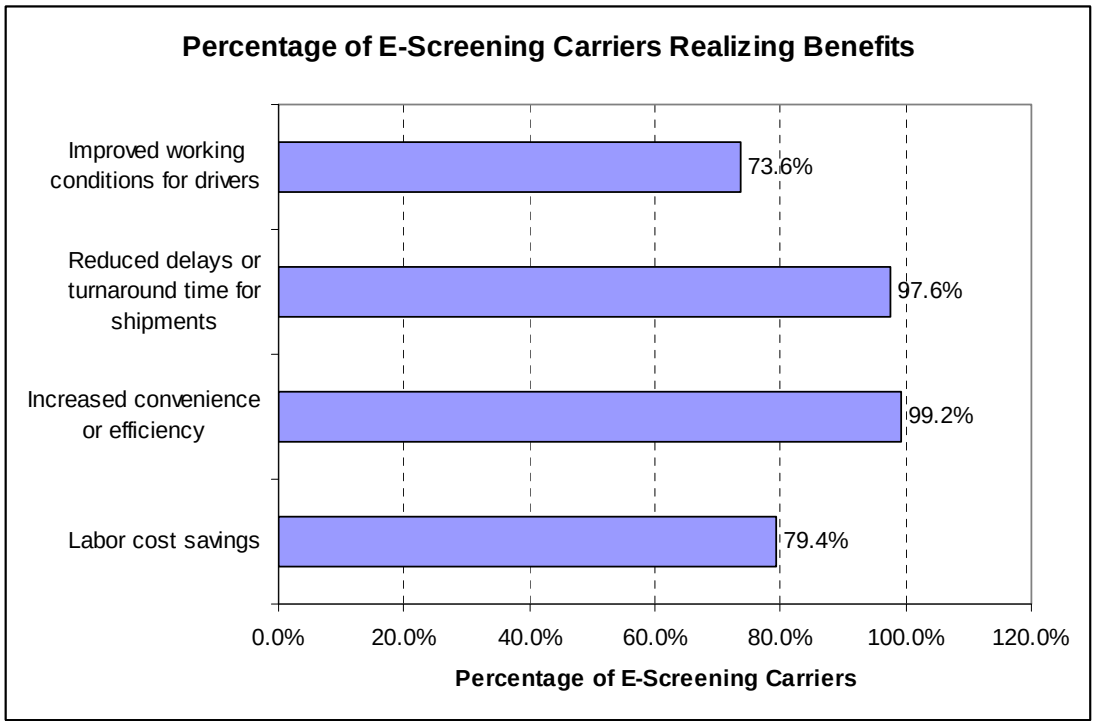
When considering e-screening, business and cost factors were commonly cited as important barriers. The two incentives that produced the largest carrier response were related to finances. About 45% of nonparticipating carriers responded that they would consider participation in e-screening if there was some sort of financial incentive for them while 37% indicated that eliminating the cost of participation would increase their chances of signing up for e-screening. This focus on cost may be because the monthly fee charged to carriers for participating in some screening programs is perceived as certain, immediate, and tangible, while the benefits (shipping time savings, labor savings, fewer stops and starts, etc.) are more diffuse and accrue only over time.

About one quarter of nonparticipating carriers wanted to see their carrier safety history updated when the vehicle is allowed to bypass the station. A few carriers commented that their ISS and other safety scores only change when they get an inspection and a violation is found. Also, 24% of nonparticipating carriers would consider e-screening more if bypass transaction data were not shared with federal or state officials. This may be because of concerns that competitive intelligence about a company's operations could be misappropriated. There was not a

statistically significant difference in the results across carrier size or level of state CVISN services.

4.3.4 Motor Carrier Benefits from E-Screening

Motor carriers may achieve a variety of benefits through participation in e-screening. Given a list of potential benefits, carriers were asked to indicate which benefits they have realized through participation in e-screening. Figure A-16 illustrates the percent of e-screening carriers achieving various benefits.



Source: Survey Question 6.3

Figure A-16. Percentage of E-Screening Carriers Realizing Benefits

Over 99% of participating carriers experienced more convenience and efficiency by participating in e-screening. Almost 98% experienced a reduction in shipping or turnaround time delays. These results provide more insight into why more small carriers are not enrolling in an e-screening program. Given the low amount of time small carriers are spending at inspection stations, benefits such as convenience or time savings may not be worth the effort involved, especially if there is a financial cost to participate.

A very high percentage of participating carriers, over three quarters, also experienced improved working conditions for drivers and a decrease in labor costs. Participating carriers were asked if there were any other benefits they realized. The most common responses were increased safety of their drivers and savings on fuel costs.

As with e-credentialing, the benefits actually achieved by motor carriers who participate in e-screening track fairly closely with the reasons those carriers give for deciding to participate originally. This seems to imply that e-screening has led to few surprises for carriers who chose to take part although additional research would need to be conducted to validate this idea as carrier responses for reasons to participate are likely to have been influenced by actual benefits achieved.

Participating motor carriers were then asked to comment on the importance of e-screening benefits. Using a scale that ranges from 1 to 10 where 1 means the benefit was not important at all and 10 means the highest importance, carriers were asked to rate the importance of each benefit their company has realized through participation in e-screening. Table A-20 shows the mean importance score and standard error expressed overall and by each carrier size level for each of the four major benefits. Cells with an '*' represent mean importance scores that are significantly greater than 5. A score significantly greater than 5 indicates a strong level of importance for the benefit. These tests were collectively done with an overall confidence level of 90% across the 16 tests.

Table A-20. Mean Importance Score (with Standard Error) for E-Screening Benefits (1=Low; 10=High) (E-Screening Participants Only)

	Mean Importance Score (with Standard Error)			
Benefit	**All E-Screening Carriers**	**Giant/Large**	**Medium**	**Small**
Labor cost savings	9.43 (0.20) *	8.16 (0.63) *	9.32 (0.38) *	9.54 (0.27) *
Increased convenience or efficiency	8.25 (0.98) *	8.13 (0.49) *	9.03 (0.56) *	7.98 (1.35)
Reduced delays or turnaround time for shipments	8.34 (1.00) *	8.93 (0.27) *	9.29 (0.36) *	7.98 (1.37)
Improved working conditions for drivers	9.54 (0.19) *	9.21 (0.23) *	9.44 (0.32) *	9.64 (0.24) *

Source: Survey Question 6.3a

* Importance factor mean score was statistically significantly greater than 5 with an overall confidence level of 90% across the 16 tests. The test-specific confidence level was therefore about 99.4%.

The results indicate that each of these benefits have been extremely important to motor carriers. The mean importance scores for all benefits were significantly above 5 both overall and within giant/large and medium carriers.. Carriers that experienced improved driver working conditions had an average rating of 9.54 while labor cost savings generated a mean score of 9.43 on the importance scale. Smaller carriers had lower mean scores than other carrier sizes for benefits involving increased convenience or efficiency and a reduction in shipment delays or turnaround time but have larger mean scores for labor cost savings and improved working conditions for drivers. However, any differences between levels of carrier size were not statistically significant for any of the benefits.

Although participation rates in transponder-based ES remain relatively low, those carriers that do enroll their trucks report extremely positive attitudes toward the benefits that their companies receive from e-screening. Reported reductions in shipping time and increases in convenience and efficiency (cited by nearly 100% of carriers who are active in e-screening) as well as the importance placed on these benefits by carriers could be used by FMCSA, state, and carrier industry representatives in working to develop the market for e-screening technologies.

5.0 Comparing National Evaluation Survey Results to MDI Survey

One previous study that collected and disseminated motor carrier opinions and attitudes toward CVISN deployment was the independent evaluation of the CVISN MDI, the results of which were published by USDOT in 2002. The purpose of the MDI, which began in 1996, was to demonstrate the technical and institutional feasibility, costs, and benefits (cost savings and other benefits) of CVISN user services and to encourage their further deployment. Initial participants included two prototype states and eight pilot states. Surveys and interviews of motor carrier companies were conducted as part of the MDI evaluation; however, due to the limited scope of CVISN deployment during these early years, most of the survey results focused on motor carrier awareness of services and expectations of benefits.

The MDI survey involved a questionnaire distributed by mail to a sample of motor carriers stratified by carrier size and state. The survey was conducted from July to December in 2000 and yielded 158 motor carrier participants. Specific details pertaining to the design and methodology or the MDI Survey are found in the MDI Evaluation Report (USDOT 2002).

Under the current CVISN Deployment Program, in which more states have adopted CVISN initiatives, a large number of motor carriers have been exposed to the concepts of EC and screening. This allowed the National Evaluation survey to better identify and gauge the factors affecting motor carriers' decisions to adopt CVISN technologies, such as transponder-based ES and EC.

Since the MDI Motor Carrier Survey was designed to provide baseline information concerning the relevant behaviors, awareness, and attitudes of motor carriers, it makes sense to compare its results with that of the current National Evaluation survey. There are some similarities in the objectives and the data collected in the two surveys, making some comparisons feasible. This section presents a few comparisons between the two surveys.

5.1 Electronic Credentialing

In late 2000, the general awareness throughout the trucking industry of CVISN-type initiatives was very low. About 4% of carriers were aware of EC methods and less than one half of one percent of carriers had any experience using EC. The National Evaluation motor carrier survey estimates that a little over one third of motor carriers (35%) are aware of the ability to obtain and pay for credentials electronically. Furthermore, 13% of all motor carriers participated in e-credentialing within the past 12 months in one or more states.

This significant increase in both awareness and participation is due mainly to the growth and expansion of e-credentialing. States have made significant progress in the past five years in the automated processing of credentials, mainly focusing on IRP and IFTA. According to figures compiled by the Johns Hopkins University Applied Physics Laboratory for FMCSA, as of January 2007, 28 states support EC for IRP while IFTA is supported by 26 states. All these states support the electronic submission of applications, evaluation processing, and application response. In addition, all but a few of these IRP and IFTA supporting states proactively provide updates to vehicle snapshots as needed when IRP and IFTA credentials actions are taken.

The IRP and IFTA clearinghouses were developed to facilitate distribution of registration funds and tax revenues among states and provinces have also seen an increase in state participation in recent years. As of August 2006, 39 states are providing IRP credential application information to the IRP clearinghouse and supporting electronic state-to-state fee payments via the clearinghouse. For IFTA, 35 states are providing the IFTA clearinghouse with IFTA credential application information using electronic data interface standards.

Expanded CVISN activities in the area of EC have focused on providing more user-friendly and efficient e-credentialing systems that further facilitate the obtaining, processing, and obtaining of credentials by motor carriers. Emphasis has also been placed on expanding the list of credentials that can be obtained online as well as making available credential information to other users.

Given the lack of general awareness of e-credentialing in 2000, it is not possible to compare motor carrier attitudes and opinions between the two surveys to any large extent. However, in the MDI Survey, carriers were asked to express a likelihood, on a scale from 0 to 10, that the carrier would opt to use e-credentialing if it were made available to them in one of the states with which there were registered. Of the carriers responding, 30% expressed some positive likelihood of doing so, as indicated by a score of six or greater. Given an open-ended invitation to explain their likelihood responses, respondents giving scores of six or higher most commonly mentioned better tracking of their "paperwork," saving time, or saving money. The most popular reasons for lower scores were limited computer equipment or expertise and fear of tracking problems.

Examining the National Evaluation results finds some common themes present in 2007. In asking carriers to rate the importance of various factors when making their decision to sign up for e-credentialing, participants mentioned the ability to get trucks into service more quickly, the convenience of obtaining credentials, and the potential staff time savings as the main reasons for participating. Carriers who chose not to participate mentioned a concern about the privacy and security of their company data, lack of technology at the company, and the time required to learn the new system.

5.2 Electronic Screening

In late 2000, about two out of three carriers said that they had not previously heard about the ability to perform mainline screening through the use of an electronic transponder. Only 7% of carriers claimed to be using ES. The remaining carriers (27%) had heard of e-screening, but three quarters of them did not expect to be using it within the next two years.

The National Evaluation motor carrier survey estimates that 54% of motor carriers have heard of e-screening, an increase over the 33% in late 2000. Despite this increased awareness, e-screening participation among all motor carriers in the nation stayed relatively constant at 6.3% of total carriers. However, it is important to keep in mind two things when considering e-screening participation. First, the participation rate is now much higher among giant/large carriers (23%) where the majority of power units reside as well as medium carriers (13%). The percentage of power units currently participating in e-screening is around 15%, as compared to about 3% as reported in the MDI evaluation. Secondly, with a sample size of only 158 completed questionnaires for the MDI survey, the standard error around the 7% estimate is fairly large.

The increase in both awareness and participation is due to the continued emergence and growth of three programs: HELP (Heavy Vehicle Electronic License Plate) PrePass, Norpass (North American Preclearance and Safety System) and Oregon's Green Light. As of January 2007, 70% of the states are participating in such ES programs. This is up from about 50% in 2002. Total truck enrollment in the three programs has grown by 167% since 2001.

Common themes emerged between the two surveys when looking at factors that influence whether or not carriers decide to participate in e-screening. The MDI survey reported that the most frequent reason mentioned by carriers in deciding to participate was the potential time savings (mentioned by 43% of carriers who had heard of e-screening) while various concerns about data privacy (24% of carriers) and costs of participation (24% of carriers) were the two main reasons carriers were not participating.

The National Evaluation survey reported the most influential factors for carriers participating in e-screening were the potential for reduced delays or turnaround time for shipments, convenience and efficiency, and the availability of e-screening in the states driven by carriers. Costs of participation (59%) and concerns about data privacy (45%) were mentioned most frequently by carriers as reasons for choosing not to participate.

6.0 Implications of Findings and Directions for Future Research

The purpose of the motor carrier survey was to identify and gauge the factors affecting motor carriers' decisions to adopt CVISN technologies, such as transponder-based ES and EC. The survey also determined the market barriers to further deployment among motor carriers. Section 6.1 captures the main conclusions from the survey as well as the implications of the findings. Section 6.2 provides some recommendations for potential research and next steps.

6.1 Conclusions and Implications of Findings

The following summarizes some conclusions from the survey results:

- **Motor Carrier Awareness of CVISN Technologies:** Electronic credentialing is a success story, being used by nearly 13% of motor carriers (representing nearly half of the

ES deployment rates among motor carriers (i.e., enrolling trucks and obtaining in-cab transponders) have been slower. Even though awareness rates are very comparable for e-credentialing and e-screening (about 65% of all power units represented in the current survey), the participation rates are very different. Among the population responding to the survey, approximately 46% of power units are operated by carriers participating in e-credentialing, whereas only about 15% of power units are operated by carriers participating in e-screening. Despite similar awareness among carriers, the institutional, business, procedural, or other barriers to adoption appear to be greater for e-screening than e-credentialing.

- **Motor Carrier Recognition of Potential Benefits:** A large percentage of motor carriers participating in e-credentialing and e-screening have reported achieving a variety of benefits through the use CVISN technologies. The most popular e-credentialing benefits included increased convenience in obtaining credentials, savings in staff time, and the ability to get trucks into service quicker. For e-screening, carriers experienced more convenience and efficiency, a reduction in shipping or turnaround time delays, improved working conditions for drivers, and a decrease in labor costs. The benefits actually achieved by motor carriers who are doing their credentialing electronically track fairly closely with the reasons those carriers give for deciding to participate originally. This seems to imply that e-credentialing has led to few surprises for carriers who chose to take part although additional research would need to be conducted to validate this idea as carrier responses for reasons to participate are likely to have been influenced by actual benefits achieved. The same holds true for e-screening benefits.

  Although participation rates in transponder-based ES remain relatively low, those carriers that do enroll their trucks report extremely positive attitudes toward the benefits that their companies receive from e-screening. Reported reductions in shipping time and increases in convenience and efficiency (cited by nearly 100% of carriers who are active in e-screening) should be highly visible "talking points" for FMCSA, state, and carrier industry representatives who work to develop the market for e-screening technologies.

- **Factors Motor Carriers Use in Deciding to Participate in CVISN Deployment:** For e-credentialing participants, the three factors of greatest importance when the companies were considering participating were convenience of obtaining credentials, potential staff time savings, and getting trucks into service more quickly. There was also a significant level of importance placed on the increased accuracy of registration information and potential dollar cost savings. Less importance was placed on concerns about cost of using e-credentialing and the size of the company. Roughly three quarters of nonparticipating carriers cited concern about privacy/security of company data as a significant factor affecting their decision not to participate. Lack of technology and staff resources were

The most important factors that play a role in carriers' decisions to participate in e-screening are the potential for reduced delays or turnaround time for shipments, the convenience or efficiency provided by e-screening, and the availability of e-screening in states where the carrier operates.

When considering e-screening, business and cost factors were commonly cited as important barriers to nonparticipants. This may be because the monthly fee charged to carriers for participating in some screening programs is perceived as certain, immediate, and tangible, while the benefits (shipping time savings, labor savings, fewer stops and starts, etc.) are more diffuse and accrue only over time. Efforts to subsidize carrier participation in e-screening might result in greater coverage, as would efforts to extend interoperable e-screening to all jurisdictions. Another carrier concern, although of less importance, was privacy of carrier data. One interesting fact was that data privacy and security were relatively greater concerns for carriers considering e-credentialing (73.9%) than e-screening (45%).

- **Acceptance of CVISN Technologies Among Motor Carriers:** A large percentage of motor carriers who participated in either e-credentialing or e-screening reported achieving benefits from the new technologies. More importantly, carriers rated the importance of these benefits extremely high in their day-to-day business.

  Although data quality and timeliness have been persistent concerns since the CVISN deployment began, the perceived increase in data accuracy afforded by e-credentialing was one of the top-rated benefits named by motor carriers. Accuracy, at 75%, was the fourth-ranked behind convenience, staff time savings, and getting trucks into service more quickly.

- **Comparison of Motor Carrier Attitudes and Opinions Across Carrier Size and Participation Status:** Efforts to increase awareness of e-credentialing have evidently been most successful among the largest carriers, which are much more likely to be aware of the service than small carriers. Similarly, larger carriers are more likely to be aware of e-screening than smaller carriers. The conventional wisdom has been that CVISN and related ITS deployments are more appealing to larger carriers than to smaller carriers and owner-operators. The current survey bears this out.

  Although awareness amongst all carrier sizes has risen over the last six years as a result of increased deployment, there is room for increased awareness of both technologies within the industry.

6.2 Potential Research and Next Steps

1. This CVISN Deployment Motor Carrier Survey was designed to survey a nationally representative sample of motor carriers and collect information on a broad range of topics relating to motor carrier attitudes and opinions towards CVISN technologies. Results from this survey need to be combined with additional information related to the motor carrier industry and CVISN technologies to provide a broader view of the success of CVISN deployment to date. There are two immediate research initiatives to help with this goal. First, results from this survey will be combined with the other facets of the evaluation of the National CVISN deployment program. These include a safety analysis, cost analysis, and a benefit-cost analysis. The final report of the entire evaluation is scheduled to be completed in the fall of 2008.

   Secondly, information developed in a separate, concurrent FMCSA/FHWA task order, "Economic Analysis and Business Case for Motor Carrier Industry Support of CVISN Deployment," will be used to augment data collected in the CVISN National Deployment Evaluation motor carrier survey task. The CVISN Motor Carrier Business Case is expected to result in a body of evidence, business context, and justifications—presented from the motor carrier company's perspective and intended to help companies decide whether to invest the time, resources, and attention required for their companies to participate in CVISN in both the short and long terms. Data were collected through interviews with more than 30 motor carrier companies. Compared to the National Evaluation survey, the data from the Business Case are focused more quantitatively on the economic facets of motor carriers' attitudes and opinions toward CVISN technologies. As such, results from the Business Case will provide insight into results obtained through the National motor carrier survey, and vice-versa. Data collection is complete for the Business Case, with the final report due in the fall of 2007.

2. FMCSA (or the state or private-sector screening programs or partnerships themselves) might consider some kind of trial period start-up incentive or cost reimbursement to encourage carriers to try e-screening, after which the carrier could enroll and, depending on the program, begin to pay the periodic charges for participation. This would enable more small and medium-sized carriers, with more limited resources, to evaluate the benefits of e-screening for their operation at a lower perceived risk.

3. To try to expand CVISN deployment, FMCSA and the motor carrier industry can publicize the measurable benefits that the largest carriers are seeing, and translate these benefits into the terms and scale of operation that smaller carriers will recognize. Another approach would be to modify the deployment program to remove or reduce the barriers that medium- and small-size motor carriers perceive. One example would be to increase the ease of use for centralized computer interfaces, so that smaller carriers—who might not have in-house information technology or programming staff—can more readily assign general administrative staff to perform the carrier-side credentialing and screening functions.

APPENDIX A.1. MOTOR CARRIER SURVEY QUESTIONNAIRE

Commercial Vehicle Information Systems and Networks
National Deployment Evaluation
Motor Carrier Survey Questionnaire

1.0 Telephone Interview Information and Respondent Demographics (to be imported from client-provided data and/or gathered in preliminary scripts and kept confidential)

- Name of Interviewer (Q1INTVR)
- Date of Interview (Q1DATE)
- Time of Interview (Q1TIME)
- Name of Respondent (Q1RESP)
- Respondent Company (Q1CARR)
- Location of Respondent Company (city, state) (Q1CITY) (Q1ST)
- Job Title or Role of Respondent (Q1RESPJOB)
- Interviewer Notes or Comments (Q1COMM)

2.0 Characteristics of Company

2.1 Q21TYPE — First I would like to ask you a few questions about your company. Which of the following best describes your company? (Choose one)

For-hire truckload carrier 1
For-hire less-than-truckload carrier 2
For-hire owner-operator 3
Private carrier (not for hire) 4
REFUSED 8
DON'T KNOW 9

2.2 — Which of the following best describes your company's most common freight or payload? (Code all that apply)

		Yes	No
Q22GEN	General freight/van/platform	1	2
Q22TANK	Tanker	1	2
Q22REF	Refrigerated goods	1	2
Q22AUTO	Automobile transport	1	2
Q22BULK	Bulk commodities	1	2
Q22HH	Household goods	1	2

Q22OTHSPC	Other specialized freight	1	2
Q22RF	REFUSED	1	2
Q22DK	DON'T KNOW	1	2

2.3 Q23RNG Which of the following options best describes the furthest geographic range of your company's current operations? (Choose one)

Local only, within a radius of 50 miles 1
Within-state only 2
Regional or national 3
International 4
REFUSED 8
DON'T KNOW 9

2.4a Q24UOWN How many power units does your company currently operate that are company owned? ..... |__|__|__|__|__|

2.4b Q24PULSD How many power units do you currently operate that are leased? ..... |__|__|__|__|__|

3.0 Awareness of Electronic Credentialing

The next questions focus on electronic, or computer-to-computer, credentialing. Electronic credentialing allows motor carriers to apply for, pay for, and receive operating credentials, such as IRP and IFTA among others, from their base state remotely, using a computer-based interface. Carriers send their information to their state via computer for processing rather than manually filling out paper forms and mailing them to the state. These services are commonly referred to as e-credentialing.

3.1 Q31ECWHO — Who currently obtains the necessary credentials for your company, whether using an electronic or paper-based system? Is it company staff, a paid outside firm such as a service bureau or credentialing agent, or both?

Company Staff 1
Paid outside firm 2
Both 3
REFUSED 8
DON'T KNOW 9

3.2 Q32ECAWR — Have you ever heard of electronic credentialing?

Yes 1
No (SKIP TO Q51AWR) 2
REFUSED (SKIP TO Q51AWR) 8
DON'T KNOW (SKIP TO Q51AWR) 9

3.3 Q33ECAVL — Is e-credentialing currently available to your company?

Yes 1
No (SKIP TO Q51AWR) 2
REFUSED (SKIP TO Q51AWR) 8
DON'T KNOW (SKIP TO Q51AWR) 9

3.4 Q34ECUSE — Has your company used e-credentialing in the past 12 months in one or more states?

Yes 1
No 2
REFUSED (SKIP TO Q51AWR) 8
DON'T KNOW (SKIP TO Q51AWR) 9

3.5 [R'S WHO CURRENTLY USE E-CREDENTIALING, THAT IS, IF Q34ECUSE =1, ASK:] A variety of business factors may play a role in a company's decision to begin using e-credentialing. I'm going to list several factors, both positive and negative. Please think

back to your original decision to begin using e-credentialing and tell me on a scale of 1 to 10 how important each factor was in your decision, where 1 is not important at all and 10 is of the highest importance.

[R'S WHO HAVE E-CREDENTIALING AVAILABLE BUT DO NOT CURRENTLY USE, THAT IS, IF Q34ECUSE =2, ASK:] A variety of business factors may play a role in a company's decision not to use or to discontinue using, e-credentialing. I'm going to list several factors, both positive and negative. Please tell me on a scale of 1 to 10 how important each factor was in your decision not to use e-credentialing, where 1 is not important at all and 10 is of the highest importance.

IF Q34ECUSE =8 or 9 SKIP TO Q51AWR.

		Not important at all		Highest Importance	RF	DK
Q35SIZE	Size of your company	1	…	10	98	99
Q35COST	Cost of using e-credentialing	1	…	10	98	99
Q35DSAV	Potential dollar cost savings	1	…	10	98	99
Q35TSAV	Potential staff time savings	1	…	10	98	99
Q35CONV	Convenience	1	…	10	98	99
Q35ACC	Increased accuracy of registration information	1	…	10	98	99
Q35SPEED	Getting trucks into service more quickly	1	…	10	98	99
Q35LEARN	Time required to learn new system	1	…	10	98	99
Q35NOTEC	Existence or lack of technology, such as computer hardware or high-speed internet, at your company	1	…	10	98	99
Q35NOTRN	Existence or lack of trained, available staff to use the system	1	…	10	98	99
Q35PRIV	Concern about privacy and security of company data	1	…	10	98	99

3.5a Q35AOTR Are there any other factors that played an important role in your company's decision? If yes, please specify.

Yes 1
No (SKIP TO SECTION 4 SKIP INSTRUCTIONS) 2
DON'T KNOW (SKIP TO SECTION 4 SKIP INSTRUCTIONS) 8
REFUSED (SKIP TO SECTION 4 SKIP INSTRUCTIONS) 9

Q35ASPEC1 SPECIFY:_____

Q35ASPEC2 SPECIFY:_____

3.5b On a scale of 1 to 10, where 1 is not important at all and 10 is of the highest importance, how important was [OTHER FACTOR] in your decision?

		Not important at all		Highest Importance	RF	DK
	IF Q35ASPEC1 NOT EMPTY, RF, OR DK CONTINUE; ELSE SKIP TO SECTION 4 SKIP INSTRUCTIONS					
Q3BOTH1	Other reason #1	1	…	10	98	99
	IF Q35ASPEC2 NOT EMPTY, RF, OR DK CONTINUE; ELSE SKIP TO SECTION 4 SKIP INSTRUCTIONS					
Q3BOTH2	Other reason #2	1	…	10	98	99

4.0 Company's Participation in E-Credentialing

SECTION 4 SKIP INSTRUCTIONS:
IF Q34ECUSE=1 CONTINUE; ELSE SKIP TO Q51AWR

4.1 Next I would like to ask about your recent use of e-credentialing. Please tell me which of the following commercial vehicle credentials or permits your company has applied for and/or obtained electronically in the past 12 months. Has your company applied for or received the following permits electronically in the past 12 months?

		Yes	No	RF	DK
Q41IRP	International Registration Plan, or IRP?	1	2	8	9
Q41IFTA	International Fuel Tax Agreement, or IFTA?	1	2	8	9
Q41OS	Oversize/Overweight, or OS/OW permits?	1	2	8	9
Q41OTH	Any other permit?	1	2	8	9
Q41SPEC	PLEASE SPECIFY _____				

4.1a [FOR EACH PERMIT IN 4.1 WHERE RESPONSE IS 2 OR 8, ASK: Are the following types of permits currently available electronically in your area?

4.1b. (IF 4.1A=2 OR 8, ASK) Would you like to see this available in your state?

	Currently Available				**To see made available**			
	Yes	No (Ask 4.1b)	RF	DK (Ask 4.1b)	Yes	No	RF	DK
International Registration Plan, or IRP? (Q41AIRP) (Q41BIRP)	1	2	8	9	1	2	8	9
International Fuel Tax Agreement, or IFTA? (Q41AIFTA) (Q41BIFTA)	1	2	8	9	1	2	8	9
Oversize/Overweight, or OS/OW permits? (Q41AOS) (Q41BOS)	1	2	8	9	1	2	8	9

4.2 [IF R APPLIED FOR OR OBTAINED ANY PERMITS ELECTRONICALLY IN PAST 12 MONTHS, THAT IS, IF ANY RESPONSE TO 4.1 = 1, ASK:] Companies may achieve a variety of benefits through e-credentialing. Please tell me if you feel your company has actually achieved each of the following benefits.

[IF R DID NOT APPLY FOR ANY PERMITS ELECTRONICALLY IN PAST 12 MONTHS AND WANTS TO SEE AT LEAST ONE BECOME AVAILABLE, THAT IS, IF ALL RESPONSES TO 4.1 = 2, 8, OR 9 AND 4.1b = YES TO ANY PERMIT LISTED, ASK:] You mentioned that you would like additional permits to be available electronically. Now I would like to ask you about the potential benefits associated with having these types of permits or credentials available electronically. Would having these permits available electronically result in the following benefits for your company?

IF Q41AIRP=1 OR Q41AIFTA=1 OR Q41AOS=1 CONTINUE;
IF Q41BIRP 1 OR Q41BIFTA=1 OR Q41BOS=1 CONTINUE;
ELSE SKIP TO Q51AWR.

Q42CSTSV	Dollar cost savings	1	2	8	9
Q42TIMSV	Staff time savings	1	2	8	9
Q42CONV	Convenience	1	2	8	9
Q42ACC	Increased accuracy of registration information	1	2	8	9
Q42SPEED	Getting trucks into service more quickly	1	2	8	9
Q42OTH	Any other benefit	1	2	8	9
Q42SPEC	PLEASE SPECIFY _____				

4.2a [FOR EACH BENEFIT IN Q4.2 WHERE RESPONSE = 1, ASK:] Next I would like to ask you about the importance of the benefits your company has achieved through participation in e-credentialing. On a scale of 1 to 10, where 1 is not important at all and 10 is of the highest importance, how would you rate the importance of the following benefits to your company?

		Not important at all		Highest Importance	RF	DK
Q42ACSTSV	Dollar cost savings	1	…	10	98	99
Q42ATIMSV	Staff time savings	1	…	10	98	99
Q42ACONV	Convenience	1	…	10	98	99
Q42AACC	Increased accuracy of registration information	1	…	10	98	99
Q42ASPEED	Getting trucks into service more quickly	1	…	10	98	99
Q42AOTH	Other benefit specified in Q42OTH	1	…	10	98	99

5.0 Awareness of E-Screening

The next questions focus on the topic of electronic screening, or e-screening. Some states are using a method of roadside screening that is sometimes called electronic screening or electronic clearance. This is where an electronic transponder on board the vehicle allows a computer program or enforcement officials to detect, identify, and weigh vehicles as they travel along the road at highway speeds. Vehicles operated by carriers with good safety records could be given a green light in the cab to bypass static weight and inspection stations if electronic records and vehicle weights for that carrier are in order.

5.1 Q51AWR Have you ever heard of electronic screening?

Yes 1
No (SKIP TO Q53WAIT) 2
REFUSED (SKIP TO Q53WAIT) 8
DON'T KNOW (SKIP TO Q53WAIT) 9

5.2 Q52USE Has your company used e-screening in the past 12 months in some or all of your trucks?

Yes 1
No 2
REFUSED 8
DON'T KNOW 9

5.3 Q53WAIT How many minutes per week would you estimate that your company's average truck spends waiting in a line or stopped at roadside weigh and inspection stations?

0 minutes (SKIP TO Q53AWHYNO) 1
1 to 30 minutes (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 2
Between 30 minutes and 1 hour (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 3
Between 1 hour and 5 hours (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 4
Between 5 hours and 20 hours (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 5
More than 20 hours (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 6
REFUSED (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 8
DON'T KNOW (SKIP TO SECTION 6.1 SKIP INSTRUCTIONS) 9

5.3a Q53AWHYNO Is that because there are no weigh or inspection stations on your routes or because you rarely have to wait when traveling through the station or your vehicles are such that you are not required to enter weigh and inspection stations?

No weigh stations on route (SKIP TO Q72COMM) 1
Not required to use weigh stations (SKIP TO Q72COMM) 2

Required to use weigh stations but never have to stop
(for example, b/c use transponder) 3
REFUSED 8
DON'T KNOW 9

[IF 5.1=2,8, OR 9, SKIP TO 7.2]

6.0 Participation in E-Screening

SECTION 6.1 SKIP INSTRUCTIONS:
IF Q52USE =1 AND Q53AWHYNO=3, 8, OR 9 CONTINUE;
ELSE SKIP TO SECTION 6.2 SKIP INSTRUCTIONS

6.1 You mentioned that your company has used e-screening in some or all of your trucks. In the past 12 months, in which of the following transponder-based e-screening program(s) or partnership(s) has your company participated? Has your company participated in…

		Yes	No	RF	DK
Q61PRE	PrePass?	1	2	8	9
Q61NOR	Norpass?	1	2	8	9
Q61GL	Green Light?	1	2	8	9

SECTION 6.2 SKIP INSTRUCTIONS:
IF Q52USE =1 Q52USE =2 AND Q53AWHYNO=3, 8, OR 9 CONTINUE;
ELSE SKIP TO SECTION 6.3 SKIP INSTRUCTIONS

6.2 A variety of factors may play a role in a company's decision to use or not to use e-screening. I'm going to list several factors, both positive and negative. Please tell me on a scale of 1 to 10 how important each factor was in your decision, where 1 is not important at all and 10 is of the highest importance.

		Not important at all		Highest Importance	RF	DK
Q62AVAIL	Availability of e-screening in states you drive	1	…	10	98	99
Q62LABSAV	Potential labor cost savings	1	…	10	98	99
Q62CONV	Convenience or efficiency	1	…	10	98	99
Q62DELAY	Potential for reduced delays or turnaround time for shipments	1	…	10	98	99
Q62COST	Cost of participation	1	…	10	98	99
Q62PRIV	Concerns about the privacy of your data	1	…	10	98	99
Q62MGTOPP	Management opposition at your company	1	…	10	98	99
Q62MGTSUP	Management support at your company	1	…	10	98	99
Q62DRV	Potential for improved working conditions for drivers	1	…	10	98	99

6.2a Q62AOTH — Were there any other factors that played a role in your company's decision? If yes, please specify.

Yes 1
No (SKIP TO Q63CSTSAV) 2
DON'T KNOW (SKIP TO Q63CSTSAV) 8
REFUSED (SKIP TO Q63CSTSAV) 9

Q62ASPEC1 SPECIFY:_____

Q62ASPEC2 SPECIFY:_____

6.2b On a scale of 1 to 10, where 1 is not important at all and 10 is of the highest importance, how important was [OTHER FACTOR] in your decision?

		Not important at all		Highest Importance	RF	DK
	IF Q62ASPEC1 NOT EMPTY, RF, OR DK CONTINUE; ELSE SKIP TO Q63CSTSAV					
Q62BOTH1	Other reason #1	1	…	10	98	99
	IF Q62ASPEC2 NOT EMPTY, RF, OR DK CONTINUE; ELSE SKIP TO Q63CSTSAV					
Q62BOTH2	Other reason #2	1	…	10	98	99

SECTION 6.3 SKIP INSTRUCTIONS:
IF Q52USE =1 AND Q53AWHYNO=3, 8, OR 9 CONTINUE;
ELSE SKIP TO SECTION 7 SKIP INSTRUCTIONS

6.3 Companies may achieve a variety of benefits through participation in e-screening. Please tell me if you feel your company has actually achieved each of the following benefits.

		Yes	No	RF	DK
Q63CSTSAV	Labor cost savings	1	2	8	9
Q63CONV	Increased convenience or efficiency	1	2	8	9
Q63DELAY	Reduced delays or turnaround time for shipments	1	2	8	9
Q63DRV	Improved working conditions for drivers	1	2	8	9
Q63OTH1	Any other benefit	1	2	8	9
Q63SPEC1	PLEASE SPECIFY _____				
Q63OTH2	Any other benefit	1	2	8	9

Q63SPEC2 PLEASE SPECIFY

_____

6.3a [FOR EACH BENEFIT IN 6.3 WHERE RESPONSE = 1, ASK:] Next I would like to ask you about the importance of the benefits your company has achieved through participation in e-screening. On a scale of 1 to 10, where 1 is not important at all and 10 is of the highest importance, how would you rate the importance of [FILL BENEFIT] to your company?

		Not important at all		Highest Importance	RF	DK
Q63ACSTSAV	Labor cost savings	1	…	10	98	99
Q63ACONV	Increased convenience or efficiency	1	…	10	98	99
Q63ADELAY	Reduced delays or turnaround time for shipments	1	…	10	98	99
Q63ADRV	Improved working conditions for drivers	1	…	10	98	99
Q63AOTH1	First Other benefit listed by R in Q63SPEC1	1	…	10	98	99
Q63AOTH2	Second Other benefit listed by R in Q63SPEC2	1	…	10	98	99

6.4 Given that e-screening systems use historical safety and other data in making red-light/green-light decisions, how concerned are you about the use of data about your company, vehicles, or drivers in making real-time e-screening decisions at the roadside? Please rate each factor on a scale from 1 to 10, where 1 is of no concern at all and 10 is of the highest concern.

		No concern		Highest Concern	RF	DK
Q64ACC	Accuracy of data in safety or credentialing databases	1	…	10	98	99
Q64TIME	Timeliness or freshness of data	1	…	10	98	99
Q64CMPMIS	Misuse of company-private data by competitors	1	…	10	98	99
Q64GOVMIS	Misuse of company-private data by government agencies	1	…	10	98	99
Q64OVER	Over-regulation	1	…	10	98	99

7.0 Company's Anticipated Use of E-Screening in the Future

SECTION 7 SKIP INSTRUCTIONS:
IF Q52USE =2 CONTINUE;
ELSE SKIP TO Q72COMM

		Yes	No
7.1	You mentioned that your company does not currently participate in electronic screening. There are a number of steps e-screening programs or partnerships could take in the future to encourage more companies to participate. Which of the following would encourage your company to participate? (CODE ALL THAT APPLY)		

		Yes	No
Q71NOCST	Eliminate cost of participation	1	2
Q71NOSHR	Don't share bypass transaction data with state or federal officials	1	2
Q71INT	Integrate e-screening transponder with other transponder functions such as electronic toll payment and fuel purchase	1	2
Q71GREEN	Update carrier safety history to indicate when vehicle is given a green light	1	2
Q71PAY	Provide financial incentive to participate	1	2
Q71OTH	Any other benefit	1	2
Q71SPEC	PLEASE SPECIFY _____		
Q71RF	REFUSE	1	2
Q71DK	DON'T KNOW	1	2

7.2 Q72COMM That completes this survey. Is there anything that we have not covered that you would like to add about electronic credentialing or electronic screening services?

Opinion or comment

CLOSING SCRIPT: That is my last question. Thank you so much for your time. We really appreciate your participation in this important study.

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Appendix A.2
Marginal Probability Distributions for Survey Questions

This appendix contains marginal probability distributions and summary statistics on the answers to each of the survey questions. For most questions, the information provided in the tables includes: 1) the number of survey respondents that provided a given answer; 2) the weighted percentage of carriers that provided a given answer; and 3) a 95% confidence interval for the weighted percentage of carriers. For questions where carriers were asked to rank concerns or importance factors on a ten point scale, summary statistics for the rankings (median, 25th percentile, 75th percentile, mean, standard error, 95% confidence interval for the mean) are given.

With the exception of the first two tables which provide summary information, each table is clearly labeled with the question number to allow for easy reference to the survey questionnaire presented in Appendix A.1. The overall results are presented for each question. Where appropriate, breakdowns of survey answers are also presented by carrier size, level of state CVISN services, and level of CVISN participation. In tables where results are presented across various levels of the stratification variables, the p-value from the chi-square test for independence is given. This chi-square test compares the distribution of answers for a given question across the levels of the stratification variable to determine if the distribution of answers is independent of the stratification variable. P-values smaller than 0.05 indicate that the distribution of answers is dependent on the level of stratification variable with 95% confidence. This test provided an initial check as to whether motor carriers' attitudes and opinions varied with respect to carrier size, level of state CVISN services, and/or level of CVISN participation.

Table A.2-1. Distribution of Motor Carrier Sample by Size

	Nationwide			Focus States		
Carrier Size	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)
Small	376	86.2%	(80.99, 90.14)	220	86.8%	(79.91, 91.60)
Medium	321	12.8%	(8.89, 18.08)	175	12.2%	(7.53, 19.26)
Large/Giant	151	1.0%	(0.73, 1.39)	57	0.9%	(0.73, 1.24)
Total	848	100.0%		452	100.0%	

Table A.2-2. Distribution of Motor Carrier Sample by Level of State CVISN Services

	Nationwide			Focus States		
State Level	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)
Low	132	25.2%	(22.29, 28.36)	0	0.0%	
Medium	536	54.6%	(49.93, 59.27)	324	44.4%	(43.68, 45.15)
High	180	20.2%	(15.70, 25.49)	128	55.6%	(54.85, 56.32)
Total	848	100%		452	100%	

Table A.2-3. Question 2.1 – Motor Carrier Description

Describe your company	Nationwide			Focus States		
	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)
For-hire truckload carrier	280	14.4%	(9.84, 20.56)	155	23.8%	(15.58, 34.65)
For-hire less-than-truckload carrier	26	0.8%	(0.21, 2.91)	16	1.9%	(0.75, 4.63)
For-hire owner-operator	125	26.2%	(18.66, 35.47)	72	17.1%	(10.38, 26.81)
Private carrier (not for hire)	409	58.6%	(49.12, 67.51)	203	57.2%	(45.72, 67.99)
Total	840	100.0%		446	100.0%	

Table A.2-4. Question 2.2 – Cargo Type

Cargo Type	Nationwide			Focus State		
	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)
Mixed Freight	43	3.7%	(1.62, 8.17)	23	4.1%	(2.01, 8.29)
Tanker	43	2.5%	(0.95, 6.68)	22	3.4%	(1.55, 7.41)
Refrigerated goods	82	6.7%	(3.20, 13.52)	44	11.9%	(5.92, 22.57)
Automobile transport	15	3.9%	(1.61, 9.08)	7	1.1%	(0.36, 3.13)
Bulk commodities	97	14.3%	(9.07, 21.85)	57	11.6%	(5.80, 21.88)
Household goods	21	5.6%	(2.05, 14.37)	9	1.0%	(0.38, 2.90)
Other specialized freight	324	63.3%	(53.76, 71.85)	165	66.8%	(55.09, 76.72)
Total	582	96.3%		304	95.9%	

Table A.2-5. Question 2.3 – Geographic Range of Carrier

Furthest geographic range of company	Nationwide			Focus State		
	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)	Sample N	Weighted Percent	95% CI for Wtd. Percent (%)
Local only, within a radius of 50 miles	140	28.3%	(21.07, 36.76)	64	21.7%	(12.80, 34.41)
Within-state only	128	22.3%	(15.88, 30.43)	68	16.3%	(9.07, 27.67)
Regional or national	527	46.6%	(38.59, 54.88)	298	60.5%	(47.78, 71.91)
International	49	2.8%	(1.03, 7.26)	21	1.5%	(0.54, 3.82)
Total	844	100.0%		451	100.0%	

Table A.2-6. Question 3.1 – Handling of Credentials for Carrier (Overall)

Who currently obtains credentials?	N	Wtd. %	95% CI for Wtd. Percent (%)
Company staff	678	81.0%	(73.13, 87.04)
Paid outside firm	63	9.4%	(5.47, 15.55)
Both	64	9.6%	(5.37, 16.59)

Table A.2-7. Question 3.1 – Handling of Credentials for Carrier (Carrier Size)

Who currently obtains credentials?	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Company staff	113	68.3%	(52.63, 80.69)	271	87.0%	(74.89, 93.74)	294	80.2%	(71.29, 86.88)	0.199
Paid outside firm	14	15.5%	(6.91, 31.36)	23	4.7%	(2.33, 9.41)	26	10.0%	(5.62, 17.32)	
Both	22	16.1%	(8.49, 28.56)	21	8.3%	(3.04, 20.67)	21	9.7%	(5.07, 17.90)	
Total	149	100%		315	100%		341	100%		

Table A.2-8. Question 3.1 – Handling of Credentials for Carrier (Level of CVISN Services)

Who currently obtains credentials?	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Company staff	145	68.5%	(46.59, 84.37)	428	82.2%	(71.59, 89.41)	105	90.2%	(76.39, 96.34)	0.227
Paid outside firm	14	18.1%	(7.59, 37.20)	42	8.6%	(4.02, 17.48)	7	2.9%	(0.55, 13.90)	
Both	16	13.5%	(4.03, 36.60)	41	9.2%	(4.18, 19.08)	7	6.9%	(2.16, 19.79)	
Total	175	100%		511	100%		119	100%		

Table A.2-9. Questions 3.2, 3.3, 3.4 – Awareness and Participation in E-Credentialing (Overall)

Availability Question	Response	N	Wtd. %	95% CI for Wtd. Percent (%)
Have you ever heard of e-credentialing?	Yes	412	34.5%	(27.14, 42.67)
	No	433	65.5%	(57.33, 72.86)
Is e-credentialing currently available?	Yes	308	22.3%	(16.25, 29.81)
	No	77	11.0%	(6.66, 17.54)
	Had not Heard of E-Cred.	433	66.7%	(58.39, 74.13)
Company used e-credentialing in past 12 months?	Yes	209	12.9%	(8.09, 19.90)
	No	94	8.9%	(5.40, 14.34)
	E-Cred. not Currently Available	77	11.0%	(6.70, 17.66)
	Had not Heard of E-Cred.	433	67.2%	(58.84, 74.55)

Table A.2-10. Questions 3.2, 3.3, 3.4 – Awareness and Participation in E-Credentialing (Carrier Size)

Availability Question	Response	Large/Giant			Medium			Small			Chi-Square p-value
		N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Have you ever heard of e-credentialing?	Yes	108	71.3%	(54.22, 83.93)	158	47.4%	(28.64, 66.98)	146	32.1%	(24.07, 41.44)	0.001
	No	42	28.7%	(16.07, 45.78)	161	52.6%	(33.02, 71.36)	230	67.9%	(58.56, 75.93)	
	Total	150	100%		319	100%		376	100%		
Is e-credentialing currently available?	Yes	84	60.6%	(44.14, 74.98)	115	24.0%	(12.20, 41.86)	109	21.6%	(14.96, 30.21)	0.006
	No	18	9.9%	(4.26, 21.39)	31	19.0%	(6.29, 44.94)	28	9.9%	(5.48, 17.14)	
	Had not Heard of E-Cred.	42	29.5%	(16.56, 46.80)	161	57.0%	(36.16, 75.63)	230	68.5%	(59.07, 76.62)	
	Total	144	100%		307	100%		367	100%		
Company used e-credentialing in past 12 months?	Yes	64	45.5%	(29.64, 62.40)	81	14.7%	(6.20, 31.11)	64	12.2%	(7.08, 20.37)	0.022
	No	19	14.7%	(6.24, 30.89)	32	9.2%	(2.75, 26.62)	43	8.8%	(4.96, 15.14)	
	E-Cred. not Currently Available	18	10.0%	(4.30, 21.60)	31	19.0%	(6.30, 44.98)	28	9.9%	(5.52, 17.27)	
	Had not Heard of E-Cred.	42	29.7%	(16.75, 47.10)	161	57.1%	(36.19, 75.70)	230	69.0%	(59.56, 77.09)	
	Total	143	100%		305	100%		365	100%		

Table A.2-11. Questions 3.2, 3.3, 3.4 – Awareness and Participation in E-Credentialing (Level of CVISN Services)

Availability Question	Response	High			Medium			Low			Chi-Square p-value
		N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Have you ever heard of e-credentialing?	Yes	87	28.4%	(12.95, 51.50)	266	39.7%	(29.48, 50.85)	59	28.1%	(17.11, 42.50)	0.322
	No	92	71.6%	(48.50, 87.05)	268	60.3%	(49.15, 70.52)	73	71.9%	(57.50, 82.89)	
	Total	179	100%		534	100%		132	100%		
Is e-credentialing currently available?	Yes	70	21.2%	(8.09, 45.14)	200	23.7%	(15.99, 33.59)	38	20.3%	(11.06, 34.26)	0.675
	No	11	6.7%	(1.34, 27.18)	47	14.1%	(7.58, 24.84)	19	7.7%	(2.92, 18.82)	
	Had not Heard of E-Cred.	92	72.1%	(48.78, 87.56)	268	62.2%	(50.68, 72.46)	73	72.0%	(57.54, 82.99)	
	Total	173	100%		515	100%		130	100%		
Company used e-credentialing in past 12 months?	Yes	42	13.8%	(3.18, 43.88)	145	15.1%	(9.16, 23.82)	22	7.4%	(2.73, 18.50)	0.589
	No	25	7.3%	(1.69, 26.65)	54	8.6%	(4.34, 16.29)	15	10.9%	(4.69, 23.25)	
	E-Cred. not Currently Available	11	6.7%	(1.35, 27.20)	47	14.1%	(7.58, 24.85)	19	7.9%	(3.00, 19.25)	
	Had not Heard of E-Cred.	92	72.2%	(48.82, 87.61)	268	62.2%	(50.68, 72.48)	73	73.8%	(59.60, 84.35)	
	Total	170	100%		514	100%		129	100%		

Table A.2-12. Question 3.5 – Importance of Factors when Deciding to Participate in E-Credentialing (Overall)

E-Credentialing Status	Importance Factor	N	Wtd. Mean	Wtd. Std. Error	Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Participants	Company size	206	4.103	0.662	4.10 (2.75, 5.46)	1	4	5
	Cost of using e-credentialing	204	4.842	0.701	4.84 (3.40, 6.28)	1	4	8
	Potential dollar cost savings	205	6.471	0.644	6.47 (5.15, 7.79)	1	6	8
	Potential staff time savings	206	8.345	0.485	8.34 (7.35, 9.34)	1	8	10
	Convenience	207	9.057	0.296	9.06 (8.45, 9.66)	5	9	10
	Increased accuracy of registration information	207	7.462	0.504	7.46 (6.43, 8.50)	5	7	9
	Getting trucks into service more quickly	206	7.891	0.681	7.89 (6.49, 9.29)	1	8	10
	Time to learn new system	207	5.015	0.676	5.01 (3.63, 6.40)	1	5	8
	Availability of technology	206	4.281	0.796	4.28 (2.65, 5.91)	1	1	8
	Availability of trained staff	206	3.777	0.703	3.78 (2.33, 5.22)	1	1	6
	Privacy/security concerns	206	5.897	0.963	5.90 (3.92, 7.87)	1	8	10
Non Participants	Company size	83	2.755	0.580	2.76 (1.57, 3.95)	1	4	5
	Cost of using e-credentialing	80	3.380	0.979	3.38 (1.37, 5.39)	1	4	8
	Potential dollar cost savings	82	3.239	0.838	3.24 (1.52, 4.96)	1	6	8
	Potential staff time savings	84	3.386	0.982	3.39 (1.37, 5.40)	1	8	10
	Convenience	83	4.564	1.077	4.56 (2.35, 6.77)	5	9	10
	Increased accuracy of registration information	82	4.069	1.152	4.07 (1.71, 6.43)	5	7	9
	Getting trucks into service more quickly	83	3.132	0.991	3.13 (1.10, 5.17)	1	8	10
	Time to learn new system	82	4.416	1.143	4.42 (2.07, 6.76)	1	5	8
	Availability of technology	85	3.882	1.070	3.88 (1.69, 6.08)	1	1	8
	Availability of trained staff	83	3.224	0.883	3.22 (1.41, 5.03)	1	1	6
	Privacy/security concerns	83	6.874	0.997	6.87 (4.83, 8.92)	1	8	10

Table A.2-13. Question 3.5 – Importance of Factors when Deciding to Participate in E-Credentialing (Carrier Size - Participants)

Importance Factor	Carrier Size	N	Mean	Std. Error	Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Company size	Small	61	3.710	0.727	3.71 (2.22, 5.20)	1	5	6
	Medium	81	5.714	0.960	5.71 (3.74, 7.68)	1	8	8
	Large/Giant	64	6.399	0.479	6.40 (5.42, 7.38)	5	6	8
Cost of using e-credentialing	Small	61	5.094	0.807	5.09 (3.44, 6.75)	1	5	8
	Medium	80	3.202	0.965	3.20 (1.22, 5.18)	1	1	5
	Large/Giant	63	6.118	0.663	6.12 (4.76, 7.48)	3	7	8
Potential dollar cost savings	Small	61	6.314	0.780	6.31 (4.71, 7.91)	5	7	9
	Medium	80	7.357	0.430	7.36 (6.47, 8.24)	8	8	8
	Large/Giant	64	6.442	0.326	6.44 (5.77, 7.11)	5	7	8
Potential staff time savings	Small	62	8.268	0.580	8.27 (7.08, 9.46)	8	9	10
	Medium	80	8.733	0.623	8.73 (7.46, 10.00)	9	10	10
	Large/Giant	64	8.539	0.271	8.54 (7.98, 9.09)	8	9	10
Convenience	Small	62	8.945	0.358	8.94 (8.21, 9.68)	8	10	10
	Medium	81	9.679	0.153	9.68 (9.36, 9.99)	10	10	10
	Large/Giant	64	9.068	0.294	9.07 (8.47, 9.67)	8	10	10
Increased accuracy of registration information	Small	62	7.561	0.595	7.56 (6.34, 8.78)	5	8	10
	Medium	81	6.719	0.805	6.72 (5.07, 8.37)	5	5	10
	Large/Giant	64	8.211	0.427	8.21 (7.33, 9.09)	8	8	10
Getting trucks into service more quickly	Small	61	7.687	0.848	7.69 (5.95, 9.43)	5	8	10
	Medium	81	8.686	0.608	8.69 (7.44, 9.93)	8	10	10
	Large/Giant	64	8.633	0.355	8.63 (7.90, 9.36)	7	10	10
Time to learn new system	Small	62	5.371	0.767	5.37 (3.80, 6.94)	3	5	8
	Medium	81	3.173	1.030	3.17 (1.06, 5.29)	1	1	5
	Large/Giant	64	4.436	0.546	4.44 (3.32, 5.56)	2	5	6
Availability of technology	Small	62	4.675	0.937	4.68 (2.75, 6.60)	1	5	9
	Medium	80	2.613	0.874	2.61 (0.82, 4.41)	1	1	1
	Large/Giant	64	2.191	0.284	2.19 (1.61, 2.77)	1	1	2
Availability of trained staff	Small	62	4.053	0.838	4.05 (2.33, 5.77)	1	5	8
	Medium	80	2.459	0.749	2.46 (0.92, 4.00)	1	1	3
	Large/Giant	64	2.890	0.397	2.89 (2.07, 3.70)	1	2	5
Privacy/security concerns	Small	61	6.039	1.167	6.04 (3.64, 8.43)	1	9	10
	Medium	81	5.277	0.525	5.28 (4.20, 6.35)	2	5	8
	Large/Giant	64	5.227	0.664	5.23 (3.87, 6.59)	2	5	7

Table A.2-14. Question 3.5 – Importance of Factors when Deciding to Participate in E-Credentialing (Carrier Size - Nonparticipants)

Importance Factor	State Level	N	Mean	Std. Error	Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Company size	Small	41	2.833	0.662	2.83 (1.48, 4.19)	1	1	4
	Medium	26	2.134	0.899	2.13 (0.29, 3.98)	1	1	1
	Large/Giant	16	3.449	1.015	3.45 (1.37, 5.53)	1	4	5
Cost of using e-credentialing	Small	40	2.722	0.947	2.72 (0.78, 4.67)	1	1	4
	Medium	24	7.742	1.638	7.74 (4.38, 10.00)	7	10	10
	Large/Giant	16	4.630	1.512	4.63 (1.53, 7.73)	1	4	8
Potential dollar cost savings	Small	40	2.534	0.710	2.53 (1.08, 3.99)	1	1	5
	Medium	25	7.945	1.508	7.94 (4.85, 10.00)	8	10	10
	Large/Giant	17	4.174	1.399	4.17 (1.30, 7.04)	1	2	8
Potential staff time savings	Small	41	3.425	1.125	3.43 (1.12, 5.73)	1	1	8
	Medium	27	2.705	1.259	2.71 (0.12, 5.29)	1	1	4
	Large/Giant	16	6.674	1.161	6.67 (4.29, 9.06)	5	5	10
Convenience	Small	41	4.759	1.194	4.76 (2.31, 7.21)	1	5	9
	Medium	27	2.991	1.464	2.99 (0.00, 5.99)	1	1	5
	Large/Giant	15	6.589	1.296	6.59 (3.93, 9.25)	5	5	10
Increased accuracy of registration information	Small	40	3.824	1.264	3.82 (1.23, 6.42)	1	1	9
	Medium	26	7.240	0.922	7.24 (5.35, 9.13)	5	8	10
	Large/Giant	16	7.517	1.419	7.52 (4.61, 10.00)	3	10	10
Getting trucks into service more quickly	Small	40	3.162	1.159	3.16 (0.78, 5.54)	1	1	5
	Medium	27	2.975	1.466	2.98 (0.00, 5.98)	1	1	5
	Large/Giant	16	2.908	0.831	2.91 (1.20, 4.61)	1	2	5
Time to learn new system	Small	40	4.698	1.290	4.70 (2.05, 7.34)	1	3	9
	Medium	26	2.603	1.218	2.60 (0.11, 5.10)	1	1	1
	Large/Giant	16	4.987	0.473	4.99 (4.02, 5.96)	5	5	5
Availability of technology	Small	41	4.234	1.200	4.23 (1.77, 6.70)	1	1	8
	Medium	27	1.746	0.666	1.75 (0.38, 3.11)	1	1	1
	Large/Giant	17	1.843	0.491	1.84 (0.84, 2.85)	1	1	1
Availability of trained staff	Small	40	3.326	1.008	3.33 (1.26, 5.40)	1	1	6
	Medium	27	2.698	1.270	2.70 (0.09, 5.30)	1	1	1
	Large/Giant	16	2.423	0.911	2.42 (0.55, 4.29)	1	1	2
Privacy/security concerns	Small	40	6.719	1.131	6.72 (4.40, 9.04)	1	8	10
	Medium	27	8.442	1.209	8.44 (5.96, 10.00)	10	10	10
	Large/Giant	16	1.986	0.521	1.99 (0.92, 3.06)	1	1	1

Table A.2-15. Question 3.5 – Importance of Factors when Deciding to Participate in E-Credentialing (Level of State CVISN Services - Participants)

Importance Factor	State Level	N	Mean	Std. Error	Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Company size	Low	22	5.367	0.296	5.37 (4.76, 5.97)	5	5	6
	Medium	143	4.741	0.687	4.74 (3.33, 6.15)	1	5	6
	High	41	1.581	0.433	1.58 (0.69, 2.47)	1	1	1
Cost of using e-credentialing	Low	22	6.013	0.402	6.01 (5.19, 6.84)	5	6	7
	Medium	141	4.559	0.893	4.56 (2.73, 6.39)	1	5	8
	High	41	4.754	1.818	4.75 (1.02, 8.48)	1	8	8
Potential dollar cost savings	Low	22	6.947	0.213	6.95 (6.51, 7.38)	7	7	7
	Medium	143	6.685	0.675	6.68 (5.30, 8.07)	5	8	8
	High	40	5.587	2.056	5.59 (1.37, 9.81)	1	9	9
Potential staff time savings	Low	22	8.353	0.449	8.35 (7.43, 9.28)	8	8	10
	Medium	143	7.993	0.705	7.99 (6.55, 9.44)	8	8	10
	High	41	9.268	0.310	9.27 (8.63, 9.90)	9	9	10
Convenience	Low	22	8.462	0.596	8.46 (7.24, 9.68)	7	8	10
	Medium	144	9.062	0.429	9.06 (8.18, 9.94)	8	10	10
	High	41	9.434	0.259	9.43 (8.90, 9.97)	9	9	10
Increased accuracy of registration information	Low	22	7.929	0.468	7.93 (6.97, 8.89)	7	8	9
	Medium	144	7.371	0.636	7.37 (6.07, 8.67)	5	8	10
	High	41	7.398	1.308	7.40 (4.71, 10.00)	5	8	10
Getting trucks into service more quickly	Low	22	5.936	0.845	5.94 (4.20, 7.67)	4	5	8
	Medium	144	8.001	0.879	8.00 (6.20, 9.80)	8	10	10
	High	40	9.836	0.155	9.84 (9.52, 10.00)	10	10	10
Time to learn new system	Low	22	5.729	1.401	5.73 (2.86, 8.60)	3	5	10
	Medium	144	5.155	0.990	5.16 (3.12, 7.19)	1	5	8
	High	41	4.170	0.517	4.17 (3.11, 5.23)	3	5	5
Availability of technology	Low	22	4.042	1.907	4.04 (0.13, 7.95)	1	2	10
	Medium	143	4.809	1.106	4.81 (2.54, 7.08)	1	5	9
	High	41	3.039	1.053	3.04 (0.88, 5.20)	1	5	5
Availability of trained staff	Low	22	4.415	1.358	4.41 (1.63, 7.20)	1	5	8
	Medium	143	3.870	1.008	3.87 (1.80, 5.94)	1	1	8
	High	41	3.109	1.044	3.11 (0.97, 5.25)	1	5	5
Privacy/security concerns	Low	22	5.468	1.766	5.47 (1.85, 9.09)	1	5	10
	Medium	143	4.938	1.115	4.94 (2.65, 7.23)	1	5	10
	High	41	8.724	0.614	8.72 (7.46, 9.98)	9	9	10

Table A.2-16. Question 3.5 – Importance of Factors when Deciding to Participate in E-Credentialing (Level of State CVISN Services - Nonparticipants)

Importance Factor	State Level	N	Mean	Std. Error	Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Company size affects use of e-credential	Low	14	3.952	1.198	3.95 (1.49, 6.41)	1	4	5
	Medium	46	1.303	0.157	1.30 (0.98, 1.63)	1	1	1
	High	23	4.232	0.531	4.23 (3.14, 5.32)	4	4	4
Cost affects use of e-credentialing	Low	14	2.569	0.734	2.57 (1.06, 4.07)	1	1	4
	Medium	46	2.796	1.452	2.80 (0.00, 5.77)	1	1	1
	High	20	6.525	1.298	6.53 (3.86, 9.19)	8	8	8
Dollar savings affects e-credentialing	Low	14	2.770	0.826	2.77 (1.08, 4.46)	1	1	5
	Medium	46	2.831	1.448	2.83 (0.00, 5.80)	1	1	1
	High	22	5.234	0.728	5.23 (3.74, 6.73)	6	6	6
Time savings affects e-credentialing	Low	14	2.273	0.440	2.27 (1.37, 3.18)	1	1	3
	Medium	47	2.629	1.165	2.63 (0.24, 5.02)	1	1	2
	High	23	7.558	1.287	7.56 (4.92, 10.00)	9	9	9
Convenience affects use e-credentialing	Low	14	3.016	0.816	3.02 (1.34, 4.69)	1	1	5
	Medium	46	4.531	1.722	4.53 (1.00, 8.06)	1	1	9
	High	23	7.681	1.210	7.68 (5.20, 10.00)	9	9	9
Increased accuracy e-credentialing	Low	14	2.325	0.714	2.33 (0.86, 3.79)	1	1	5
	Medium	45	3.964	1.898	3.96 (0.07, 7.86)	1	1	9
	High	23	7.662	1.221	7.66 (5.16, 10.00)	9	9	9
Getting trucks into service more quickly	Low	14	2.681	0.731	2.68 (1.18, 4.18)	1	1	4
	Medium	46	1.436	0.244	1.44 (0.94, 1.94)	1	1	1
	High	23	7.659	1.223	7.66 (5.15, 10.00)	9	9	9
Time to learn new system affects	Low	14	3.817	1.322	3.82 (1.10, 6.53)	1	3	4
	Medium	45	3.510	1.736	3.51 (0.00, 7.07)	1	1	8
	High	23	7.538	1.299	7.54 (4.87, 10.00)	9	9	9
Availability of technology affects	Low	14	3.752	1.566	3.75 (0.54, 6.97)	1	1	7
	Medium	48	2.627	1.175	2.63 (0.22, 5.04)	1	1	2
	High	23	7.444	1.355	7.44 (4.66, 10.00)	9	9	9
Availability of trained staff affects	Low	14	1.941	0.501	1.94 (0.91, 2.97)	1	1	2
	Medium	46	3.463	1.735	3.46 (0.00, 7.02)	1	1	7
	High	23	5.222	0.732	5.22 (3.72, 6.72)	6	6	6
Privacy/security concerns affect	Low	14	8.000	0.614	8.00 (6.74, 9.26)	8	8	10
	Medium	46	5.069	1.798	5.07 (1.38, 8.76)	1	7	8
	High	23	8.551	1.343	8.55 (5.80, 10.00)	10	10	10

Table A.2-17. Question 4.1 – Credentials Obtained Electronically (Overall)

Application Information	N	Wtd. %	95% CI for Wtd. Percent (%)
Company has applied for IRP in past 12 months	130	46%	(24.41, 68.52)
Company has applied for IFTA in past 12 months	137	70%	(46.32, 86.73)
Company has applied for OS/OW permits in past 12 months	73	30%	(13.15, 55.08)
Company has applied for any other permit in past 12 months	87	53%	(31.31, 74.14)

Table A.2-18. Question 4.1 - Credentials Obtained Electronically (Carrier Size)

Application Information	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Company has applied for IRP in past 12 months	45	62.2%	(37.48, 81.83)	51	85.8%	(66.66, 94.82)	34	38.2%	(16.90, 65.21)	0.163
Company has applied for IFTA in past 12 months	39	58.2%	(33.36, 79.51)	51	69.5%	(38.18, 89.34)	47	71.0%	(41.85, 89.32)	0.728
Company has applied for OS/OW permits in past 12 months	20	25.5%	(10.45, 49.98)	32	15.6%	(4.97, 39.39)	21	32.7%	(12.77, 61.80)	0.645
Company has applied for any other permit in past 12 months	32	42.2%	(22.36, 65.00)	35	68.3%	(35.44, 89.44)	20	51.3%	(26.37, 75.61)	0.499

Table A.2-19. Question 4.1 - Credentials Obtained Electronically (Level of CVISN Services)

Application Information	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Company has applied for IRP in past 12 months	26	10.0%	(1.91, 38.94)	89	52.8%	(27.03, 77.11)	15	68.1%	(20.14, 94.78)	0.356
Company has applied for IFTA in past 12 months	22	56.6%	(13.10, 91.86)	102	75.9%	(44.92, 92.40)	13	66.9%	(19.49, 94.40)	0.792
Company has applied for OS/OW permits in past 12 months	9	6.0%	(1.12, 26.22)	56	37.5%	(14.75, 67.51)	8	34.3%	(6.11, 80.78)	0.445
Company has applied for any other permit in past 12 months	19	42.1%	(7.69, 86.38)	55	49.6%	(23.50, 75.88)	13	87.0%	(66.87, 95.68)	0.275

Table A.2-20. Question 4.1a – Availability of Credentials (Overall)

Application Availability	N	Wtd. %	95% CI for Wtd. Percent (%)
IRP available in your area?	30	68%	(26.79, 92.69)
IFTA available in your area?	30	89%	(57.55, 98.05)
OS/OW available in your area?	64	90%	(74.50, 96.59)

Table A.2-21. Question 4.1a – Availability of Credentials (Carrier Size)

Application Availability	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
IRP available in your area?	4	57.1%	(17.98, 89.00)	11	28.7%	(5.73, 72.73)	15	70.6%	(24.44, 94.68)	0.475
IFTA available in your area?	11	88.0%	(68.89, 96.05)	12	60.0%	(24.62, 87.33)	7	97.4%	(75.13, 99.79)	0.320
OS/OW available in your area?	20	82.5%	(58.07, 94.12)	24	69.4%	(42.17, 87.59)	20	96.4%	(86.68, 99.11)	0.101

Table A.2-22. Question 4.1a – Availability of Credentials (Level of CVISN Services)

Application Availability	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
IRP available in your area?	10	56.6%	(10.65, 93.43)	19	86.5%	(59.08, 96.61)	1	51.3%	(6.25, 94.31)	0.530
IFTA available in your area?	10	98.9%	(87.89, 99.92)	16	61.2%	(29.94, 85.30)	4	91.7%	(65.40, 98.49)	0.213
OS/OW available in your area?	14	99.4%	(94.97, 99.94)	43	80.3%	(50.48, 94.23)	7	95.4%	(63.60, 99.60)	0.227

Table A.2-23. Question 4.1b – Desire for Available Credentials (Overall)

Desire Application Availability	N	Wtd. %	95% CI for Wtd. Percent (%)
Want IRP available in state?	28	34%	(5.97, 80.70)
Want IFTA available in state?	22	31%	(5.56, 78.19)
Want OS/OW available in state?	33	59%	(18.80, 90.08)

Table A.2-24. Question 4.1b – Desire for Available Credentials (Carrier Size)

Desire Application Availability	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Want IRP available in state?	10	83.1%	(33.15, 97.99)	11	68.3%	(22.96, 93.96)	7	30.5%	(3.99, 82.25)	0.378
Want IFTA available in state?	8	84.0%	(36.79, 97.92)	11	84.3%	(50.93, 96.55)	3	6.5%	(0.61, 44.14)	0.091
Want OS/OW available in state?	13	59.0%	(22.52, 87.65)	9	43.9%	(13.62, 79.47)	11	60.5%	(16.34, 92.32)	0.800

Table A.2-25. Question 4.1b – Desire for Available Credentials (Level of CVISN Service)

Desire Application Availability	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Want IRP available in state?	2	0.7%	(0.04, 13.12)	22	54.5%	(8.93, 93.59)	4	100.0%		0.253
Want IFTA available in state?	6	89.2%	(55.46, 98.20)	13	25.0%	(3.76, 73.97)	3	100.0%		0.305
Want OS/OW available in state?	9	99.1%	(93.91, 99.88)	22	37.4%	(7.46, 81.58)	2	29.4%	(3.86, 81.14)	0.358

Table A.2-26. Question 4.2 – Benefits for E-Credentialing Participants (Overall)

Benefits for E-Credentialing Users	N	Wtd. %	95% CI for Wtd. Percent (%)
Dollar cost savings	138	58%	(34.22, 78.84)
Staff time savings	185	83%	(60.81, 94.03)
Convenience	200	94%	(69.40, 99.19)
Increased accuracy of registration information	164	75%	(47.70, 90.59)
Getting trucks into service more quickly	165	80%	(57.58, 92.27)
Any other benefit	9	11%	(3.03, 34.76)

Table A.2-27. Question 4.2 – Benefits for E-Credentialing Participants (Carrier Size)

Benefits for E-Credentialing Users	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Dollar cost savings	45	69.9%	(43.83, 87.33)	53	81.1%	(54.95, 93.78)	40	53.7%	(27.34, 78.11)	0.438
Staff time savings	58	94.8%	(81.50, 98.70)	73	90.9%	(72.37, 97.46)	54	81.4%	(55.01, 94.00)	0.481
Convenience	60	98.9%	(94.55, 99.78)	79	98.2%	(84.98, 99.81)	61	93.5%	(63.39, 99.18)	0.711
Increased accuracy of registration information	53	93.2%	(80.13, 97.88)	62	82.6%	(58.23, 94.19)	49	72.7%	(41.61, 90.88)	0.356
Getting trucks into service more quickly	49	74.7%	(49.69, 89.79)	66	87.3%	(66.58, 95.98)	50	79.0%	(51.55, 93.01)	0.636
Any other benefit	3	10.8%	(1.71, 45.64)	2	2.6%	(0.28, 20.30)	4	12.9%	(3.08, 40.88)	0.483

Table A.2-28. Question 4.2 – Benefits for E-Credentialing Participants (Level of CVISN Services)

Benefits for E-Credentialing Users	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Dollar cost savings	24	54.6%	(12.22, 91.19)	99	57.4%	(27.31, 82.81)	15	67.1%	(20.09, 94.31)	0.920
Staff time savings	37	99.7%	(98.46, 99.93)	129	80.7%	(51.83, 94.23)	19	68.8%	(21.06, 94.79)	0.364
Convenience	37	99.8%	(99.25, 99.96)	141	91.2%	(58.03, 98.72)	22	100.0%		0.579
Increased accuracy of registration information	33	99.5%	(97.65, 99.87)	115	62.1%	(31.31, 85.45)	16	93.2%	(75.20, 98.41)	0.213
Getting trucks into service more quickly	33	98.7%	(92.48, 99.79)	117	80.2%	(51.75, 93.84)	15	65.3%	(19.72, 93.54)	0.433
Any other benefit	0	0.0%		9	18.0%	(4.93, 48.14)	0	0.0%		0.308

Table A.2-29. Question 4.2 – Benefits for Non E-Credentialing Participants who want to See Made Available (Overall)

Potential benefits for E-Credentialing Non-Users	N	Wtd. %	95% CI for Wtd. Percent (%)
Potential benefit of dollar cost savings	40	94%	(78.78, 98.26)
Potential benefit of staff time savings	56	98%	(85.55, 99.73)
Potential benefit of convenience	60	100%	
Potential benefit of increased accuracy	53	97%	(84.65, 99.35)
Potential benefit of getting trucks into Service	47	92%	(73.67, 98.01)
Any other potential benefit	1	0%	(0.04, 3.54)

Table A.2-30. Question 4.2 – Benefits for Non E-Credentialing Participants who want to See Made Available (Carrier Size)

Potential benefits for E-Credentialing Non-Users	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Potential benefit of dollar cost savings	13	62.5%	(21.21, 91.15)	16	70.7%	(31.88, 92.55)	11	97.9%	(90.70, 99.56)	0.154
Potential benefit of staff time savings	19	96.8%	(80.39, 99.56)	21	82.5%	(35.99, 97.54)	16	99.9%	(98.91, 99.99)	0.376
Potential benefit of convenience	20	100%		23	100%		17	100%		
Potential benefit of increased accuracy	17	96.3%	(81.37, 99.36)	21	76.6%	(35.20, 95.19)	15	99.2%	(92.28, 99.93)	0.349
Potential benefit of getting trucks into Service	15	58.6%	(22.12, 87.60)	20	82.9%	(35.74, 97.69)	12	97.5%	(87.96, 99.52)	0.215
Any other potential benefit	0	0.0%		0	0.0%		1	0.4%	(0.04, 4.46)	0.675

Table A.2-31. Question 4.2 – Benefits for Non E-Credentialing Participants who want to See Made Available (Level of State CVISN Services)

Potential benefits for E-Credentialing Non-Users	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Potential benefit of dollar cost savings	8	99.8%	(98.08, 99.98)	28	88.5%	(64.24, 97.07)	4	95.6%	(66.86, 99.57)	0.390
Potential benefit of staff time savings	12	100%		39	96.3%	(74.74, 99.58)	5	95.8%	(68.05, 99.59)	0.520
Potential benefit of convenience	11	100%		43	100%		6	100%		0.827
Potential benefit of increased accuracy	11	100%	(99.68, 100.00)	38	95.4%	(74.67, 99.33)	4	69.4%	(19.40, 95.55)	0.371
Potential benefit of getting trucks into Service	8	87.8%	(37.07, 98.88)	35	93.9%	(74.57, 98.79)	4	60.8%	(13.87, 93.72)	0.559
Any other potential benefit	0	0.0%		1	0.7%	(0.07, 6.39)	0	0.0%		0.643

Table A.2-32. Question 4.2a – Importance of Benefits Realized by E-Credentialing Participants (Overall)

Importance Factor	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Dollar cost savings	98	8.760	0.596	8.76 (7.54, 9.98)	6	10	10
Staff time savings	129	9.212	0.478	9.21 (8.23, 10.00)	7	10	10
Convenience	140	9.722	0.173	9.72 (9.37, 10.00)	9	10	10
Increased accuracy of registration information	111	9.482	0.377	9.48 (8.71, 10.00)	9	10	10
Getting trucks into service more quickly	118	9.084	0.534	9.08 (7.99, 10.00)	8	10	10

Table A.2-33. Question 4.2a – Importance of Benefits Realized by E-Credentialing Participants (Carrier Size)

Importance Factor	Carrier Size	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Dollar cost savings	Small	29	8.520	0.868	8.52 (6.74, 10.00)	8	10	10
	Medium	37	9.485	0.373	9.48 (8.72, 10.00)	10	10	10
	Large/Giant	32	7.745	0.695	7.75 (6.32, 9.17)	6	8	10
Staff time savings	Small	38	9.094	0.601	9.09 (7.86, 10.00)	10	10	10
	Medium	52	9.793	0.125	9.79 (9.54, 10.00)	10	10	10
	Large/Giant	39	8.977	0.388	8.98 (8.18, 9.77)	8	10	10
Convenience	Small	44	9.728	0.212	9.73 (9.29, 10.00)	10	10	10
	Medium	56	9.878	0.065	9.88 (9.74, 10.00)	10	10	10
	Large/Giant	40	8.890	0.388	8.89 (8.09, 9.69)	8	10	10
Increased accuracy of registration information	Small	34	9.451	0.486	9.45 (8.45, 10.00)	10	10	10
	Medium	41	9.892	0.075	9.89 (9.74, 10.00)	10	10	10
	Large/Giant	36	8.400	0.631	8.40 (7.11, 9.70)	8	9	10
Getting trucks into service more quickly	Small	38	8.931	0.665	8.93 (7.57, 10.00)	10	10	10
	Medium	46	9.802	0.154	9.80 (9.48, 10.00)	10	10	10
	Large/Giant	34	9.169	0.477	9.17 (8.19, 10.00)	9	10	10

Table A.2-34. Question 4.2a – Importance of Benefits Realized by E-Credentialing Participants (Level of CVISN Services)

Importance Factor	State Level	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Dollar cost savings	Low	11	6.882	0.977	6.88 (4.88, 8.89)	5	8	8
	Medium	71	9.578	0.206	9.58 (9.16, 10.00)	10	10	10
	High	16	8.746	0.575	8.75 (7.57, 9.93)	8	10	10
Staff time savings	Low	14	8.567	0.903	8.57 (6.71, 10.00)	7	9	10
	Medium	90	9.175	0.667	9.18 (7.81, 10.00)	10	10	10
	High	25	9.905	0.098	9.91 (9.70, 10.00)	10	10	10
Convenience	Low	16	8.991	0.713	8.99 (7.53, 10.00)	7	10	10
	Medium	98	9.913	0.038	9.91 (9.83, 9.99)	10	10	10
	High	26	9.882	0.115	9.88 (9.65, 10.00)	10	10	10
Increased accuracy of registration information	Low	12	8.479	1.239	8.48 (5.94, 10.00)	5	10	10
	Medium	77	9.827	0.088	9.83 (9.65, 10.00)	10	10	10
	High	22	9.860	0.140	9.86 (9.57, 10.00)	10	10	10
Getting trucks into service more quickly	Low	11	7.759	1.546	7.76 (4.59, 10.00)	5	10	10
	Medium	82	9.152	0.660	9.15 (7.80, 10.00)	10	10	10
	High	25	9.976	0.022	9.98 (9.93, 10.00)	10	10	10

Table A.2-35. Question 4.2a – Importance of Potential Benefits for Carriers not Currently Using E-Credentialing Participants but Want to see it Made Available (Overall)

Importance Factor	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Dollar cost savings	40	7.875	1.177	7.87 (5.46, 10.00)	6	10	10
Staff time savings	56	7.595	0.407	7.59 (6.76, 8.43)	7	10	10
Convenience	60	8.674	0.626	8.67 (7.39, 9.96)	9	10	10
Increased accuracy of registration information	53	8.507	0.252	8.51 (7.99, 9.02)	9	10	10
Getting trucks into service more quickly	47	8.069	0.399	8.07 (7.25, 8.89)	8	10	10

Table A.2-36. Question 4.2a – Importance of Potential Benefits for Carriers not Currently Using E-Credentialing Participants but Want to see it Made Available (Carrier Size)

Importance Factor	Carrier Size	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Dollar cost savings	Small	11	7.849	1.308	7.85 (5.16, 10.00)	6	10	10
	Medium	16	8.290	1.330	8.29 (5.56, 10.00)	8	10	10
	Large/Giant	13	7.490	0.493	7.49 (6.48, 8.50)	7	7	8
Staff time savings	Small	16	7.338	0.457	7.34 (6.40, 8.27)	7	8	8
	Medium	21	9.730	0.183	9.73 (9.35, 10.00)	10	10	10
	Large/Giant	19	8.314	0.463	8.31 (7.36, 9.26)	7	9	9
Convenience	Small	17	8.531	0.731	8.53 (7.03, 10.0)	9	9	10
	Medium	23	9.807	0.147	9.81 (9.51, 10.00)	10	10	10
	Large/Giant	20	8.680	0.640	8.68 (7.37, 9.99)	7	10	10
Increased accuracy of registration information	Small	15	8.555	0.281	8.56 (7.98, 9.13)	8	9	9
	Medium	21	8.314	0.734	8.31 (6.81, 9.82)	7	10	10
	Large/Giant	17	7.879	0.531	7.88 (6.79, 8.97)	7	8	9
Getting trucks into service more quickly	Small	12	7.665	0.347	7.66 (6.95, 8.38)	7	8	8
	Medium	20	9.806	0.169	9.81 (9.46, 10.00)	10	10	10
	Large/Giant	15	8.901	0.382	8.90 (8.12, 9.68)	9	9	10

Table A.2-37. Question 4.2a – Importance of Potential Benefits for Carriers not Currently Using E-Credentialing Participants but Want to see it Made Available (Level of CVISN Services)

Importance Factor	State Level	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Dollar cost savings	Low	4	8.791	0.854	8.79 (7.04, 10.00)	7	10	10
	Medium	28	5.944	0.454	5.94 (5.01, 6.88)	5	6	6
	High	8	9.995	0.005	10.00 (9.98, 10.00)	10	10	10
Staff time savings	Low	5	8.760	0.826	8.76 (7.06, 10.00)	7	10	10
	Medium	39	7.126	0.478	7.13 (6.15, 8.11)	6	7	7
	High	12	8.096	0.091	8.10 (7.91, 8.28)	8	8	8
Convenience	Low	6	8.790	0.802	8.79 (7.14, 10.00)	7	10	10
	Medium	43	8.373	1.077	8.37 (6.16, 10.00)	6	10	10
	High	11	9.050	0.046	9.05 (8.95, 9.15)	9	9	9
Increased accuracy of registration information	Low	4	8.379	0.968	8.38 (6.39, 10.00)	7	7	10
	Medium	38	8.160	0.151	8.16 (7.85, 8.47)	8	8	8
	High	11	8.932	0.074	8.93 (8.78, 9.08)	9	9	9
Getting trucks into service more quickly	Low	4	9.749	0.285	9.75 (9.17, 10.00)	10	10	10
	Medium	35	7.943	0.379	7.94 (7.16, 8.72)	7	8	8
	High	8	9.889	0.104	9.89 (9.67, 10.00)	10	10	10

Table A.2-38. Questions 5.1, 5.2 – Awareness and Participation for E-Screening (Overall)

Awareness/Participation	N	Wtd. %	95% CI for Wtd. Percent (%)
Have you ever heard of electronic screening?	552	54%	(45.42, 61.43)
Has your company used e-screening?	176	6%	(3.21, 11.93)

Table A.2-39. Questions 5.1, 5.2 - Awareness and Participation for E-Screening (Carrier Size)

Awareness/Participation	Giant/Large			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Have you ever heard of electronic screening?	116	69.9%	(53.83, 82.28)	216	67.1%	(47.54, 82.14)	220	51.3%	(42.26, 60.26)	0.051
Has your company used e-screening?	59	23.2%	(15.47, 33.16)	69	12.8%	(5.09, 28.57)	48	5.1%	(2.15, 11.71)	0.001

Table A.2-40. Questions 5.1, 5.2 – Awareness and Participation for E-Screening (Level of CVISN Services)

Awareness/Participation	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Have you ever heard of electronic screening?	121	71.6%	(51.65, 85.57)	363	52.7%	(41.20, 63.83)	68	41.0%	(27.90, 55.43)	0.035
Has your company used e-screening?	39	14.0%	(4.42, 36.48)	120	5.2%	(2.18, 11.79)	17	2.5%	(0.48, 12.21)	0.096

Table A.2-41. Question 5.3 – Average Wait Time per Truck at Weigh/Inspection Station (Overall)

Minutes per week average truck waits	N	Wtd. %	95% CI for Wtd. Percent (%)
0 minutes	239	46%	(36.91, 55.33)
1 to 30 minutes	318	36%	(28.13, 43.98)
Between 30 minutes and 1 hour	112	12%	(6.67, 20.24)
Between 1 hour and 5 hours	71	5%	(2.58, 9.79)
Between 5 hours and 20 hours	8	1%	(0.34, 5.36)
More than 20 hours	5	0%	(0.01, 0.08)

Table A.2-42. Question 5.3 – Average Wait Time per Truck at Weigh/Inspection Station (Carrier Size)

Minutes per week average truck waits	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
0 minutes	11	13.6%	(4.60, 34.14)	76	15.1%	(9.24, 23.61)	152	50.5%	(40.57, 60.44)	0.0004
1 to 30 minutes	54	44.6%	(28.47, 62.04)	125	47.5%	(28.42, 67.28)	139	34.0%	(25.95, 43.00)	
Between 30 minutes and 1 hour	27	24.2%	(12.63, 41.45)	49	17.5%	(7.16, 36.98)	36	11.0%	(5.48, 20.78)	
Between 1 hour and 5 hours	15	12.9%	(5.21, 28.42)	40	14.3%	(5.78, 31.13)	16	3.8%	(1.41, 9.60)	
Between 5 hours and 20 hours	2	0.7%	(0.10, 4.51)	3	5.7%	(0.75, 32.27)	3	0.8%	(0.10, 5.74)	
More than 20 hours	5	3.9%	(1.48, 9.89)	0	0.0%	(. , .)	0	0.0%	(. , .)	

Table A.2-43. Question 5.3a – Reasons for No Wait Time at Weigh/Inspection Stations (Overall)

Reason for no waiting at weigh station	N	Wtd. %	95% CI for Wtd. Percent (%)
No weigh station on route	103	51%	(38.66, 63.09)
Not required to use weigh stations	92	42%	(30.21, 54.54)
Required to use weigh stations but never have to stop	41	7%	(3.32, 14.87)

Table A.2-44. Question 5.3a – Reasons for No Wait Time at Weight/Inspection Stations (Carrier Size)

Reason for no waiting at weigh station	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
No weigh station on route	4	46.4%	(7.96, 89.68)	27	36.3%	(22.30, 53.12)	72	51.6%	(38.74, 64.17)	0.403
Not required to use weigh stations	4	49.2%	(8.80, 90.65)	28	46.1%	(30.67, 62.40)	60	41.7%	(29.57, 54.90)	
Required to use weigh stations but never have to stop	3	4.4%	(0.70, 23.19)	20	17.5%	(8.25, 33.50)	18	6.8%	(2.89, 15.00)	

Table A.2-45. Question 5.3a – Reasons for No Wait Time at Weight/Inspection Stations (Level of CVISN Services)

Reason for no waiting at weigh inspection	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
No weigh station on route	22	51.7%	(21.97, 80.30)	69	63.9%	(45.49, 78.94)	12	31.8%	(17.07, 51.45)	0.077
Not required to use weigh stations	15	47.9%	(19.49, 77.81)	51	34.8%	(19.93, 53.31)	26	48.9%	(30.43, 67.64)	
Required to use weigh stations but never have to stop	9	0.3%	(0.12, 0.93)	22	1.3%	(0.60, 2.99)	10	19.3%	(8.19, 39.03)	

Table A.2-46. Question 6.1 – Participation in E-Screening Programs (Overall)

Participation	N	Wtd. %	95% CI for Wtd. Percent (%)
Company participated in PrePass in last 12 months	122	88.8%	(59.76, 97.69)
Company participated in Norpass in last 12 months	39	12.1%	(2.01, 47.95)
Company participated in Green Light in last 12 months	33	9.8%	(1.64, 41.39)

Table A.2-47. Question 6.1 – Participation in E-Screening Programs (Carrier Size)

Participation	Giant/Large			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Company participated in PrePass in last 12 months	52	97.6%	(84.59, 99.66)	45	93.8%	(73.45, 98.79)	25	86.6%	(46.10, 97.99)	0.583
Company participated in Norpass in last 12 months	11	7.0%	(2.55, 17.71)	12	2.5%	(0.42, 13.09)	16	15.8%	(2.14, 61.52)	0.638
Company participated in Green Light in last 12 months	11	14.5%	(5.29, 33.99)	12	2.6%	(0.38, 16.04)	10	12.1%	(1.53, 54.99)	0.350

Table A.2-48. Question 6.1– Participation in E-Screening Programs (Level of CVISN Services)

Participation	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Company participated in PrePass in last 12 months	23	98.0%	(93.03, 99.42)	84	96.3%	(87.21, 98.99)	15	16.0%	(2.73, 56.32)	0.521
Company participated in Norpass in last 12 months	18	2.0%	(0.49, 7.43)	20	23.7%	(3.41, 73.29)	1	4.4%	(0.48, 30.98)	0.609
Company participated in Green Light in last 12 months	0	0.0%		32	3.5%	(1.11, 10.36)	1	80.7%	(35.30, 96.96)	0.506

Table A.2-49. Question 6.2 – Importance of Factors in Deciding to Use E-Screening (Overall - Participants)

Importance Factor for e-screening use	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Availability of E-screening in states you drive	163	7.954	0.842	7.95 (6.23, 9.68)	1	3	8
Potential labor cost saving	162	7.458	0.732	7.46 (5.96, 8.96)	1	4	8
Convenience or efficiency	163	8.228	0.964	8.23 (6.25, 10.00)	2	5	9
Potential for reduced delays or turnaround time for shipments	164	8.425	0.503	8.43 (7.39, 9.46)	1	5	9
Cost of participation	163	6.755	1.027	6.75 (4.65, 8.86)	1	8	10
Concerns about the privacy of your data	164	5.562	1.194	5.56 (3.11, 8.01)	1	5	10
Management opposition at your company	161	2.601	0.966	2.60 (0.62, 4.58)	1	1	6
Management support at your company	163	7.593	1.254	7.59 (5.02, 10.00)	1	3	9
Potential for improved working conditions for drivers	165	6.106	0.977	6.11 (4.10, 8.11)	1	5	8

Table A.2-50. Question 6.2 – Importance of Factors in Deciding Not to Use E-Screening (Overall - Nonparticipants)

Importance Factor for e-screening use	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Availability of E-screening in states you drive	254	3.593	0.526	3.59 (2.51, 4.67)	1	3	8
Potential labor cost saving	253	3.854	0.484	3.85 (2.86, 4.85)	1	4	8
Convenience or efficiency	252	4.876	0.492	4.88 (3.87, 5.89)	2	5	9
Potential for reduced delays or turnaround time for shipments	250	4.419	0.521	4.42 (3.35, 5.49)	1	5	9
Cost of participation	247	5.947	0.525	5.95 (4.87, 7.02)	1	8	10
Concerns about the privacy of your data	254	5.420	0.625	5.42 (4.14, 6.70)	1	5	10
Management opposition at your company	254	4.012	0.514	4.01 (2.96, 5.07)	1	1	6
Management support at your company	251	3.789	0.515	3.79 (2.73, 4.84)	1	3	9
Potential for improved working conditions for drivers	250	5.140	0.500	5.14 (4.11, 6.17)	1	5	8

Table A.2-51. Question 6.2 – Importance of Factors in Deciding to Use E-Screening (Carrier Size - Participants)

Importance Factor for e-screening use	Carrier Size	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Availability of E-screening in states you drive	Small	43	7.536	1.164	7.54 (5.15, 9.92)	4	9	10
	Medium	64	9.153	0.456	9.15 (8.22, 10.00)	8	10	10
	Large/Giant	56	7.787	0.429	7.79 (6.91, 8.67)	7	8	10
Potential labor cost saving	Small	42	7.229	1.045	7.23 (5.09, 9.37)	4	8	10
	Medium	65	8.099	0.354	8.10 (7.37, 8.83)	8	8	10
	Large/Giant	55	7.481	0.492	7.48 (6.47, 8.49)	7	8	10
Convenience or efficiency	Small	43	7.831	1.330	7.83 (5.10, 10.00)	8	9	10
	Medium	65	9.292	0.392	9.29 (8.49, 10.00)	9	10	10
	Large/Giant	55	8.586	0.290	8.59 (7.99, 9.18)	8	9	10
Potential for reduced delays or turnaround time for shipments	Small	43	8.492	0.708	8.49 (7.04, 9.94)	6	9	10
	Medium	65	8.257	0.285	8.26 (7.67, 8.84)	8	8	10
	Large/Giant	56	8.281	0.427	8.28 (7.41, 9.16)	8	9	10
Cost of participation	Small	43	6.593	1.463	6.59 (3.59, 9.59)	4	9	9
	Medium	65	7.286	0.455	7.29 (6.35, 8.22)	6	8	8
	Large/Giant	55	6.199	0.554	6.20 (5.06, 7.34)	5	7	8
Concerns about the privacy of your data	Small	44	5.928	1.579	5.93 (2.69, 9.17)	3	5	9
	Medium	65	4.608	0.905	4.61 (2.75, 6.47)	3	3	7
	Large/Giant	55	5.024	0.477	5.02 (4.05, 6.00)	2	5	8
Management opposition at your company	Small	42	2.814	1.297	2.81 (0.15, 5.48)	1	1	5
	Medium	63	1.922	0.559	1.92 (0.77, 3.07)	1	1	1
	Large/Giant	56	3.088	0.484	3.09 (2.09, 4.08)	1	2	5
Management support at your company	Small	42	7.073	1.739	7.07 (3.50, 10.00)	5	9	10
	Medium	65	8.971	0.589	8.97 (7.76, 10.00)	9	10	10
	Large/Giant	56	8.146	0.465	8.15 (7.19, 9.10)	7	10	10
Potential for improved working conditions for drivers	Small	44	5.389	1.293	5.39 (2.74, 8.04)	5	5	9
	Medium	65	7.839	0.450	7.84 (6.92, 8.76)	7	7	10
	Large/Giant	56	8.085	0.420	8.08 (7.22, 8.95)	7	9	10

Table A.2-52. Question 6.2 – Importance of Factors in Deciding Not to Use E-Screening (Carrier Size - Nonparticipants)

Importance Factor for e-screening use	Carrier Size	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Availability of E-screening in states you drive	Small	108	3.470	0.579	3.47 (2.28, 4.66)	1	1	6
	Medium	103	3.898	1.210	3.90 (1.42, 6.38)	1	1	7
	Large/Giant	43	5.068	0.926	5.07 (3.17, 6.97)	1	5	8
Potential labor cost saving	Small	108	3.683	0.522	3.68 (2.61, 4.75)	1	2	5
	Medium	102	4.351	1.170	4.35 (1.95, 6.75)	1	5	7
	Large/Giant	43	4.784	0.904	4.78 (2.93, 6.64)	1	5	8
Convenience or efficiency	Small	108	4.704	0.610	4.70 (3.45, 5.96)	1	5	8
	Medium	100	5.421	0.866	5.42 (3.64, 7.20)	4	5	7
	Large/Giant	44	5.146	0.917	5.15 (3.27, 7.03)	1	5	8
Potential for reduced delays or turnaround time for shipments	Small	108	4.480	0.626	4.48 (3.20, 5.76)	1	3	8
	Medium	99	4.171	1.025	4.17 (2.07, 6.27)	1	2	6
	Large/Giant	43	5.234	0.945	5.23 (3.30, 7.17)	1	5	10
Cost of participation	Small	106	5.638	0.646	5.64 (4.31, 6.96)	1	8	10
	Medium	98	6.993	0.853	6.99 (5.24, 8.74)	6	8	10
	Large/Giant	43	5.884	0.919	5.88 (4.00, 7.77)	3	5	10
Concerns about the privacy of your data	Small	109	5.334	0.697	5.33 (3.90, 6.77)	1	5	10
	Medium	101	5.738	1.372	5.74 (2.92, 8.55)	2	7	10
	Large/Giant	44	4.800	0.904	4.80 (2.95, 6.66)	1	5	8
Management opposition at your company	Small	108	3.432	0.646	3.43 (2.11, 4.76)	1	1	5
	Medium	102	5.889	0.855	5.89 (4.13, 7.64)	5	6	9
	Large/Giant	44	4.204	0.889	4.20 (2.38, 6.03)	1	3	5
Management support at your company	Small	106	3.557	0.563	3.56 (2.40, 4.71)	1	1	5
	Medium	101	4.452	1.196	4.45 (2.00, 6.91)	1	2	8
	Large/Giant	44	5.212	0.907	5.21 (3.35, 7.07)	2	5	7
Potential for improved working conditions for drivers	Small	107	4.904	0.565	4.90 (3.75, 6.06)	1	5	8
	Medium	100	5.850	1.332	5.85 (3.12, 8.58)	2	8	10
	Large/Giant	43	6.022	0.969	6.02 (4.03, 8.01)	1	8	8

Table A.2-53. Question 6.2 – Importance of Factors in Deciding to Use E-Screening (Level of CVISN Services - Participants)

Importance Factor for e-screening use	State Level	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Availability of E-screening in states you drive	Low	16	5.617	0.517	5.62 (4.56, 6.68)	5	5	5
	Medium	111	9.452	0.258	9.45 (8.92, 9.98)	10	10	10
	High	36	6.971	1.555	6.97 (3.78, 10.00)	4	9	9
Potential labor cost saving	Low	16	5.081	0.257	5.08 (4.55, 5.61)	5	5	5
	Medium	111	8.843	0.443	8.84 (7.93, 9.75)	8	10	10
	High	35	6.597	1.248	6.60 (4.04, 9.16)	4	8	8
Convenience or efficiency	Low	16	8.525	0.435	8.52 (7.63, 9.42)	9	9	9
	Medium	111	9.619	0.187	9.62 (9.23, 10.00)	10	10	10
	High	36	6.752	1.881	6.75 (2.89, 10.00)	3	9	9
Potential for reduced delays or turnaround time for shipments	Low	16	8.736	0.231	8.74 (8.26, 9.21)	9	9	9
	Medium	112	8.946	0.457	8.95 (8.01, 9.88)	8	10	10
	High	36	7.826	0.935	7.83 (5.91, 9.74)	6	9	9
Cost of participation	Low	16	8.079	0.748	8.08 (6.54, 9.61)	9	9	9
	Medium	111	6.320	1.610	6.32 (3.02, 9.62)	1	8	10
	High	36	6.891	1.547	6.89 (3.72, 10.00)	4	9	9
Concerns about the privacy of your data	Low	16	5.025	0.234	5.03 (4.54, 5.51)	5	5	5
	Medium	113	5.027	1.663	5.03 (1.62, 8.44)	1	3	10
	High	35	6.233	1.948	6.23 (2.24, 10.00)	3	9	9
Management opposition at your company	Low	16	4.601	0.328	4.60 (3.93, 5.27)	5	5	5
	Medium	110	3.622	1.815	3.62 (0.00, 7.35)	1	1	10
	High	35	1.120	0.092	1.12 (0.93, 1.31)	1	1	1
Management support at your company	Low	16	6.800	0.271	6.80 (6.24, 7.35)	7	7	7
	Medium	111	9.372	0.294	9.37 (8.77, 9.97)	10	10	10
	High	36	5.972	2.517	5.97 (0.81, 10.00)	1	9	9
Potential for improved working conditions for drivers	Low	16	8.456	0.505	8.46 (7.42, 9.49)	9	9	9
	Medium	113	7.681	0.891	7.68 (5.85, 9.51)	5	7	10
	High	36	3.957	1.227	3.96 (1.44, 6.47)	1	5	5

Table A.2-54. Question 6.2 – Importance of Factors in Deciding Not to Use E-Screening (Level of CVISN Services - Nonparticipants)

Importance Factor for e-screening use	State Level	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Availability of E-screening in states you drive	Low	38	4.620	0.801	4.62 (2.98, 6.26)	1	5	7
	Medium	160	3.020	0.718	3.02 (1.55, 4.49)	1	1	5
	High	56	3.806	1.304	3.81 (1.13, 6.48)	1	2	7
Potential labor cost saving	Low	36	4.683	0.869	4.68 (2.90, 6.47)	1	5	8
	Medium	162	3.219	0.542	3.22 (2.11, 4.33)	1	2	5
	High	55	4.463	1.380	4.46 (1.63, 7.29)	1	2	7
Convenience or efficiency	Low	36	5.602	0.967	5.60 (3.62, 7.59)	1	6	9
	Medium	160	4.322	0.688	4.32 (2.91, 5.73)	1	3	7
	High	56	5.395	0.926	5.40 (3.49, 7.30)	3	5	8
Potential for reduced delays or turnaround time for shipments	Low	36	4.940	0.891	4.94 (3.11, 6.77)	1	5	8
	Medium	160	4.460	0.828	4.46 (2.76, 6.16)	1	3	10
	High	54	3.718	0.688	3.72 (2.31, 5.13)	2	2	5
Cost of participation	Low	35	5.876	0.983	5.88 (3.86, 7.89)	1	8	8
	Medium	157	5.874	0.768	5.87 (4.30, 7.45)	1	8	10
	High	55	6.217	0.925	6.22 (4.32, 8.11)	5	8	8
Concerns about the privacy of your data	Low	36	4.815	0.856	4.82 (3.06, 6.57)	1	5	8
	Medium	161	5.737	0.890	5.74 (3.91, 7.56)	1	5	10
	High	57	5.340	1.501	5.34 (2.26, 8.42)	2	2	9
Management opposition at your company	Low	36	3.779	0.712	3.78 (2.32, 5.24)	1	3	5
	Medium	162	4.228	0.812	4.23 (2.56, 5.89)	1	1	10
	High	56	3.754	0.890	3.75 (1.93, 5.58)	1	3	6
Management support at your company	Low	36	4.330	0.769	4.33 (2.75, 5.91)	1	5	6
	Medium	159	3.048	0.614	3.05 (1.79, 4.31)	1	1	5
	High	56	4.974	1.390	4.97 (2.12, 7.83)	2	2	8
Potential for improved working conditions for drivers	Low	36	6.144	0.867	6.14 (4.36, 7.92)	1	7	8
	Medium	158	4.873	0.708	4.87 (3.42, 6.33)	1	5	8
	High	56	4.635	1.101	4.64 (2.38, 6.89)	2	2	7

Table A.2-55. Question 6.3 – Benefits Achieved Through E-Screening (Overall)

Benefits achieved through e-screening	N	Wtd. %	95% CI for Wtd. Percent (%)
Labor cost savings	128	79.4%	(36.70, 96.27)
Increased convenience or efficiency	155	99.2%	(97.69, 99.75)
Reduced delays or turnaround time for shipments	144	97.6%	(93.13, 99.19)
Improved working conditions for drivers	139	73.6%	(32.19, 94.26)

Table A.2-56. Question 6.3 – Benefits Achieved Through E-Screening (Carrier Size)

Benefits achieved through e-screening	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Labor cost savings	44	77.8%	(56.37, 90.49)	55	92.2%	(71.25, 98.27)	29	75.0%	(23.06, 96.77)	0.537
Increased convenience or efficiency	52	93.9%	(81.86, 98.10)	64	99.8%	(99.10, 99.97)	39	99.3%	(96.86, 99.84)	0.183
Reduced delays or turnaround time for shipments	50	88.0%	(69.69, 95.89)	59	95.8%	(73.41, 99.48)	35	98.7%	(95.79, 99.63)	0.216
Improved working conditions for drivers	48	84.1%	(69.01, 92.67)	60	90.4%	(65.42, 97.92)	31	64.3%	(16.25, 94.35)	0.700

Table A.2-57. Question 6.3 – Benefits Achieved Through E-Screening (Level of CVISN Services)

Benefits achieved through e-screening	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Labor cost savings	23	61.0%	(9.16, 96.05)	97	96.0%	(86.88, 98.87)	8	85.8%	(44.54, 97.84)	0.537
Increased convenience or efficiency	32	99.3%	(95.32, 99.91)	110	99.4%	(96.61, 99.91)	13	97.8%	(84.29, 99.74)	0.561
Reduced delays or turnaround time for shipments	30	98.5%	(92.44, 99.74)	102	96.7%	(87.20, 99.22)	12	97.5%	(84.27, 99.66)	0.793
Improved working conditions for drivers	26	20.3%	(4.39, 58.43)	101	95.8%	(86.65, 98.76)	12	94.0%	(61.26, 99.36)	0.388

Table A.2-58. Question 6.3a – Importance Factor for Benefits of E-Screening Use (Overall)

Importance factor for benefits of e-screening use	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Improved working conditions for drivers	138	9.540	0.187	9.54 (9.16, 9.92)	9	10	10
Reduced delays or turnaround time for shipments	140	8.338	0.998	8.34 (6.29, 10.00)	9	10	10
Labor cost savings	127	9.425	0.200	9.43 (9.02, 9.83)	9	10	10
Increased convenience or efficiency	154	8.252	0.975	8.25 (6.25, 10.00)	9	10	10

Table A.2-59. Question 6.3a – Importance Factor for Benefits of E-Screening Use (Carrier Size)

Importance factor for benefits of e-screening use	Carrier Size	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Improved working conditions for drivers	Small	31	9.643	0.241	9.64 (9.15, 10.00)	9	10	10
	Medium	59	9.442	0.319	9.44 (8.79, 10.00)	10	10	10
	Large/Giant	48	9.214	0.230	9.21 (8.74, 9.69)	9	10	10
Reduced delays or turnaround time for shipments	Small	33	7.982	1.367	7.98 (5.18, 10.00)	9	9	10
	Medium	58	9.291	0.359	9.29 (8.55, 10.00)	9	10	10
	Large/Giant	49	8.927	0.272	8.93 (8.37, 9.49)	8	9	10
Labor cost savings	Small	29	9.538	0.265	9.54 (8.99, 10.00)	9	10	10
	Medium	54	9.316	0.384	9.32 (8.53, 10.00)	9	10	10
	Large/Giant	44	8.157	0.633	8.16 (6.86, 9.46)	6	10	10
Increased convenience or efficiency	Small	39	7.978	1.351	7.98 (5.21, 10.00)	9	9	10
	Medium	63	9.035	0.560	9.03 (7.89, 10.00)	9	10	10
	Large/Giant	52	8.128	0.489	8.13 (7.12, 9.13)	8	9	10

Table A.2-60. Question 6.3a – Importance Factor for Benefits of E-Screening Use (Level of CVISN Services)

Importance factor for benefits of e-screening use	State Level	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Improved working conditions for drivers	Low	12	8.939	0.077	8.94 (8.78, 9.10)	9	9	9
	Medium	100	9.647	0.187	9.65 (9.26, 10.00)	10	10	10
	High	26	9.786	0.113	9.79 (9.56, 10.00)	10	10	10
Reduced delays or turnaround time for shipments	Low	12	9.713	0.244	9.71 (9.21, 10.00)	10	10	10
	Medium	100	9.605	0.188	9.61 (9.22, 9.99)	10	10	10
	High	28	6.761	1.914	6.76 (2.83, 10.00)	3	9	9
Labor cost savings	Low	8	9.927	0.077	9.93 (9.77, 10.00)	10	10	10
	Medium	96	9.565	0.218	9.56 (9.12, 10.00)	10	10	10
	High	23	9.039	0.111	9.04 (8.81, 9.27)	9	9	9
Increased convenience or efficiency	Low	13	9.768	0.196	9.77 (9.37, 10.00)	10	10	10
	Medium	109	9.345	0.296	9.35 (8.74, 9.95)	10	10	10
	High	32	6.789	1.910	6.79 (2.87, 10.00)	3	9	9

Table A.2-61. Question 6.4 – Concerns in E-Screening Use (Overall - E-Screening Participants Only)

Importance factor for areas of concern in e-screening use	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Accuracy of data in safety or credentialing databases	159	6.558	1.018	6.56 (4.47, 8.65)	4	8	9
Timeliness or freshness of data	158	6.363	1.031	6.36 (4.25, 8.48)	4	7	9
Misuse of company-private data by competitors	160	5.170	1.423	5.17 (2.25, 8.09)	1	6	9
Misuse of company-private data by government agencies	161	5.227	1.423	5.23 (2.31, 8.15)	1	5	9
Over-regulation	160	6.012	1.341	6.01 (3.26, 8.76)	1	6	9

Table A.2-62. Question 6.4 – Concerns in E-Screening Use (Carrier Size - E-Screening Participants Only)

Importance factor for areas of concern in e-screening use	Carrier Size	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Accuracy of data in safety or credentialing databases	Small	40	6.168	1.464	6.17 (3.16, 9.17)	4	5	9
	Medium	65	7.602	0.440	7.60 (6.70, 8.50)	8	8	8
	Large/Giant	54	6.928	0.519	6.93 (5.86, 7.99)	5	8	9
Timeliness or freshness of data	Small	39	6.568	1.467	6.57 (3.56, 9.58)	4	9	9
	Medium	65	5.699	0.563	5.70 (4.54, 6.85)	5	5	8
	Large/Giant	54	7.029	0.492	7.03 (6.02, 8.04)	5	8	9
Misuse of company-private data by competitors	Small	41	5.616	1.886	5.62 (1.75, 9.49)	1	7	9
	Medium	65	3.889	1.372	3.89 (1.07, 6.70)	1	1	7
	Large/Giant	54	5.402	0.683	5.40 (4.00, 6.80)	2	5	10
Misuse of company-private data by government agencies	Small	42	5.455	1.886	5.46 (1.59, 9.32)	1	5	9
	Medium	65	4.653	1.722	4.65 (1.12, 8.19)	1	1	10
	Large/Giant	54	4.754	0.664	4.75 (3.39, 6.12)	2	3	9
Over-regulation	Small	42	6.325	1.702	6.33 (2.83, 9.82)	5	6	9
	Medium	65	5.315	1.992	5.31 (1.23, 9.40)	1	5	10
	Large/Giant	53	4.671	0.463	4.67 (3.72, 5.62)	2	5	6

Table A.2-63. Question 6.4 – Concerns in E-Screening Use (Level of CVISN Services - E-Screening Participants Only)

Importance factor for areas of concern in e-screening use	State Level	N	Wtd. Mean	Wtd. Std. Error	Wtd. Mean (95% Confidence Interval)	25th Percentile	Median	75th Percentile
Accuracy of data in safety or credentialing databases	Low	16	5.412	0.358	5.41 (4.68, 6.15)	5	5	5
	Medium	109	6.502	1.623	6.50 (3.17, 9.83)	1	8	10
	High	34	6.879	1.520	6.88 (3.76, 10.00)	4	9	9
Timeliness or freshness of data	Low	16	8.374	0.525	8.37 (7.30, 9.45)	9	9	9
	Medium	108	5.465	1.532	5.46 (2.32, 8.61)	1	5	10
	High	34	6.809	1.516	6.81 (3.70, 9.92)	4	9	9
Misuse of company-private data by competitors	Low	16	6.611	0.461	6.61 (5.67, 7.56)	7	7	7
	Medium	109	4.507	1.796	4.51 (0.82, 8.19)	1	1	10
	High	35	5.509	2.517	5.51 (0.34, 10.00)	1	9	9
Misuse of company-private data by government agencies	Low	16	4.843	0.349	4.84 (4.13, 5.56)	5	5	5
	Medium	110	4.821	1.883	4.82 (0.96, 8.68)	1	1	10
	High	35	5.726	2.479	5.73 (0.64, 10.00)	1	9	9
Over-regulation	Low	15	5.111	0.235	5.11 (4.63, 5.59)	5	5	5
	Medium	110	6.347	1.635	6.35 (2.99, 9.70)	1	6	10
	High	35	5.879	2.518	5.88 (0.71, 10.00)	1	9	9

Table A.2-64. Question 7.1 – Anticipated E-Screening Use in Future (Overall)

Factors that would encourage e-screening participation	N	Wtd. %	95% CI for Wtd. Percent (%)
Eliminate cost of participation	202	37%	(26.60, 49.66)
Do not share bypass transaction data with state or federal officials	131	24%	(14.39, 36.71)
Integrate e-screening transponder with other transponder functions such as electronic toll payment and fuel purchase	127	15%	(8.06, 26.02)
Update carrier safety history to indicate when vehicle is given a green light	168	26%	(16.77, 38.88)
Provide financial incentive to participate	201	45%	(33.58, 56.95)
Any other benefit	74	36%	(25.65, 48.67)

Table A.2-65. Question 7.1 – Anticipated E-Screening Use in Future (Carrier Size)

Factors that would encourage e-screening participation	Large/Giant			Medium			Small			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Eliminate cost of participation	30	40.7%	(20.79, 64.25)	80	59.0%	(28.55, 83.85)	92	33.6%	(22.55, 46.81)	0.365
Do not share bypass transaction data with state or federal officials	14	14.8%	(4.67, 37.98)	53	32.3%	(13.07, 60.31)	64	22.4%	(12.60, 36.63)	0.472
Integrate e-screening transponder with other transponder functions such as electronic toll payment and fuel purchase	24	35.3%	(16.44, 60.20)	52	33.0%	(10.06, 68.49)	51	11.5%	(5.78, 21.67)	0.097
Update carrier safety history to indicate when vehicle is given a green light	25	27.6%	(11.71, 52.22)	73	48.3%	(20.58, 77.12)	70	22.5%	(13.56, 34.97)	0.336
Provide financial incentive to participate	30	55.8%	(32.14, 77.14)	83	70.3%	(38.28, 89.99)	88	40.4%	(28.83, 53.23)	0.148
Any other benefit	4	1.6%	(0.51, 4.65)	34	32.0%	(10.47, 65.39)	36	37.6%	(25.78, 51.04)	0.005

Table A.2-66. Question 7.1 – Anticipated E-Screening Use in Future (Level of CVISN Services)

Factors that would encourage e-screening participation	High			Medium			Low			Chi-Square p-value
	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	N	Wtd. %	95% CI for Wtd. Percent (%)	
Eliminate cost of participation	47	37.4%	(14.02, 68.64)	134	41.4%	(27.99, 56.25)	21	26.8%	(11.39, 50.94)	0.504
Do not share bypass transaction data with state or federal officials	29	13.4%	(3.21, 42.04)	90	26.8%	(13.48, 46.30)	12	28.1%	(12.19, 52.38)	0.461
Integrate e-screening transponder with other transponder functions such as electronic toll payment and fuel purchase	30	15.9%	(2.78, 55.45)	84	15.3%	(7.60, 28.54)	13	12.7%	(4.05, 33.38)	0.946
Update carrier safety history to indicate when vehicle is given a green light	35	18.1%	(4.00, 54.10)	117	30.8%	(17.87, 47.62)	16	24.4%	(9.88, 48.63)	0.663
Provide financial incentive to participate	45	39.8%	(15.65, 70.21)	130	46.2%	(32.69, 60.37)	26	47.8%	(26.32, 70.15)	0.908
Any other benefit	17	48.2%	(21.28, 76.23)	47	36.4%	(23.49, 51.63)	10	22.1%	(8.86, 45.43)	0.292

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APPENDIX B. COST ANALYSIS SUPPORTING INFORMATION

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Appendix B.1. Example CVISN Cost Analysis Interview Protocol

Contact Information:

State employee name and address here.

Introduction

The Federal Motor Carrier Safety Administration (FMCSA) is updating the cost analysis of the Commercial Vehicle Information Systems and Networks (CVISN) it performed in the evaluation of the CVISN Model Deployment Initiative (MDI) in 2002 by using new and more extensive sources of information to make more traceable and well-documented cost data available to all states. The cost data in this evaluation will also be used as input to a return on investment (ROI) tool that will be useful to states interested in learning more about deployment strategies and cost structures in place within states across the nation. Finally, the cost analysis will document start-up and recurrent costs for various scenarios differentiated based on deployment scope and strategy.

One of the key sources of information collected in support of this analysis will be well documented and detailed information from four states – Montana, South Dakota, New York and New Jersey. Detailed cost data from the four states will be used to augment self-evaluation data previously submitted by numerous states. The objectives of our contact with your state are:

- Learn more about the costs of deployment and operation of CVISN in each state,
- Observe and document changes in costs (increases or decreases) to the state brought about by CVISN deployment,
- Clarify any questions and evaluate the accuracy of the data provided for the state in its self-evaluation report,
- Determine the applicability or comparability of cost data from this state to other states,
- Document the state's strategy to CVISN deployment, and
- Learn what has been observed in this state in terms of costs or savings for motor carriers participating in CVISN.

A member of the research team will visit the state in order to interview state transportation, law enforcement, and credentials administration officials in order to achieve the aforementioned objectives. However, this pre-visit contact will start the process of updating, verifying, and expanding the data collected through the self-evaluation templates in a manner that will assist the research team in conducting the initial cost analysis.

Prior to our meeting, please review the questions in this survey and provide responses and validate the cost data previously submitted under the CVISN self evaluation.

CVISN Deployment General Overview Questions

Describe your general approach to implementing your CVISN program. What components of CVISN have been deployed? What were the motivations behind the manner in which you structured your CVISN program? Which state agencies were involved with the deployment of CVISN? Please describe the general role that each state agency played in implementing CVISN. What in your view is unique about your implementation approach relative to other states?

Provide an overview of your credentialing system prior to implementing CVISN electronic credentialing. Describe how your legacy credentialing systems changed following CVISN deployment.

How has CVISN electronic credentialing affected the internal operation of your state's credentials administration office, compared with using the legacy system? How much staff time has been freed up due to the adoption of electronic credentialing?

Please describe the pre-CVISN deployment IRP credentialing system. Describe the work tasks involved in the legacy system and how they differ from the work tasks involved for your system post-CVISN deployment. What work tasks were most significant to contributing to annual labor costs for legacy systems and are significant to contributing to the costs for CVISN post deployment?

Please describe the pre-CVISN deployment IFTA credentialing system. Describe the work tasks involved in the legacy system and how they differ from the work tasks involved for post-CVISN deployment. What work tasks were most significant to contributing to annual labor costs for legacy systems and are significant to contributing to the costs for CVISN post deployment?

If you have adopted CVISN Safety Information Exchange, what benefits have you observed, as reported to you by system managers, inspectors, other state employees, or motor carriers?

Does your state use CVISN safety information exchange to support your state's roadside inspection program? What sorts of characteristics might be interesting or unique about your program compared to other states?

Has your state documented any safety benefits associated with the implementation of its safety information exchange system? Please share your assessment of these benefits.

Are there any other institutional issues you observed that would be of interest or value for other states considering a CVISN deployment?

Cost Data

In this cost data section, the research team has obtained and summarized the data that your state input into the CVISN self evaluation website. Please verify the accuracy of the input elements. Further, please use the additional tables provided to identify cost elements not previously identified in the self evaluation template.

Electronic Credentials

One-time (start-up) purchase costs for equipment and materials (including installation costs and excluding leased equipment):

a. Computer network servers for electronic credentialing

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

b. Personal computers (desktop or laptop) for state employees to use in electronic credentials administration

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

c. Consumable supplies and materials for outreach, internal and external publicity, training, or supporting the deployment of electronic credentialing

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

d. Other central office or branch office network hardware and peripherals for electronic credentialing (specify function):

Description	Quantity	Unit Cost ($)	Actual or	Expected	Comments and Qualifiers

	Deployed		Estimated	Service Life (Yrs.)	

One-time (start-up) purchase costs for software:

a. Credentialing software packages purchased for back-end database management and data processing or reporting

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

b. Credentialing software packages purchased for front-end user interface and data entry

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

c. Other software purchased for electronic credentialing start-up (specify function):

Description	Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

One-time (start-up) costs for labor:

a. State employee labor for new electronic credentialing software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

b. State employee labor for new hardware configuration (after original installation)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

c. Contractor labor for new electronic credentialing software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

d. Contractor labor for new hardware configuration (after original installation)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

e. Third-party vendor labor for software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

f. Third-party vendor labor for hardware configuration

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

g. Labor for existing (legacy) system interface and/or modification (State employee labor plus contractor or vendor labor)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

h. Labor for training associated with credentialing system development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

i. Other start-up labor costs for electronic credentialing (specify function):

Description	Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

Recurring (annual) costs for operating and maintaining electronic IRP credentialing system (excluding labor):

a. Membership fees paid to IRP Clearinghouse

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

b. Fees paid to third-party IRP credentials administrator (for example, VISTA, Polk) for operating a back-end database management and data processing system

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

c. Fees paid to third-party IRP credentials administrator (for example, VISTA, Polk) for operating a front-end user interface and data entry system

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

d. Lease payments for computer equipment (specify function in comments section at right)

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

e. Recurring costs for marketing, outreach, publicity, etc.

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

f. Other recurring (annual) costs for electronic IRP credentialing operation and maintenance, excluding labor (specify function):

Description	Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

Recurring (annual) labor costs for operating and maintaining electronic IRP credentialing system:

a. State employee annual labor

Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

b. Contractor annual labor

Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

c. Third-party vendor annual labor

Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

d. Other recurring (annual) CVISN-related electronic IRP credentialing labor cost elements not listed above (specify function):

	Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Description	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

Recurring (annual) costs for operating and maintaining electronic IFTA credentialing system (excluding labor):

a. Membership fees paid to IFTA Clearinghouse

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

b. Fees paid to third-party IFTA credentials administrator (for example, VISTA, Polk) for operating a back-end database management and data processing system

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

c. Fees paid to third-party IFTA credentials administrator (for example, VISTA, Polk) for operating a front-end user interface and data entry system

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

d. Lease payments for computer equipment (specify function in comments section at right in this row)

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

e. Recurring costs for marketing, outreach, publicity, etc.

Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

f. Other recurring (annual) costs for electronic IFTA credentialing operation and maintenance, excluding labor (specify function):

Description	Total Annual Cost to State ($)	Actual or Estimated	Comments and Qualifiers

Recurring (annual) labor for IFTA credentialing:[2]

a. State employee annual labor

Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

b. Contractor annual labor

Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

c. Third-party vendor annual labor

Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

[2] Include all labor charges for IFTA credentials administration, including processing the applications, handling payments, issuing the final credentials, serving customers, analyzing computer systems, programming, reporting, and management. If you report labor dollars, use the fully loaded amount, including fringe benefits and other overhead-type labor costs. Provide annual costs for your state's baseline credentials administration function, for comparison with the costs for your state's corresponding credentialing function after the deployment of CVISN technologies.

d. Other recurring (annual) CVISN-related electronic ITA credentialing labor cost elements not listed above (please specify):

	Legacy System Labor (Pre-deployment)			CVISN Labor (Post-deployment)			
Description	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments of Qualifiers

Are there any recurring or non-recurring costs of electronic credentialing that have not been covered thus far? If so, please describe these items in detail.

Description	Number of Units	Total Cost or Unit Cost	Actual or Estimated	Comments and Qualifiers

Safety Information Exchange

One-time (start-up) purchase costs for equipment and materials (including installation costs and excluding leased equipment):

a. Computer network servers for safety information exchange, including mobile network servers used in roadside enforcement, **include detail if your State has deployed servers of various capacities and costs**

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

b. Desktop personal computers for administering the safety information exchange system (including desktop computers used at roadside check stations)

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

c. Laptop personal computers for roadside use in inspections for safety information exchange

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

d. Portable printers for mobile enforcement

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

e. Wireless modems for vehicle and/or roadside use

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

f. Consumable supplies and materials for outreach, internal and external publicity, training, and supporting the deployment or safety information exchange

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

g. Other central office, branch office, roadside, or mobile telecommunications equipment for safety information exchange (specify function)

Description	Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

One-time (start-up) purchase costs for software:

a. Safety information exchange software purchased off the shelf

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

b. Other software purchased for safety information exchange start-up (specify function):

Description	Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

One-time (start-up) costs for labor:

a. State employee labor for new safety information exchange software development (for example, CVIEW)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

b. State employee labor for new hardware configuration (after original installation)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

c. Contractor labor for new safety information exchange software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

d. Contractor labor for new hardware configuration (after original installation)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

e. Third-party vendor labor for software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

f. Third-party vendor labor for hardware configuration

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

g. Labor for existing (legacy) system interface and/or modification (state employee labor plus contractor or vendor

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

h. Labor for training associated with safety information exchange system deployment

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

i. Other start-up labor costs for safety information exchange (specify function)

Description	Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

Recurring (annual) costs for operating and maintaining safety information exchange system (specify function in comments field at the right in this row):

a. Lease payments for computer equipment for safety information exchange

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

b. Telephone and internet service charges

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

c. Wireless communication charges

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

d. Charges for linking to central data services (for example, AAMVAnet)

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

e. Other recurring (annual) costs for safety information exchange operation and maintenance, excluding labor (specify function):

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

Recurring (annual) costs for labor (provide hours and/or $):

a. State employee annual labor

Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

b. Contractor annual labor

Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

c. Third-party vendor annual labor

Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

d. Other recurring (annual) safety information exchange labor costs (specify function):

Annual Labor Hours	Annual Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

Program Costs

One-time (start-up) purchase costs for equipment and materials (including installation costs and excluding leased equipment):

a. Computer network server dedicated to electronic screening

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

b. Desktop personal computer dedicated to electronic screening

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

c. Laptop personal computer dedicated to electronic screening

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

d. Mainline (highway speed) weigh-in-motion (WIM) scale

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

e. Sorter lane (ramp speed) WIM scale

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

f. In-vehicle transponder purchased by state for distribution (free of charge) to motor carriers enrolling vehicles in electronic screening

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

g. In-vehicle transponder purchased by state for resale (cost-recovery or other basis) to motor carriers enrolling vehicles in electronic screening

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

h. Automated vehicle identification (AVI) equipment/system (in the comments section at the right of this row, specify type, for example, DSRC, optical, video, other)

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

i. Telecommunication equipment between upstream site and weigh station/base

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

j. Electronic sign for weigh station

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

k. Loop detector for weigh station

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

l. Upgrade of existing fixed-site weigh station infrastructure (excluding items listed above) for electronic screening (specify function in comments section at right in this row)

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

m. One-time start-up fees paid to electronic screening provider or partnership (for example, PrePass, Norpass)

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

n. Consumable supplies and materials for outreach, internal and external publicity, training, or supporting the deployment of electronic screening

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

o. Other central office or branch office network hardware and peripherals purchased for electronic screening (specify function):

Description	Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

One-time (start-up) purchase costs for software:

a. Electronic screening software purchased off the shelf

Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

b. Other software for electronic screening start-up (specify function):

Description	Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

One-time (start-up) costs for labor:

a. State employee labor for electronic screening software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

b. State employee labor for new hardware configuration (after original installation)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

c. Contractor labor for electronic screening software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

d. Contractor labor for new hardware configuration (after original installation)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

e. Third-party vendor labor for software development

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

f. Third-party vendor labor for hardware configuration

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

g. Labor for existing (legacy) system interface and/or modification (state employee labor + contractor or vendor labor)

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

h. Labor for training associated with system deployment

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

i. Other start-up labor costs (specify function):

Description	Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

Recurring (annual) costs, operating and maintaining electronic screening system (excluding labor):

a. Lease payments for computer equipment for electronic screening

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

b. Annual payments made to electronic screening administrator/vendor/partnership (for example, PrePass, Norpass)

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

c. Annual maintenance cost for mainline WIM scale

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

d. Annual maintenance cost for sorter-lane WIM scale

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

e. Annual maintenance cost for other roadside equipment (AVI, transponder readers, etc.)

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

f. Recurring costs for marketing, outreach, publicity, etc.

Description	Total Amount Cost to State ($)	Actual or Estimated	Comments and Qualifiers

g. Other recurring (annual) costs for operation and maintenance, excluding labor (specify function):

Description	Total Amount Cost to State ($)	Actual or Estimated	Actual or Estimated	Comments and Qualifiers

Recurring (annual) costs for labor (provide hours and/or $):

a. State employee annual labor

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

b. Contractor annual labor

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

c. Third-party vendor annual labor

Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

d. Other recurring (annual) electronic screening labor costs (specify function):

Description	Total Labor Hours	Total Labor Cost ($)	Actual or Estimated	Comments and Qualifiers

Are there any recurring or non-recurring costs of electronic screening that have not been covered thus far? If so, please fill in the table below:

Description	Quantity Deployed	Unit Cost ($)	Actual or Estimated	Expected Service Life (Yrs.)	Comments and Qualifiers

Electronic Screening and Electronic Credentialing System Information

Electronic Screening System Data

In which electronic screening program or partnership does your state participate or expect to participate?

x	HELP/PrePass
○	Norpass
○	Self-administered
○	Not applicable
○	Other
	If Other, please describe your program or partnership:

At how many permanent weigh sites (where a static scale is installed in the ground) does your state now offer (or plan to offer) electronic screening? The 12-month and 5-year estimates should include the sum of both existing and new sites.

	Now	In 12 Months	In 5 Years
Number of permanent sites that have or expect to have electronic screening			

At how many other sites (remote from an existing permanent weigh or inspection site) does your state now use (or plan to use - including existing and new sites) electronic screening technologies?

	Now	In 12 Months	In 5 Years
Number of remote screening sites that use or plan to use electronic screening			

How many high-speed mainline weigh-in-motion (WIM) devices does your state have installed or plan to install (including existing and new devices)?

	Now	In 12 Months	In 5 Years
Number of mainline WIMs			

How many reduced-speed ramp or sorter-lane weigh-in-motion (WIM) devices does your state have installed or plan to install (including existing and new ramps/devices)?

	Now	In 12 Months	In 5 Years
Number of ramp or sorter-lane WIMs			

Counting each time an enrolled, transponder-equipped vehicle encountered an electronic screening site, in the past 12 months (or the latest reporting period), approximately how many:

	Number
Commercial vehicle electronic screenings were performed by your state's system?	
Screened vehicles were given a green light transponder signal to bypass an open weigh or inspection station?	
Screened vehicles were given a red light transponder signal to enter a weigh or inspection station?	

What is your state's prevailing random pull-in rate? That is, in approximately what percentage of electronic screening-site encounters would a safe, enrolled, transponder-equipped vehicle still be given a red light and requested to enter a weigh/inspection station?

Percent = (Number of red lights / number of station encounters) * 100

○ Random pull-in rate varies from time to time or from carrier to carrier

If rate varies, briefly describe your state's method of determining pull-in rate in the space provided below:

○	Averages 0 to 5 percent
○	Averages 6 to 10 percent
○	Averages 11 to 15 percent
○	Averages greater than 15 percent
○	Not applicable

How are in-vehicle transponders purchased and distributed to motor carriers and vehicles? (Check all that apply)

☐	Purchased and distributed by state government, without direct charge to the participating motor carrier
☐	Purchased by state government and distributed by a third party (outsourced)
☐	Purchased and distributed by interstate program or partnership (for example, PrePass)
☐	Purchased directly from vendor by motor carrier
☐	Not applicable
☐	**Other (please specify):**

If possible, estimate the vehicle operating time (VOT) savings (in hours) to motor carriers attributable to electronic screening annually in your state?

Approximately how many vehicles have passed through a weigh or inspection station during the past 12 months?

How many accidents / fatalities involving motor vehicles have occurred at weight or inspection stations during the past 5 years?

What is the average amount of VOT lost when motor carriers pull into state-operated weigh or inspection stations?

☐	0-2 minutes
☐	2-4 minutes
☐	4-6 minutes
☐	6-8 minutes
☐	8-10 minutes
☐	More than 10 minutes (please specify)

ELECTRONIC CREDENTIALING

IRP Credentialing

Approximately how many commercial motor carrier accounts and commercial vehicles (power units) now have state-issued **IRP** credentials in your state?

Number of Motor Carrier Accounts	Number of Commercial Vehicles

An **IRP** credentialing transaction is defined as the process of obtaining new registration, renewals, or supplemental credentials for one or more vehicles. Approximately how may of each of the various credentialing transactions were processed in the past 12 months (or the latest reporting year) in your state, including CVISN, electronic, walk-in, paper based, or legacy system transactions? Indicate both the total number of credentials and the total number of credentialed vehicles.

	New Credential	Renewal	Supplemental
Total number of transactions per year			
Total number of vehicles credentialed per year			

Consider the percentage of commercial motor carrier accounts in your state that apply for **IRP** credentials electronically. Complete the table below to show the approximate percent of motor carrier accounts using CVISN for **IRP** credentials now and those expected to be applying for such credentials in the future.

	Now	In 12 Months	In 5 Years
Total number of transactions per year			
Total number of vehicles credentialed per year			

Which third-party vendor (if any) does your state use for any aspect of **IRP** credentialing?

Check all that apply.

☐	ACS/VISTA/MVS Express
☐	Polk/COVERS/COVERSnet
☐	CACI International Inc.
☐	Not Applicable
☐	Other (please specify)”

Consider an **IRP** credentialing system as having two parts: a front-end user interface or data entry part and a back-end database management and data processing or reporting part. Use check marks in the table below to indicate who owns and who operates each of the various parts of your state’s electronic credentialing system for processing credentials. If the ownership or operation is a joint effort, briefly describe the arrangement in the space below.

	Owned by Your State	Owned by Vendor	Operated and Maintained Mainly by State Employees	Operated and Maintained Mainly by Vendor Employees
Front-end user interface system and related central-office hardware				
Back-end database management system and hardware				

How has CVISN changed the manner in which you operate your legacy **IRP** credentialing system? What has been the annual cost savings in terms of capital, operation and maintenance, or staff time tied to the continued operation of your legacy systems? Please attempt to document these savings.

Consider that prior to e-credentialing that a paper-based system required four actions on the part of the state authority issuing **IRP** credentials: a) sending the renewal notice and application to the motor carrier, b) processing the motor carrier's application and sending an invoice along with additional detail on the application to the motor carrier, c) state receives and processes payment, d) state sends credentials to carriers. Estimate the labor, mailing, and materials costs associated with each action on a per-transaction basis. In the rows below the four actions outlined in the table, please add other cost elements as appropriate. To the extent that cost information is not available please estimate the labor time taken on a per-transaction basis.

	Labor	Materials	Mailing Expense	Other (Please specify)	Total
Renewal Notice / Application					
Processing Application / Sending Invoice					
Payment Processing					
Send Credentials to Carrier					
Other					
Other					
Other					
Other					

IFTA Credentialing

Approximately how many commercial motor carrier accounts and commercial vehicles (power units) now have state-issued **IFTA** credentials in your state?

Number of Motor Carrier Accounts	Number of Commercial Vehicles

An **IFTA** credentialing transaction is defined as the process of obtaining new registration, renewals, or supplemental credentials for one or more vehicles. Approximately how may of each of the various credentialing transactions were processed in the past 12 months (or the latest reporting year) in your state, including CVISN, electronic, walk-in, paper based, or legacy system transactions? Indicate both the total number of credentials and the total number of credentialed vehicles.

	New Credential	Renewal	Supplemental
Total number of transactions per year			
Total number of vehicles credentialed per year			

Consider the percentage of commercial motor carrier accounts in your state that apply for **IFTA** credentials electronically. Complete the table below to show the approximate percent of motor carrier accounts using CVISN for credentials now and those expected to be applying for such credentials in the future.

	Now	In 12 Months	In 5 Years
Total number of transactions per year			
Total number of vehicles credentialed per year			

Which third-party vendor (if any) does your state use for any aspect of **IFTA** credentialing?

Check all that apply.

☐	ACS/VISTA/MVS Express
☐	Polk/COVERS/COVERSnet
☐	CACI International Inc.
☐	Not Applicable
☐	Other (please specify)”

Consider an **IFTA** credentialing system as having two parts: a front-end user interface or data entry part and a back-end database management and data processing or reporting part. Use check marks in the table below to indicate who owns and who operates each of the various parts of your state’s electronic credentialing system for processing credentials. If the ownership or operation is a joint effort, briefly describe the arrangement in the space below.

	Owned by Your State	Owned by Vendor	Operated and Maintained Mainly by State Employees	Operated and Maintained Mainly by Vendor Employees
Front-end user interface system and related central-office hardware				
Back-end database management system and hardware				

How has CVISN changed the manner in which you operate your legacy **IFTA** credentialing system? What has been the annual cost savings in terms of capital, operation and maintenance, or staff time tied to the continued operation of your legacy systems? Please attempt to document these savings.

Consider that prior to e-credentialing that a paper-based system required four actions on the part of the state authority issuing **IFTA** credentials: a) sending the renewal notice and application to the motor carrier, b) processing the motor carrier's application and sending an invoice along with additional detail on the application to the motor carrier, c) state receives and processes payment, d) state sends credentials to carriers. Estimate the labor, mailing, and materials costs associated with each action on a per-transaction basis. In the rows below the four actions outlined in the table, please add other cost elements as appropriate. To the extent that cost information is not available please estimate the labor time taken on a per-transaction basis.

	Labor	Materials	Mailing Expense	Other (Please specify)	Total
Renewal Notice / Application					
Processing Application / Sending Invoice					
Payment Processing					
Send Credentials to Carrier					
Other					
Other					
Other					
Other					

Credentials Administration Other than IRP and IFTA

If your state issues any other kinds of permits or credentials besides IRP and IFTA, complete the table below to indicate approximately how many applications were received for each kind of credential using CVISN technology in the past 12 months (or the last reporting year) in the first column. Then indicate in the second column how many applications were received by all methods combined (walk-in + paper forms + legacy system + CVISN, etc.).

	Applications Received Using CVISN	Total Applications Received by All Methods (CVISN + Non-CVISN)
Single State registration system		
Single trip (motor carrier, use fuel, permit)		
Registration (30-, 60-, 90-day)		
Envelope permits		
Oversize/overweight		
Other		
Other		
Other		

Appendix B.2. State Points of Contact

The following were the points of contact for the states interviewed for this report:

Montana

Dennis Hult
Montana Department of Transportation
Motor Carrier Services Division
Phone 406-444-9237
dhult@mt.gov

Alternate Montana contact: Drew Livesay, 406-444-7638, dlivesay@mt.gov

New Jersey

John Powers
New Jersey DOT
PO Box 600
Trenton, NJ 08625
Phone 609-530-5270
John.powers@dot.state.nj.us

Alternate New Jersey contact: Linda Forrester, 609-530-5590

New York

Donald Baker
New York State Department of Transportation
Passenger and Freight Safety Division
Phone 518-457-4613
dbaker@dot.state.ny.us

Alternate New York CVISN contact: Rick McDonough, rmcdonough@dot.state.ny.us

South Dakota

Anselem H. (Hal) Rumpca
South Dakota Department of Transportation
Division of Planning and Engineering
Office of Research
Phone 605-773-3852
hal.rumpca@state.sd.us

Alternate South Dakota contact: David Huft, phone 605-773-3358; dave.huft@state.sd.us

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Appendix B.3 Reported Unit Costs Or Computed Hourly Labor Cost

	Min	Mean	Median	Max	Std Dev	Response Count
6: EC One Time Start-up Costs, Equipment and Materials						
a. Computer network servers for electronic credentialing	$1,043	$26,384	$10,927	$70,925	27,612	10
b. Personal computers (desktop or laptop) for state employees to use in electronic credentials administration	$939	$17,626	$2,022	$152,419	47,390	10
c. Consumable supplies and materials for outreach, internal and external publicity, training, or supporting the deployment of electronic credentialing	$84	$13,328	$6,003	$52,151	17,519	12
Other: Bar code readers	$863	$863	$863	$863	NA	1
Other: Bar code readers for law enforcement	$539	$539	$539	$539	NA	1
Other: Fax machines-Ports of Entry	$313	$313	$313	$313	NA	1
Other: Maintenance contracts	$593,170	$593,170	$593,170	$593,170	NA	1
Other: Network infrastructure	$204,886	$204,886	$204,886	$204,886	NA	1
Other: ONE TIME SET UP FEES FOR ENTIRE CVISN SERVER PLATFORM	$11,624	$11,624	$11,624	$11,624	NA	1
Other: Printers (central office, high-capacity)	$5,392	$5,392	$5,392	$5,392	NA	1
Other: Printers capable of printing 2D bar codes (for tag agents)	$1,078	$1,078	$1,078	$1,078	NA	1
Other: Printers-Ports of Entry	$522	$522	$522	$522	NA	1
Other: Wireless modems for vehicle and/or roadside use.	$65	$65	$65	$65	NA	1

	Min	Mean	Median	Max	Std Dev	Response Count
7: EC One Time Start-up Costs, Software						
a. Credentialing software packages purchased for back-end database management and data processing or reporting	$27,100	$63,583	$50,261	$166,060	44,624	8
b. Credentialing software packages purchased for front-end user interface and data entry	$1,900	$352,323	$183,048	$1,671,440	590,014	7
Other: Amount for IFTA software development	$65,130	$65,130	$65,130	$65,130	NA	1
Other: Amount for IRP software development	$165,862	$165,862	$165,862	$165,862	NA	1
Other: Bar-code software for PRISM	$1,078	$1,078	$1,078	$1,078	NA	1
Other: Computer-to-computer communications	$8,088	$8,088	$8,088	$8,088	NA	1
Other: credit card	$386	$386	$386	$386	NA	1
Other: Database engines	NA	NA	NA	NA	NA	0
Other: Microsoft SourceSafe for 6 developers (config mgt)	$2,157	$2,157	$2,157	$2,157	NA	1
Other: MVS Express GUI User Interface	$44,283	$44,283	$44,283	$44,283	NA	1
Other: Oracle processing licenses and support (1 year)	$58,231	$58,231	$58,231	$58,231	NA	1
Other: Software purchase	$4,778	$4,778	$4,778	$4,778	NA	1
Other: System software for production and test environments	$91,302	$91,302	$91,302	$91,302	NA	1
Other: Third-party EFT software	$74,668	$74,668	$74,668	$74,668	NA	1
Other: User interface, web hosting, system performance	$261,526	$261,526	$261,526	$261,526	NA	1

	Min	Mean	Median	Max	Std Dev	Response Count
8: EC One Time Start-up Costs, Labor						
a. State employee labor for new electronic credentialing software development	$27	$57	$43	$136	38	7
b. State employee labor for new hardware configuration (after original installation)	$27	$38	$38	$49	16	2
c. Contractor labor for new electronic credentialing software development	$56	$163	$81	$434	181	4
d. Contractor labor for new hardware configuration (after original installation)	$86	$86	$86	$86	NA	1
e. Third-party vendor labor for software development	NA	NA	NA	NA	NA	0
f. Third-party vendor labor for hardware configuration	NA	NA	NA	NA	NA	0
g. Labor for existing (legacy) system interface and/or modification (state employee labor plus contractor or vendor labor)	$10	$51	$49	$94	36	4
h. Labor for training associated with credentialing system development	$27	$42	$43	$55	12	5
Other: CVISN system architect (contractor)	$118	$118	$118	$118	NA	1
Other: E-cred feasibility study; OS/OW permitting	NA	NA	NA	NA	NA	0
Other: IFTA/IRP program staff (state employees)	$24	$24	$24	$24	NA	1
Other: Intrastate Road Tax System	NA	NA	NA	NA	NA	0
Other: Maintenance	NA	NA	NA	NA	NA	0
Other: Miscellaneous A&E, hardware, software contracted	NA	NA	NA	NA	NA	0
Other: OS/OW System	NA	NA	NA	NA	NA	0
Other: Planning & Facilitation	NA	NA	NA	NA	NA	0
Other: Program queries by registration staff & law enforcement	$93	$93	$93	$93	NA	1
Other: Training and Travel	NA	NA	NA	NA	NA	0
Other: Travel expenses	NA	NA	NA	NA	NA	0
Other: VIN Edit interface	NA	NA	NA	NA	NA	0
Other: Web application hosting	$391	$391	$391	$391	NA	1

	Min	Mean	Median	Max	Std Dev	Response Count
9: EC Recurring Annual Operating and Maintenance Cost for IRP Credentialing System						
a. Membership fees paid to IRP Clearinghouse	NA	NA	NA	NA	NA	0
b. Fees paid to third-party IRP credentials administrator (for example, VISTA, Polk) for operating a back-end database management and data processing system	NA	NA	NA	NA	NA	0
c. Fees paid to third-party IRP credentials administrator (for example, VISTA, Polk) for operating a front-end user interface and data entry system	NA	NA	NA	NA	NA	0
d. Lease payments for computer equipment (specify function in comments section at right)	NA	NA	NA	NA	NA	0
e. Recurring costs for marketing, outreach, publicity, etc.	NA	NA	NA	NA	NA	0
Other: Annual costs for IRP/IFTA electronic credentialing	NA	NA	NA	NA	NA	0
Other: Meetings	NA	NA	NA	NA	NA	0
Other: Postage for notifying selected IRP registrants	NA	NA	NA	NA	NA	0
Other: South Dakota Automated Permitting and Routing System	NA	NA	NA	NA	NA	0
Other: Web application hosting	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
10: EC Recurring Annual Labor Cost for IRP Credentialing Legacy						
a. State employee annual labor CVISN	$27	$27	$27	$27	NA	1
a. State employee annual labor Legacy	$19	$110	$26	$626	227	7
b. Contractor annual labor CVISN	NA	NA	NA	NA	NA	0
b. Contractor annual labor Legacy	$54	$54	$54	$54	NA	1
c. Third-party vendor annual labor CVISN	NA	NA	NA	NA	NA	0
c. Third-party vendor annual labor Legacy	NA	NA	NA	NA	NA	0
Other: Travel for Prog Mgt CVISN	NA	NA	NA	NA	NA	0
Other: Travel for Prog Mgt Legacy	NA	NA	NA	NA	NA	0

	Min	Mean	Median	Max	Std Dev	Response Count
11: EC Recurring Annual Operating and Maintenance Costs for Electronic IFTA Credentialing System						
a. Membership fees paid to IFTA Clearinghouse	NA	NA	NA	NA	NA	0
b. Fees paid to third-party IFTA credentials administrator (for example, VISTA, Polk) for operating a back-end database management and data processing system	NA	NA	NA	NA	NA	0
c. Fees paid to third-party IFTA credentials administrator (for example, VISTA, Polk) for operating a front-end user interface and data entry system	NA	NA	NA	NA	NA	0
d. Lease payments for computer equipment (specify function in comments section at right in this row)	NA	NA	NA	NA	NA	0
e. Recurring costs for marketing, outreach, publicity, etc.	NA	NA	NA	NA	NA	0
Other: Bank Services	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
12: EC Recurring Annual Labor Costs for IFTA Credentialing CVISN						
a. State employee annual labor CVISN	$15	$21	$23	$27	6	3
b. Contractor annual labor CVISN	NA	NA	NA	NA	NA	0
c. Third-party vendor annual labor CVISN	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
12: EC Recurring Annual Labor Costs for IFTA Credentialing Legacy						
a. State employee annual labor Legacy	$15	$25	$24	$42	9	6
b. Contractor annual labor Legacy	NA	NA	NA	NA	NA	0
c. Third-party vendor annual labor Legacy	NA	NA	NA	NA	NA	0

	Min	Mean	Median	Max	Std Dev	Response Count
14: SIE One Time Start-up Costs, Equipment and Materials						
a. Computer network servers for safety information exchange, including mobile network servers used in roadside enforcement	$2,214	$15,442	$14,019	$32,350	10,981	11
b. Desktop personal computers for administering the safety information exchange system (including desktop computers used at roadside check stations)	$830	$1,885	$1,665	$4,313	1,013	10
c. Laptop personal computers for roadside use in inspections for safety information exchange	$2,588	$5,684	$4,039	$26,075	6,469	12
d. Portable printers for mobile enforcement	$209	$394	$362	$742	141	12
e. Wireless modems for vehicle and/or roadside use	$135	$1,604	$848	$5,392	1,935	8
f. Consumable supplies and materials for outreach, internal and external publicity, training, and supporting the deployment or safety information exchange	$4,428	$5,879	$5,392	$8,303	1,679	4
Other: Cisco router high capacity	$12,940	$12,940	$12,940	$12,940	NA	1
Other: Cisco router light capacity	$6,470	$6,470	$6,470	$6,470	NA	1
Other: Network equipment	$8,627	$8,627	$8,627	$8,627	NA	1
Other: Router	$5,392	$5,392	$5,392	$5,392	NA	1
Other: Satellite units in DPS mobile units	$1,618	$1,618	$1,618	$1,618	NA	1
Other: T1 Lines	$32,350	$32,350	$32,350	$32,350	NA	1
Other: T1 lines to fixed scales	$3,235	$3,235	$3,235	$3,235	NA	1
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
15 SIE One Time Start-up Costs, Software						
a. Safety information exchange software purchased off the shelf	$6,642	$12,606	$11,108	$21,567	6,437	4
Other: Code for CVIEWcs product from Cambridge Systematics	$104,301	$104,301	$104,301	$104,301	NA	1
Other: Notes on costs for Roadside Safety	NA	NA	NA	NA	NA	0
Other: VINA Vin number look up software	$54,246	$54,246	$54,246	$54,246	NA	1

	Min	Mean	Median	Max	Std Dev	Response Count
16: SIE One Time Start-up Costs, Labor						
a. State employee labor for new safety information exchange software development (for example, CVIEW)	$27	$48	$41	$104	25	8
b. State employee labor for new hardware configuration (after original installation)	$30	$32	$32	$34	2	2
c. Contractor labor for new safety information exchange software development	$38	$57	$59	$73	18	3
d. Contractor labor for new hardware configuration (after original installation)	NA	NA	NA	NA	NA	0
e. Third-party vendor labor for software development	NA	NA	NA	NA	NA	0
f. Third-party vendor labor for hardware configuration	NA	NA	NA	NA	NA	0
g. Labor for existing (legacy) system interface and/or modification (state employee labor plus contractor or vendor	$33	$68	$63	$108	38	3
h. Labor for training associated with safety information exchange system deployment	$23	$65	$65	$108	60	2
Other: CVISN system architect (contractor)	$118	$118	$118	$118	NA	1
Other: OS/OW System, SSRS, Intrastate Road Tax	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
17: SIE Recurring Annual Operating and Maintenance costs						
a. Lease payments for computer equipment for safety information exchange	NA	NA	NA	NA	NA	0
b. Telephone and internet service charges	NA	NA	NA	NA	NA	0
c. Wireless communication charges	NA	NA	NA	NA	NA	0
d. Charges for linking to central data services (for example, AAMVAnet)	NA	NA	NA	NA	NA	0
Other: Charges for DB2 CPU for CVIEW	NA	NA	NA	NA	NA	0
Other: MQ Websphere annual license fee	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
18: SIE Recurring Annual Labor Cost						
a. State employee annual labor	$22	$33	$30	$52	11	7
b. Contractor annual labor	$11	$51	$58	$77	28	4
c. Third-party vendor annual labor	$75	$75	$75	$75	NA	1
Other: Expenses, contractor	NA	NA	NA	NA	NA	0
Other: Expenses, state govt	NA	NA	NA	NA	NA	0

	Min	Mean	Median	Max	Std Dev	Response Count
19: ES One Time Start-up Cost, Equipment and Materials						
a. Computer network server dedicated to electronic screening	$3,235	$15,052	$14,019	$26,400	8,958	5
b. Desktop personal computer dedicated to electronic screening	$2,533	$2,903	$2,921	$3,235	385	4
c. Laptop personal computer dedicated to electronic screening	$3,235	$94,412	$3,235	$276,766	157,923	3
d. Mainline (highway speed) weigh-in-motion (WIM) scale	$43,134	$265,769	$251,366	$847,582	261,720	9
e. Sorter lane (ramp speed) WIM scale	$20,489	$286,870	$193,736	$739,520	319,889	4
f. In-vehicle transponder purchased by state for distribution (free of charge) to motor carriers enrolling vehicles in electronic screening	$13	$38	$47	$54	22	3
g. In-vehicle transponder purchased by state for resale (cost-recovery or other basis) to motor carriers enrolling vehicles in electronic screening	$38	$46	$46	$54	11	2
h. Automated vehicle identification (AVI) equipment/system (in the comments section at the right of this row, specify type, for example, DSRC, optical, video, other)	$15,097	$147,054	$80,451	$417,204	153,048	6
i. Telecommunication equipment between upstream site and weigh station/base	$900	$38,842	$17,183	$120,100	55,735	4
j. Electronic sign for weigh station	$6,642	$37,061	$34,617	$81,355	27,767	6
k. Loop detector for weigh station	$539	$4,404	$1,771	$12,371	4,996	5
l. Upgrade of existing fixed-site weigh station infrastructure (excluding items listed above) for electronic screening (specify function in comments section at right in this row)	$5,500	$117,283	$47,605	$427,634	176,217	5
m. One-time start-up fees paid to electronic screening provider or partnership (for example, PrePass, Norpass)	$13,285	$15,342	$15,645	$16,606	1,297	5
n. Consumable supplies and materials for outreach, internal and external publicity, training, or supporting the deployment of electronic screening	$3	$1,325	$1,348	$2,600	1,249	4
Other: Cabinets and consoles	$41,950	$41,950	$41,950	$41,950	NA	1
Other: Electronic screening system	$625,806	$625,806	$625,806	$625,806	NA	1
Other: laptop and software	$2,696	$2,696	$2,696	$2,696	NA	1
Other: Lightning protection system	$2,451	$2,451	$2,451	$2,451	NA	1
Other: Mainline compliance tracking system	$21,567	$21,567	$21,567	$21,567	NA	1
Other: Overheight detectors	$539	$539	$539	$539	NA	1
Other: Remote camera with video transceiver	$3,235	$3,235	$3,235	$3,235	NA	1
Other: Sales tax, contingency, unforeseen costs	$324,452	$324,452	$324,452	$324,452	NA	1

	Min	Mean	Median	Max	Std Dev	Response Count
20: ES One Time Start-up Purchase Costs for Software						
a. Electronic screening software purchased off the shelf	$539	$2,251	$1,900	$4,313	1,911	3
Other: Data base and software licenses	$2,157	$2,157	$2,157	$2,157	NA	1
Other: ModelMACS	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
21: ES One Time Start-up Costs, Labor						
a. State employee labor for electronic screening software development	$30	$32	$32	$34	3	2
b. State employee labor for new hardware configuration (after original installation)	$30	$32	$32	$34	2	2
c. Contractor labor for electronic screening software development	NA	NA	NA	NA	NA	0
d. Contractor labor for new hardware configuration (after original installation)	NA	NA	NA	NA	NA	0
e. Third-party vendor labor for software development	$33,833	$33,833	$33,833	$33,833	NA	1
f. Third-party vendor labor for hardware configuration	NA	NA	NA	NA	NA	0
g. Labor for existing (legacy) system interface and/or modification (state employee labor + contractor or vendor labor)	$30	$69	$69	$108	55	2
h. Labor for training associated with system deployment	$33	$286	$286	$539	358	2
Other: Contractor labor and material costs for the Jefferson POE	NA	NA	NA	NA	NA	0
Other: CVISN system architect (contractor)	$118	$118	$118	$118	NA	1
Other: Enforcement and engineering program staff (state employees)	$35	$35	$35	$35	NA	1
Other: Site design, engineering, construction for 8 sites	NA	NA	NA	NA	NA	0
Other: State employee labor and costs for the Jefferson POE	$41	$41	$41	$41	NA	1

	Min	Mean	Median	Max	Std Dev	Response Count
22: ES Recurring Annual Operating and Maintenance Cost						
a. Lease payments for computer equipment for electronic screening	NA	NA	NA	NA	NA	0
b. Annual payments made to electronic screening administrator/vendor/partnership (for example, PrePass, Norpass)	NA	NA	NA	NA	NA	0
c. Annual maintenance cost for mainline WIM scale	NA	NA	NA	NA	NA	0
d. Annual maintenance cost for sorter-lane WIM scale	NA	NA	NA	NA	NA	0
e. Annual maintenance cost for other roadside equipment (AVI, transponder readers, etc.)	NA	NA	NA	NA	NA	0
f. Recurring costs for marketing, outreach, publicity, etc.	NA	NA	NA	NA	NA	0
Other: Expenses for Ag Elec Bill of Lading Program	NA	NA	NA	NA	NA	0
Other: Maintenance of E-Screening systems (AVI/WIM)	NA	NA	NA	NA	NA	0
	Min	**Mean**	**Median**	**Max**	**Std Dev**	**Response Count**
23: ES Recurring Annual Labor Cost						
a. State employee annual labor	$25	$33	$30	$49	10	5
b. Contractor annual labor	NA	NA	NA	NA	NA	0
c. Third-party vendor annual labor	NA	NA	NA	NA	NA	0

APPENDIX C. SAFETY ANALYSIS FINAL REPORT

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1.0 Introduction

This document is the Final Report for the safety analysis portion of the CVISN National Evaluation. The remainder of this section provides information on the safety analysis objectives and hypotheses, and a preview of the organization of this report.

1.1 Evaluation Objectives and Hypotheses

A Test Plan for carrying out the Safety Analysis was submitted to USDOT (January 19, 2007a), documenting the specific data collection and analysis methods to be used to address Goal Area 1 of the CVISN National Deployment Evaluation: ***"Measure the effects of CVISN technologies on the safety of trucks and the general traveling public, through improved roadside enforcement and administrative processes."***

Objectives and hypotheses for the safety analysis were as follows:

Objective 1.1 - Evaluate current and potential future inspection selection methods used (e.g., Inspection Selection System, or ISS, and Query Central)

> **Hypothesis:** Inspectors use national and state data at the roadside in different ways to help make inspection selection decisions
>
> **Hypothesis:** Various national and state data sources can be effectively integrated (consistent with the National ITS Architecture) for efficient use by roadside inspectors
>
> **Hypothesis:** If inspectors could have access to real-time, updated safety information based on accurate vehicle or carrier identity, then inspectors would use that information to help make inspection selection decisions
>
> **Hypothesis:** Inspectors' use of visual cues and intuition to select trucks for inspection will decline as the ready availability of more accurate, convenient, historical data increases at the roadside check station

Objective 1.2 - Determine effectiveness of CVISN at increasing the efficiency of inspections (i.e., focusing on high-risk or noncompliant carriers, vehicles, and drivers)

> **Hypothesis:** The availability of real-time safety information at the roadside, combined with other available or developmental roadside measures (e.g., in-vehicle transponders for automatic vehicle identification, or AVI, license plate readers, weigh-in-motion, or WIM scales, remote video imagery), will help inspectors more effectively target higher-risk carriers, vehicles, and drivers
>
> **Hypothesis:** The availability of real-time credentials and licensing information at the roadside will help inspectors more effectively target noncompliant carriers, vehicles, and drivers

Objective 1.3 - Determine reductions in crashes, injuries, and fatalities nationwide under various deployment scenarios

> **Hypothesis:** If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided directly, through increased inspection efficiency

> **Hypothesis:** If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided indirectly, through increased motor carrier compliance with safety and licensing regulations

Section 2.0 presents a list of the data collected to achieve the research objectives along with a high-level description of the safety analysis approach. Section 3.0 provides an assessment of CVISN deployment from a national perspective along with various states' strategies in selecting vehicles for inspection. Section 4.0 provides detailed information on the techniques used in field study data collection as well as how these data were used to meet the objectives of the independent evaluation. The inspection efficiency of inspection sites in four states is assessed in Section 5.0. In this section, summary results for studies in Ohio, Colorado, Kentucky, and New York are presented. More detailed results for these four states can be found in Appendices C.2 through C.5. Section 6.0 covers the safety benefits calculated based on various scenarios if roadside inspectors had instant, real-time (or advance) access to truck and motor carrier historic safety/inspection/driver information via CVISN technologies. Appendices C.1 through C.10 contain supplemental information and more detailed results pertinent to the safety evaluation.

Table C-1 lists the evaluation objectives and hypotheses and maps them to the section of this report where methodologies and findings for the hypotheses are addressed. Only appendices having a direct link to evaluation hypotheses are shown in Table C-1.

Table C-1. Study Hypotheses and Section of Report Detailing Findings

Objectives/Hypotheses	3.0 - Assessment of State CVISN Deployments	4.0 - Field Study Data Collection	5.0 Field Study Results	6.0 Safety Benefits	Appendix
1.1 Evaluate current and potential future inspection selection methods					
Inspectors use national and state data at the roadside in different ways to help make inspection selection decisions	**X**	**X**			
Various national and state data sources can be effectively integrated for efficient use by roadside inspectors	**X**	**X**			
If inspectors could have access to real-time, updated safety information based on accurate vehicle or carrier identity, then inspectors would use that information to help make inspection selection decisions	**X**	**X**			**C.6, C.7**
Inspectors' use of visual cues and intuition to select trucks for inspections will decline as the ready availability of more accurate, convenient, historical data increases at the roadside check station	**X**	**X**			
1.2 Determine effectiveness of CVISN at increasing the efficiency of inspections (i.e. focusing on high-risk on noncompliant carriers, vehicles, and drivers)					
The availability of real-time safety information at the roadside, combined with other available or developmental roadside measures will help inspectors more effectively target higher-risk carriers, vehicles, and drivers		**X**	**X**		**C.2, C.3, C.4, C.5**
The availability of real-time credentials and licensing information at the roadside will help inspectors more effectively target noncompliant carriers, vehicles, and drivers		**X**			**C.8**
1.3 Determine reductions in crashes, injuries, and fatalities nationwide under various deployment scenarios					
If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided directly, through increased inspection efficiency		**X**		**X**	**C.9, C.10**
If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided indirectly, through increased motor carrier compliance with safety and licensing regulations		**X**		**X**	

Appendices C.2-C.4: Field Study Results for New York, Colorado, Kentucky, and Ohio respectively
Appendix C.6: Prior Research on Infrared Brake Screening Technology for CMVs
Appendix C.7: Availability of Inspections in SAFER
Appendix C.8: Potential for Using Credentialing Data in Roadside Enforcement
Appendix C.9: Safety Benefits Using Mainline Screening of Indexed ISS Score
Appendix C.10: Alternate Crash Avoidance Model

2.0 Approach

Data to address the evaluation objectives and hypotheses were collected from states through three methods: (1) Examination of existing data sources such as the CVISN Self-Evaluation Database (Appendices G and H) and the CVISN State Deployment Matrix (Table 4-1 in the main report); (2) Phone interviews with various state CVISN officials; and (3) Field studies conducted at inspection sites located in Colorado, New York, Ohio, and Kentucky.

First, state-supplied information contained in the CVISN State Deployment Matrix, maintained by Johns Hopkins University Applied Physics Laboratory (JHU/APL), and the CVISN self-evaluation database was compiled to characterize how states utilize specific types of CVISN screening and safety data exchange technologies at their inspection sites to help them make inspection selection decisions. Additional input was also solicited directly from states by the evaluation team. Finally, all CVISN states were invited to participate in this research by nominating themselves for inclusion in the evaluation. States that responded and that looked the most promising were selected to participate in a phone interview with the evaluation team where a more in-depth investigation of each state's current approach to the roadside screening and inspection process was conducted. Results from the phone interviews were also used to identify those states that were the most able to contribute to the evaluation and that were interested in participating in the field studies. States that offered different perspectives on safety by having a variety of sites and techniques, or states whose roadside operations represented the operations of a large number of similar states, were considered ideal candidates for the field studies. Other factors in the selection of sites included geographic diversity (each state from the other, and compared with the states that were central to the CVISN Model Deployment Initiative, or MDI evaluation), and the variety of CVISN deployment approaches in each state. CVISN officials at the departments of transportation and law enforcement agencies from each state interviewed were very cooperative in the evaluation.

One reason for Ohio's inclusion was their relatively high level of commercial vehicle inspection activity as reported in the CVISN Self-Evaluations. Colorado has an active program of truck crash analysis and collects an abundance of truck data at inspection stations allowing for a convenient way to identify high-risk carriers and trucks. Furthermore, the roadside operations of Ohio and Colorado represent the operations of a large number of similar states. New York expressed interest in linking carrier information to specific vehicles. New York performs all commercial vehicle inspections at temporary or mobile sites, having no permanent weigh/inspection facilities. This unique facet makes New York an attractive choice as it provided a different perspective on mobile inspection methods and safety enforcement.

Other data sources used in this evaluation included various federal and state safety data sources as well as past federal studies that relate to commercial motor vehicle crashes and safety.[1] Listed below are the main data used and the role each data source played in achieving the goals of the evaluation:

[1] Data from Kentucky were developed under a separate but related USDOT task order, BA34018, on the same contract as the National Evaluation, DTFH61-02-C-00134 (FMCSA 2008a,b).

- **CVISN Self Evaluation Database and CVISN State Deployment Matrix**. A review of the self-evaluation template data and state deployment matrix as they relates to state-offered CVISN technologies for roadside screening and enforcement for each state was conducted to provide an initial idea of how states utilize specific types of CVISN screening and safety data exchange technologies at their inspection sites to help them make inspection selection decisions.

- **Interviews with state CVISN program managers, specialists, and roadside inspectors**. Information was compiled from 10 states to characterize and understand each state's current approach to the roadside screening and inspection process as well as the data sources used in the inspection process.

- **Interviews with CVISN experts and stakeholders (Volpe National Transportation Systems Center, JHU/APL, Upper Great Plains Transportation Institute, HELP PrePass, Norpass).** Information was collected from individuals who are involved in the design, development, implementation, and monitoring of CVISN activities as to the specific CVISN activities and technologies adopted by certain states related to roadside screening and enforcement. This information was combined with data obtained from state officials to characterize how different states utilize specific types of CVISN screening and safety data exchange technologies at their inspection sites to help them make inspection selection decisions.

- **USDOT numbers for all trucks that traversed an inspection station during separate field studies conducted in Colorado, New York, Ohio, and Kentucky (during normal daytime hours).** This collection of USDOT numbers provided a representative sample of carriers that traverse each inspection station. The USDOT numbers were used to acquire various carrier demographic information as well as current and historical safety information from federal and state data sources.

- **Norpass (electronic screening/pre-clearance) bypass decisions per truck for one week during Kentucky field study.** This data was used to understand the number of trucks that utilize the Norpass system at the Laurel County station in Kentucky as well as to provide an idea of the percentage of trucks that are given green and red lights to either bypass or pull into the station. Data on these trucks were combined with data from the trucks that entered the station. Electronic screening (ES) information was not available in the other states.

- **Electronic copies of inspections performed during field studies.** These inspections provided the evaluation team insight into the types of vehicles that are selected for inspection at the each inspection station. The inspection reports contained information on the specific types of violations found during the inspection. In addition, USDOT numbers of vehicles inspected were cross-referenced with federal and state data sources to learn more about the safety risk of carriers that are inspected at each site.

- **Electronic copies of statewide inspections spanning 1 to 3 years (depending on state availability).** These inspection reports provided a more robust picture of trucks selected

- **SAFER.** A copy of the SAFER (Safety and Fitness Electronic Records) carrier and inspection tables was obtained from the Volpe Center at the time of the field study. SAFER was used to obtain current safety risk measures such as SafeStat (Safety Status Measurement System) and ISS scores in addition to other historical safety-related information on trucks observed during the field study as well as those trucks that were inspected statewide historically. SAFER enabled the evaluation team to place both observed and inspected trucks into safety risk categories defined by their current ISS score.

- **Large Truck Crash Causation Study (LTCCS).** Data from the LTCCS were used to identify those OOS violations that present a high relative crash risk. This was important in that a larger number of crashes could be avoided by finding those OOS violations in an inspection that have a higher relative crash risk.

- **2003 National Truck Fleet Safety Survey.** An FMCSA-sponsored survey in which approximately 2,800 trucks were selected at random for inspection in order to estimate the percentages of trucks and drivers that operate with OOS conditions. These OOS rates were used as estimates for the probability of finding an OOS violation when inspectors select trucks for inspection randomly.

- **Large Truck Crash Facts – 2005.** Federal statistics on the number of crashes, injuries, and fatalities in which large commercial vehicles were involved were used to help estimate the safety benefits involved in various roadside deployment scenarios.

The goal of roadside enforcement is to avoid as many crashes as possible by putting unsafe vehicles OOS before those conditions present on the vehicle contribute to a crash. A means to this end is to improve the inspection selection process in such a way that the greatest benefit can result from a fixed number of inspections. This makes the most efficient use of limited time, human resources, and facilities. The overall approach of this evaluation is to first assess the effectiveness of the current inspection selection methods at selecting high-risk trucks.

In addition, alternative methods for selecting vehicles for inspection were evaluated based on potential availability of information from the above data sources. First, the most basic selection process of selecting vehicles randomly for inspection is addressed. This is presented mainly to assess the contribution of the inspectors' knowledge and experience when examining the current vehicle selection process used in the four states. Other scenarios make use of progressively more involved selection criteria. One involves using electronic screening[2] to eliminate all low and

[2] The term "electronic screening" is defined, for purposes of this study, as using any computer-based, real-time information source to aid in selecting trucks for inspection, whether the truck carries a transponder or not, and

medium-risk carriers from selection consideration so that inspectors can focus on high-risk trucks or those with insufficient safety information in federal databases. There are multiple metrics to use when assigning commercial vehicles to safety risk categories. Two that were explored were the carrier's ISS score, a rating system promoted by USDOT, and the carrier's vehicle and driver OOS rates, metrics preferred by Kentucky in roadside enforcement. Additional scenarios examined other novel approaches that can be defined using other types of data that could be made available at the roadside. In particular, the scenarios use information on OOS violations with a high relative crash risk.

Finally, the evaluation measured the success of these new inspection selection methods by simulating what would happen if inspectors used this additional information to select high-risk trucks for inspection. The measures used to evaluate success were the estimated number of crashes, injuries, and fatalities avoided.

3.0 Assessment of State CVISN Deployments

Since the MDI Evaluation (2002), many more states have adopted CVISN roadside screening and enforcement technologies. As of spring 2008 there were 20 Expanded CVISN states that had completed Core Deployment. An additional 25 states along with the District of Columbia were in the midst of the Core Deployment Phase, while the remaining 5 states were in the Core Planning and Design Phase. As such, there is a wide range in the level of CVISN sophistication and capabilities across different states as indicated in Table 4-1 in the main report. Data on current capabilities were compiled to characterize how states utilize specific types of CVISN screening and safety information exchange (SIE) technologies at their inspection sites to help them make inspection selection decisions. The range of manual and automated inspection selection methods and supporting data systems (e.g., SAFER, Query Central) that are currently being used were identified as were any state-of-the-art practices. Specific attention was focused on the degree to which sites are integrating various national and state data sources.

Section 3.1 of this appendix provides a description of each data collection method and the types of data collected from each one to assess state capabilities. Section 3.2 of this appendix examines results from a handful of states that were interviewed as part of this evaluation. The range of state CVISN deployments across the U.S., in all of the CVISN technology areas, is presented in detail in Section 4.0 of the main report.

3.1 Data Collection

3.1.1 CVISN Self-Evaluation Database

Self-evaluation reporting templates have been completed by state transportation and law enforcement officials between 2003 and the present. The deployment template of the CVISN

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whether the screening occurs at mainline or ramp/sorter-lane speeds. Further details are provided in Section 6.2 below.

self-evaluation survey contains five sections and 62 questions, which collectively provide general information, including 1) information about the respondents; 2) credential administration information such as IFTA, IRP, and other credentials statistics; 3) roadside SIE data; 4) roadside ES system overviews; and 5) general information about CVISN deployment. The information provided by the states in the deployment template is essential and plays a central role in determining the scale of a state's operations in terms of ES, and use of CVISN technologies for roadside enforcement. Currently, more than 20 states have completed their self-evaluation reports, with partial data from a number of other states.

A review of the self-evaluation template data as it relates to state-offered CVISN technologies for roadside screening and enforcement for each state was conducted.

3.1.2 CVISN State Deployment Status Provided by JHU/APL

The deployment status of CVISN technologies across the U.S., in terms of SIE, ES, and Electronic Credentialing (EC), is continually monitored and updated by JHU/APL with information provided by the states. The last available update was in August of 2006. JHU/APL was in the process of updating the information in late 2007 but the update was not was available at the time this safety analysis report was written. The August 2006 information was used in this evaluation with an understanding that a number of states have made progress in CVISN deployment since that time.

3.1.3 Phone Interviews

A series of phone interviews were conducted with state CVISN officials from a sample of 10 states. States were chosen so that a broad representation of CVISN deployment levels could be covered. Initial information on state deployments came from information presented in monthly CVISN roadside enforcement conference calls organized by JHU/APL. Through these interviews, information was compiled to characterize the state's approach to the roadside screening and inspection process. One objective was to understand the layout of the inspection facilities and the specific mechanisms and policies in place to support roadside screening and enforcement. Another objective was to understand the state's philosophy on CVISN technologies and to identify any constraints the state has experienced in adopting and implementing these technologies. For states that have completed a CVISN Self-Evaluation, these phone interviews provided an opportunity to better understand the Self-Evaluation data and to ensure that the data were interpreted correctly. For states that had not completed a Self-Evaluation, this phone interview helped gather new information.

A secondary goal of the phone interview was to identify those states that were the most able to participate in one of the field observation studies. States that offered different perspectives on safety by having a variety of sites and techniques, or states whose roadside operations represented the operations of a large number of similar states, were considered ideal candidates for the field tests.

Appendix C.1 contains a complete list of the questions that were used in the phone interviews. The questionnaire was divided into three sections:

- General Questions – These questions characterize the operations and layout of the different types of inspection sites within the state.
- CVISN Deployment – These questions characterize the level and type of CVISN technologies used to make inspection selection decisions.
- Attitudes Toward CVISN Roadside Technologies – These questions capture the state's views on CVISN in terms of benefits the state has realized in conjunction with implementation of CVISN technologies. They also look at limitations and barriers states have experienced in working with CVISN.

In all, 10 states were interviewed. Table C-2 provides a listing of the states, the corresponding state officials interviewed, and other information about the state.

3.1.4 Interviews with CVISN Experts/Stakeholders

Interviews were also conducted with CVISN experts at the federal level. CVISN experts from FMCSA and program support organizations who are involved in the design, development, implementation, and monitoring of CVISN activities were able to provide invaluable information as to the specific CVISN activities and technologies adopted by certain states related to roadside screening and enforcement. Table C-3 provides a list of organizations and personnel that provided information.

The JHU/APL is working with USDOT to improve the safety and efficiency of operations for commercial vehicles (trucks and buses). Under contract from FMCSA to provide support to the CVISN program, Valerie Barnes and Mary Stuart of JHU/APL among others are actively involved in coordinating CVISN planning and deployment activities among all the stakeholders. As part of this coordination effort, JHU/APL records and tracks the states' progress and adherence to CVISN design requirements in all the capability areas. JHU/APL provided the latest information on CVISN deployment, which was instrumental in understanding the current state of the CVISN program.

Dr. Brenda Lantz of the Upper Great Plains Transportation Institute (UGPTI) provided insight into various methods for determining the safety risk of commercial vehicles. Since one goal of CVISN is to inspect trucks that are more risky from a safety perspective, it is essential to have a sound methodology for determining the risk rating for each truck and thus identifying those that are high-risk. Dr. Lantz provided information on how the SafeStat and ISS algorithms were created and then later modified to provide more accurate safety-related information. She provided advice to the evaluation team in an effort to define the various risk categories that were used for various analyses in this report.

Table C-2. State Interview Information

State	Contact	Organization	Level of CVISN Deployment	Date of Interview	Electronic Screening
New York	Don Baker	NY Dept of Transportation	Core Deployment	3/28/2006	None
Ohio	Alan Martin	Ohio Public Utilities Commission	Completed Core Deployment	4/20/2006	PrePass
	Skip Dodd, James Feddern, Robert Knauff	Ohio State Highway Patrol		7/20/2006	
Utah	Carrie Silcox	Utah Dept of Transportation	Completed Core Deployment	5/3/2006	PrePass
Oklahoma	Valinda Gorder	CVISN Project Manager, Parker Young	Core Deployment	5/4/2006	PrePass
Tennessee	Michael Meador	Tennessee Department of Safety	Completed Core Deployment	5/11/2006	PrePass
	Capt Steve Binkley	Tennessee Highway Patrol			
Florida	Richard and Sharon Easley	E-Squared Engineering	Core Deployment	5/23/2006	PrePass
	Mike Akridge	Florida Dept of Transportation		7/19/2006	
Texas	Tammy Duncan	Southwest Research Institute	Core Deployment	6/7/2006	None
	David Doyle	Department of Public Safety		6/23/2006	
Washington	Douglas Deckert	WSDOT	Completed Core Deployment	9/11/2006	Norpass
	Ross Morris	WSDOT			
	Jim Stuart	WSDOT			
	John Nicholas	Washington State Patrol			
	William Balcom	WSDOT			
	Capt Coral Estes	Washington State Patrol			
Colorado	Alan Rutledge	Colorado Department of Revenue	Completed Core Deployment	12/6/2006	PrePass
Kentucky	David Hunsucker	Kentucky Transportation Center	Completed Core Deployment	1/24/2007	Norpass
	Mark Bell	Kentucky Transportation Center			

Table C-3. CVISN Experts/Stakeholders Interviewed

Organization	Contact
FMCSA	Jeff Hall
Volpe National Transportation Systems Center	Jingfei Wu
Johns Hopkins University Applied Physics Laboratory	Valerie Barnes, Mary Stuart
Upper Great Plains Transportation Institute	Brenda Lantz
HELP PrePass	Jim Gentner
Norpass	Mark Spellman

Dr. Lantz also provided results of a survey conducted of state CVISN representatives in October 2004 assessing the use of ISS and other technologies as part of the screening and inspection processes (UGPTI, 2004a,b). Some results from this survey were used in this analysis.

Jeff Hall of FMCSA organized a conference call involving FMCSA, Brenda Lantz, members of the Compass Pilot Connectivity Team, and the independent evaluation team. The Compass Connectivity Test was a pilot test involving three states (Kentucky, Tennessee, and Arizona) in which data connectivity at the roadside was examined. The pilot team was tasked to assess states' needs for data connectivity at the roadside, implement solutions, and examine metrics to determine and compare the speed of various data upload and download methods. Specific technologies examined were wireless air cards, private radio networks, and satellite communications. The test focused on communication efforts after the decision had been made to select a specific truck for inspection. Thus, attention was focused on getting data from Query Central to populate Aspen and then to upload the inspection report to SAFER. At the time of the conference call, the pilot was ongoing and there were no plans to make the results publicly available.

Conversations with Jingfei Wu of the Volpe Center resulted in an understanding of the most recent advances in SAFER. SAFER is a component of ITS and supports data exchange operations for U.S. inter- and intrastate carriers as well as Canadian and Mexican intrastate carriers. SAFER uses other systems as its primary source of data, e.g., SAFETYNET and MCMIS (Motor Carrier Management Information System). It is a national on-line system that provides standardized carrier, vehicle, and driver snapshots and reports containing safety and credentials information to authorized users. Ms. Wu explained the different methods by which SAFER can be accessed at the roadside by inspectors. Predominantly, SAFER is accessed either directly through the SAFER web site or through Query Central. For each of the field observational studies associated with this evaluation, Ms. Wu provided the evaluation team with a snapshot of certain parts of the SAFER database. Specifically, she provided the Carrier, Inspection, and Temp Transaction tables for use in the field studies analyses. This information was used to assess the degree to which SAFER is being used at the roadside as well as to provide SafeStat and ISS ratings for all trucks observed at weigh stations during our field studies.

Jim Gentner of HELP/PrePass and Mark Spellman of Norpass provided statistics on current membership and recent growth of their respective mainline ES (preclearance) systems. In addition, both were helpful in providing detailed explanations on the functionality of the

screening systems and in understanding enhancements to these systems since the CVISN MDI evaluation (USDOT 2002).

3.2 State CVISN Usage as of 2005/2006

Overall, there was a wide variation in CVISN capabilities among the states interviewed. Some states were well-established in their CVISN programs and were expanding by deploying some state-of-the-art technologies in screening and data collection. Other states are earlier in their CVISN development and are working hard to integrate CVISN technologies into their roadside practices. State CVISN deployment is described at an overview level for all states in Section 4.1 of the main CVISN National Evaluation report. In this section, a more detailed discussion of CVISN usage is presented using results from the ten state interviews.

Based on information collected from interviews with state CVISN representatives and other sources such as the CVISN Self-Evaluation Database and FMCSA support organizations, three settings depicting CVISN capabilities and development are presented in this section. These settings are defined by the level of CVISN services used in the state for the roadside screening and inspection processes. Most data comes from the state interviews since they represent more recent information than reported by states in the Self-Evaluation Database in most cases. States interviewed were placed into one of the three settings. Interviews were conducted from early 2005 through 2006, so most findings below reflect CVISN capability information as of that time frame. These state placements are necessarily somewhat subjective. Also, if a state has further developed or changed its CVISN capabilities recently, such changes may not be reflected in the settings.

The three CVISN Capability Settings are defined as follows:

- Setting A – State has achieved CVISN Core (formerly known as Level 1) Deployment and is more advanced in its vehicle screening and SIE processes

- Setting B – State has achieved CVISN Core Deployment or is very close to doing so – its operations are not as advanced as Scenario A

- Setting C – State is currently using few CVISN technologies or is in the early stages of developing them.

Based on the results of the state interviews, Table C-4 shows the interviewed states that best matched up with each setting at the time. Following the table, more information about each setting is provided along with summaries of state capabilities for all interviewed states. The states listed in Table C-4 are representative of many more CVISN participating states. As an example of the changing deployment conditions in many states, Texas was classified as a Planning State based on its June 2006 interview. Since that time, Texas has been more active in the commercial vehicle inspection process and has made significant progress on its Border Safety Inspection Facility (BSIF) program. Some information on this program received in February 2008 is presented in the Texas discussion below. It was not, however, used in classifying Texas.

Table C-4. Interviewed States Assigned to CVISN Capability Settings

Setting A – Advanced States	Setting B – Deploying States	Setting C – Planning States
Colorado	Florida	Oklahoma
Kentucky	New York	Texas
Tennessee	Ohio	
Washington	Utah	

Setting A: Advanced States

This setting depicts states that are very involved in CVISN capability development and are more advanced in their roadside screening and inspection processes. Characteristics associated with these states include:

- State relies heavily on safety and credential related information to make inspection decisions
- State regularly uses federal data sources and tools such as SAFER, Query Central, and L&I (License and Insurance)
- State is involved in developing or implementing new technologies to improve the data available to make inspection decisions and the manner in which data is collected.

States in setting A demonstrate that various national and state data sources can be effectively integrated for efficient use by roadside inspectors. Inspectors in these states are more inclined to utilize real-time, updated safety information as their main source of information to help make inspection selection decisions while still relying somewhat on visual cues and intuition. Table C-5 provides a summary information for interviewed states that were classified as Advanced states.

Colorado

Colorado has ten Port of Entry locations on major interstates leading into the state along with a few internal ports. Some locations have inspection sites on both sides of the interstate. They have 17 PrePass sites with 11 of them containing mainline WIMs tied to PrePass. They have completed deployment of Core CVISN capabilities. In addition to PrePass, Colorado has a unique method for preclearing vehicles at all their ports. For each vehicle entering the port, a counter officer will enter the last eight characters of the Vehicle Identification Number (VIN) into a Colorado Port of Entry Business System. State law requires that commercial carriers that travel through Colorado have these last eight characters displayed on their cab. The business system consists of a database that contains all vehicles registered in Colorado plus any vehicles that have been cleared through a Colorado port in the past. Through their business system, counter officers and inspectors can look at carrier and vehicle safety and credential information to help them make an instantaneous decision to inspect the vehicle.

Table C-5. Major Features of Setting A (Advanced) Interviewed States

	Colorado	Kentucky	Tennessee	Washington
CVISN Level	Completed Core Deployment	Completed Core Deployment	Completed Core Deployment	Completed Core Deployment
Number of Fixed Sites	10 Ports of entry on major interstates (few internal sites)	17	5	52
E-Screening	PrePass (all major ports)	Norpass (12 sites)	PrePass (all 5 sites)	Norpass (10 sites)
WIMs (weigh-in-motion scales)	Mainline tied to PrePass	Mainline and sorter lane	At one station	Mainline and sorter lane
Primary Inspection Selection Method	ISS Score, visual inspection, inspector experience and judgment	OOS rate algorithm, visual inspection, inspector experience and judgment	Visual inspection, inspector experience and judgment, limited use of ISS	Visual inspection, inspector experience and judgment, weight of vehicle, e-screening results
CVIEW[a]	Yes	No but in development	Yes	Yes
Comments	Records and stores USDOT of every truck that clears all ports	ISSES located at 3 sites (USDOT and license plate reader, thermal imaging system, radiation detection monitor)	One site with license plate reader and radiation detection equipment	Very advanced e-screening system

a. CVIEW = Commercial Vehicle Information Exchange Window

Although not directly connected to federal systems such as SAFER, safety information is downloaded quarterly from SAFER and other systems. Once a VIN is entered, the computer screen in the scale house instantly shows data on the tractor that is on the scale, particularly a green, yellow, or red square indicating bypass (green), optional (yellow), and inspect (red) based on their ISS score. The local database driving this lookup function relates the partial VIN with the USDOT number, which in turn displays the ISS inspection decision (color coded) and other parameters, such as

- VIN, USDOT number, Declared Gross Vehicle Weight, Actual Gross vehicle weight (from WIM)
- Carrier name, address, base state, truck class, license plate number
- Info on special permits/registrations: Hazardous material carrier, fuel type, state registration status (IRP), IFTA data, Larger vehicle combos, SSRS (being replaced soon by Uniform Carrier Registration).

Figure C-1 displays a screenshot of the basic interface of the Colorado Business System. All information on the left half of the screen will populate once the last eight characters of the VIN are entered by the counter officer. The right side of the screen contains tabs that are used if a summons is written or the vehicle is parked for inspection or OOS condition.

The Colorado Business System is not integrated with other state databases either. All credentialing and registration information in the database is populated by counter officers when a truck enters a port. If information is missing or appears out of date, counter officers will instruct a truck to pull over and have the driver enter the port building to provide the necessary documentation to update the database.

If available, inspectors will stand next to a counter officer in the station to prescreen vehicles for inspections based on their ISS score. The decision to inspect a truck is based on: 1) the inspector's visual look as the truck goes over the scale; 2) the ISS score; and 3) the number of available inspectors on duty at the time.

The station is not staffed to inspect all "Red" trucks (i.e., those scoring >75 on ISS). They inspect as many as they can. If no inspector is available, but the counter officers observe an obvious defect or unsafe condition on a vehicle, they will direct the driver to park and ask the driver to correct the situation him/herself. If not completed, then the counter officer would call the state patrol to come to the site and issue a citation or OOS order. The counter officers at the Monument port of entry commented that about 99% of drivers will attempt to fix defects themselves, so they can return to the highway quickly.

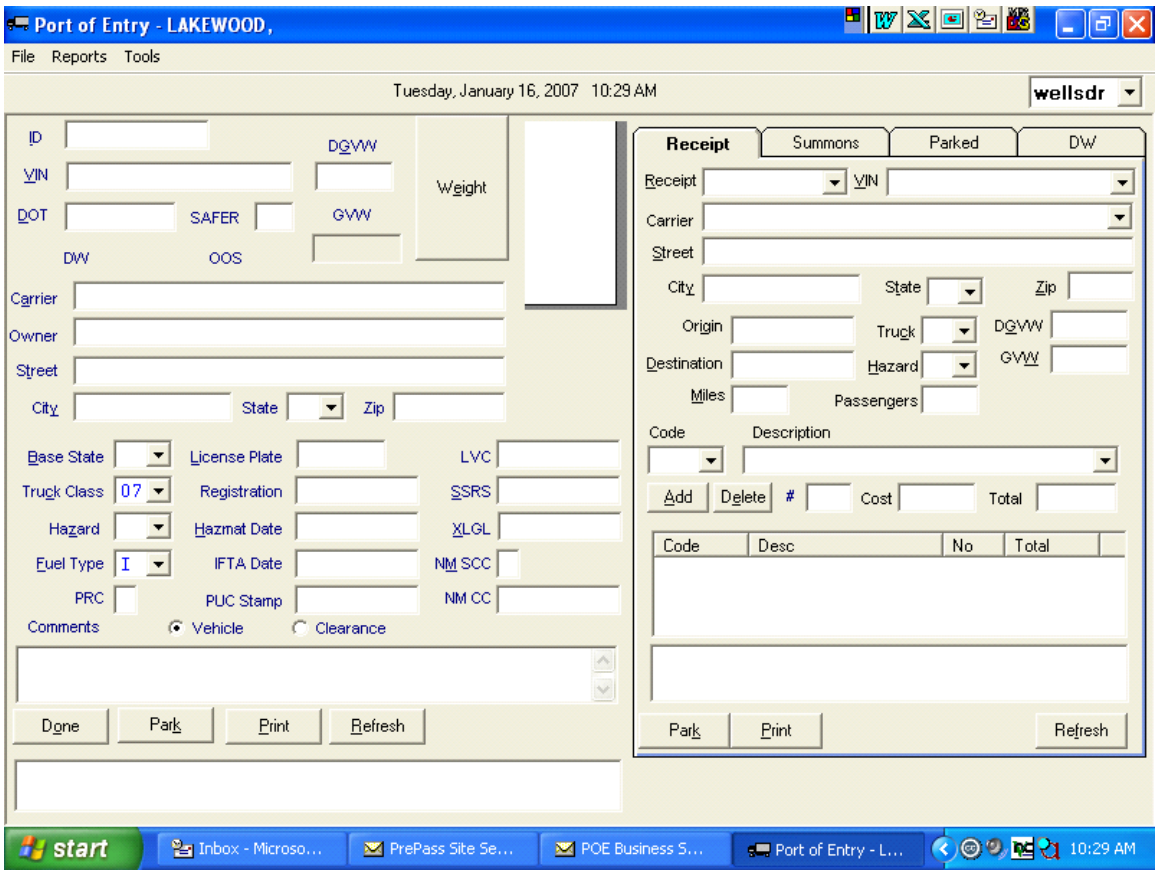


Figure C-1. Screenshot of Colorado Business System

During inspections, Aspen is used to enter and upload the information at the end of each day. Inspectors would sometimes use the Past Inspection Query (PIQ) function, although this practice varied by inspector. An inspector commented that PIQ is useful when dealing with hours of service violators and to better focus the inspection. It is also a good tool to use to see if a truck has an outstanding OOS order. Query Central is available to Colorado inspectors, its use varied by inspector.

Colorado also has a system called the Integrated Data System (IDS). This database contains clearance information on every truck that has cleared a Colorado port. The clearance information from the Colorado Business System populates IDS. For each clearance, the system would have the date and time of clearance, port the truck cleared, USDOT number, and license plate number of the truck.

Colorado has a joint port agreement with New Mexico and Utah whereby Colorado has given username/password access to states, so these states can have access to the Colorado in-state data on trucks that pass through Colorado ports. Motor carriers can also request access to this system to monitor the activities of their own trucks and drivers. Colorado offers this service free to states and motor carriers.

Colorado also has their own CVIEW that provides data to SAFER on a regular basis. Colorado also supports EC services for IRP and IFTA, including providing information to IRP and IFTA clearinghouses. Colorado recently instituted EC for oversize/overweight permits.

Kentucky

Kentucky has 17 weigh and inspection sites. Electronic clearance is available at 12 sites as part of the Norpass partnership. Kentucky has developed an algorithm for observing and pulling in trucks for inspection. The algorithm is used at inspection stations where an office support assistant is available to capture (by keypad data entry) the USDOT or Kentucky Use (KYU) number from every truck that enters the station. The algorithm relies heavily on this truck identifying information as well as the Kentucky Clearinghouse, a state database containing carrier-based safety, credentialing, and licensing information that is housed at the Kentucky Transportation Cabinet in Frankfort. The Kentucky Clearinghouse is similar to a CVIEW but is not directly tied to any federal data sources such as SAFER in real time. The Clearinghouse receives information from sources such as SAFER and SafetyNet on a daily basis through a file extraction or upload process. Listed below are some of the data elements queried.

1. Daily updates from SafetyNet
    - USDOT number
    - DBA (motor carrier company “doing business as” name)
2. Out of service rate for vehicles with that carrier
3. Out of service rate for drivers with that carrier
4. Fuel tax payment status (Kentucky has a weight-distance mileage tax)
5. IFTA tax payment status
6. IRP credentials status
7. Insurance coverage status

8. PRISM Target file (Performance and Registration Information Management System)
9. Intrastate Operating Authority status
10. ICC Exempt status (Interstate Commerce Commission).

An algorithm, using these data fields and indexed on the data-entered USDOT or KYU number, screens trucks as they pass through the inspection station. Within about a second, the database returns any red flags for the carrier. Based on the results of the algorithm and their own judgment, office assistants or inspectors make an instant decision whether to pull the truck over for further review or inspection. Inspection decisions are based on three factors: 1) Out-of-service rates; 2) Carrier's status in PRISM Target File; and 3) the number of times the carrier's vehicles have visited a Kentucky station since their last inspection.

This algorithm is the same one that feeds the mainline automated clearance system (Model-MACS) in the state's Norpass e-screening algorithm. As Kentucky does not have sufficient resources to place such an office assistant at each inspection station, the algorithm is not used at every Kentucky inspection station.

Kentucky officials prefer to use the driver and vehicle OOS rates, as opposed to ISS scores, as criteria for deciding to inspect a vehicle. They have found greater variation in the OOS rates across carriers as opposed to ISS scores, which are more centered around 95 to 100 because of the amount of carriers with insufficient inspection data in SAFER.

Kentucky also has an advanced, computer-aided, integrated system intended to help commercial vehicle inspectors with Kentucky Vehicle Enforcement improve the effectiveness and efficiency of roadside safety, security, and registration enforcement operations. The system is called the Integrated Safety and Security Enforcement System (ISSES). The system is also known as part of "Kentucky's Weigh Station of the 21st Century." Currently, three weigh stations have the ISSES system (Laurel, Simpson, and Kenton Counties) with a fourth site in Lyon County plus possible mobile versions of ISSES planned.

The ISSES technology in Kentucky is intended to give inspectors real-time information about trucks passing by the scale house at a slow ramp speed (less than approximately 15 mph) through several integrated subsystems:

- A bulk radiation detection monitor
- A front tractor automated license plate recognition system
- A USDOT number reader, using optical character recognition technology
- A thermal imaging (infrared) inspection system
- A vehicle classification system (laser scanner).

The overall goal of the roadside deployment of the ISSES is to enhance the screening of commercial trucks by more readily identifying those trucks that might pose safety hazards and/or unreasonable risks to homeland security. Kentucky seeks to develop a roadside system that gives the inspectors automated tools to work more efficiently, while not burdening the inspectors with added duties and complexity. Kentucky transportation officials want a system that will

contribute to the selection of the highest-risk trucks, so that screening, enforcement, and inspection resources can be focused on these flagged trucks.

Kentucky does not yet have a CVIEW but is working toward having an XML (Extensible Markup Language) CVIEW. Kentucky supports EC services for IRP and IFTA and provides information to the IRP and IFTA clearinghouses.

Tennessee

Tennessee has five permanent fixed weigh scale sites used for vehicle inspections. All five have PrePass operational for electronic clearance. They also perform inspections at rest areas and other places that have wide spaces on the side of the road. They have about 90 portable systems that allow them to do this. At fixed sites, truck weight is measured on a permanent scale. The inspector in the scale house would run the ISS score as a prescreening tool. This is not a universal or required practice, however, and inspectors generally can select trucks for inspection in any manner they choose. Some inspectors use ISS while some rely on visual or personal knowledge/experience. However, ISS is mainly used as a prescreening tool rather than an after-the-fact tool. WIM data are collected at one site in Knoxville. All other data are collected while the vehicle is being weighed on the static scale.

Once a vehicle is chosen for inspection, inspectors will access SAFER and CDLIS (Commercial Driver License Information System) for further information. The state has its own CVIEW product to do this. The Knoxville station has the latest technology. It is the only station with a WIM and it also houses a license plate reader and radiation detection equipment. Plans are in place to put infrared and brake testing equipment at another site in Green County while discussions of a virtual weigh station on the North Carolina border are also occurring.

Tennessee has a CVIEW product that is both providing data to and receiving data from SAFER. The state also supports EC services for IRP and IFTA as well as exchanging data with the IRP and IFTA clearinghouses.

Washington

Washington has 52 fixed facilities. Of these, ten have ES and other CVISN technologies and are mostly located in the Seattle and Tacoma areas. The ten with CVISN technologies all have mainline WIMs, e-screening, and a camera to take still photographs of each truck about one half mile ahead of the weigh station. One facility also has a sorter lane with a WIM in addition to the one on the mainline.

Washington's electronic clearance system is very advanced and screens vehicles on 43 different criteria, 15 of which are credential related. For vehicles that have a transponder, a terminal inside the scale house displays a still photograph of the vehicle along with various information about the vehicle such as: the name of the carrier, license plate, speed, transponder number, and any violations based on the screening criteria. Violations are color-coded based on the severity of the violation with the highest priority violations appearing in red. For transpondered vehicles, the decision to have the vehicle pull in is made automatically by the e-screening system based on the

built-in screening criteria. All of this information, however, is made available to the officer in the scale house to better focus the inspection. All non-transpondered vehicles will enter the inspection station for further examination.

If a vehicle is brought into the station (either non-transpondered truck or a transponder truck signaled to enter station), inspectors will first look for the presence of a Commercial Vehicle Safety Alliance (CVSA) sticker and then conduct a quick visual check of the vehicle. The truck will then be weighed. It is possible to look up the ISS score at this point but it is generally not used as a prescreening tool. Data used to make an inspection decision comes from inspector judgment, presence of CVSA sticker, vehicle weight, and e-screening results if the truck is enrolled in Norpass.

Once a decision has been made to inspect a vehicle, national crime databases are checked for criminal related activity. An ISS score is obtained through Aspen while SAFER is sometimes utilized to capture additional safety information. Washington has a CVIEW product that communicates with SAFER. They also support EC for IRP and IFTA as well as exchanging data with the IRP and IFTA clearinghouses.

In looking forward, Washington is exploring the idea of a Virtual Weigh Station. They are looking into a program called PreAssess. The idea is that a vehicle traveling through a weigh station is screened virtually as if the screening were being done by a real officer. This screening would be done through the use of 3-D imaging, infrared detectors, cameras, and various other detection devices. Examples of data captured are width of the vehicle, width of the tire, USDOT number, license plate number, and a picture of the driver to detect seatbelt use. Through these tools, a vehicle can still be monitored as it travels through the station while officers are busy with other things.

Setting B: Deploying States

This setting depicts states that are very involved in CVISN capability development and have put into practice most, if not all, of the Core CVISN Deployment capabilities. They are not as advanced in their roadside screening and inspection processes as those states in Setting A. Characteristics associated with these states include:

- State relies on using safety and credential related information to make inspection decisions
- State uses federal data sources and tools such as SAFER, Query Central, and L&I
- State is active in the CVISN planning and deployment process
- State is proactively looking for new ways to improve the exchange of safety information in their state.

Table C-6 shows a summary of the four interviewed states classified as Deploying states.

Table C-6. Major Features of Setting B (Deploying) Interviewed States

	Florida	New York	Ohio	Utah
CVISN Level	Core Deployment	Core Deployment	Completed Core Deployment	Completed Core Deployment
Number of Fixed Sites	18	None, all inspections at mobile sites	15	9
E-Screening	PrePass (17 sites)	None	PrePass (13 sites)	PrePass (6 sites)
WIMs	Mainline and sorter lane	None	Mainline at 2 sites	Sorter lane
Primary Inspection Selection Method	Visual inspection, inspector experience and judgment, weight of vehicle	Visual inspection, inspector experience and judgment	Visual inspection, inspector experience and judgment, limited use of ISS	Visual inspection, inspector experience and judgment
CVIEW	No	No	Yes	No (in progress)

Florida

Florida has 16 fixed sites with inspection barns. There are two additional stations with a static scale without an inspection barn but not many inspections are done at these locations. They also have six equipped trailers with 1,016 portable scales to use for mobile inspections. According to Mike Akridge, Florida's CVISN Program Manager, Florida does not do a lot of truck inspections as compared to other states, mostly because of personnel limitations. There are two different types of inspectors: 1) weight enforcement inspectors who look at weight, IFTA, and IRP but do not do physical inspection; and 2) law enforcement officers who perform truck inspections.

Fixed sites usually have two weight enforcement inspectors at locations with a WIM and one for stations without WIMs. A site can have anywhere from one to three CVSA-certified inspectors at a time. Some stations with WIM devices are open 24 hours a day, every day although staffing levels fluctuate depending on availability. Currently, 19 sites (17 permanent and 2 temporary) are configured with a WIM on ramps leading to the station. If a truck is close to the 80,000 pound limit, it is brought in for a weight check on the static scale. If not, it is free to go back to the mainline. Mr. Akridge mentioned that very few trucks are inspected unless they are overweight. There is a lot of traffic and too few people are dedicated to motor vehicle inspections.

Florida has 17 sites utilizing ES through PrePass. At fixed sites, most inspection decisions are made based on the weight of the truck and a visual inspection as they approach the scales. Sometimes, requests from other agencies for post crash or compliance reviews as well as new motor carrier companies play a role in vehicle selection. ISS is used as a tool to gather information on a motor carrier but mostly after the decision to inspect has already been made. SAFER and Query Central are also used to help conduct and focus the inspection although they are not used consistently across sites and inspectors.

At mobile sites, inspection decisions are made by physical observation of truck. Inspectors can do a Level I inspection as they see fit. They have a portable scale but no check of SAFER or any

other safety databases. They use ASPEN and state software called SmartCop, which provides the Motor Carrier Compliance group with a database check system but does not have all the functionality of a CVIEW.

Florida representatives mentioned that there are no major limitations for CVISN implementation in the state. Mr. Akridge commented that Florida is only looking at possibilities, including a virtual weigh station to catch trucks bypassing current fixed stations. Florida does not have a CVIEW product. As of August 2006, they did not support EC for IRP and IFTA but were working on implementing this in early 2007. When operational, the system would exchange data with SAFER directly.

New York

New York State does not have fixed site weigh and inspection stations. All inspections are done with portable scales, at temporary sites. The state uses its larger rest areas for commercial vehicle inspections, except on Long Island and New York City, where they use parking lots. In New York, weighing a vehicle is the exception rather than the rule. The state has 35 Department of Transportation inspectors plus 15 other inspectors who do driver checks and walk-around inspections. The state also has 105 State Police inspectors.

The same site is rarely open two days in a row. There are 120 sites that are used for inspections 80% of the time. On a daily basis, 15 to 18 inspection sites are operational. At a single site, there are usually four to five inspection stations with two State Police and two or three New York State DOT (NYSDOT) inspectors. About 70% of carriers are common to a given corridor, and known to the regular inspectors. Although vehicles are inspected at random, inspectors also perform a quick visual inspection of trucks as they enter the rest area to help in the selection process.

Most inspectors will run an ISS score on a truck after it has been chosen for inspection, to help the inspector focus the inspection. Because ISS is a carrier-based system, the state courts in New York would not sustain a violation based on an inspection whose only basis for choosing the vehicle was an ISS score. This is because the inspection decision in New York (because of probable cause laws) must be vehicle-based. ISS scores as well as a large amount of safety information in SAFER that either already is or could be made available to roadside inspectors is applicable to an entire motor carrier and not a specific truck. As it is now, by state law, inspectors cannot stop a truck without probable cause of a violation. New York inspectors would prefer to use carrier-based information for inspection selection decisions if it were possible.

In New York, trucks are mainly selected randomly for inspection. Trucks are pulled over for inspection based on the judgment and experience of the inspector as well a visual inspection of the truck as it approaches the inspection area. If the inspector sees an obvious defect (flat tire, unsecured load, light out, etc.), and there is an inspection bay and an inspector available at the time, then that truck is pulled in. Conversely, if the inspector sees a current CVSA inspection sticker (last 3 to 6 months), then that truck is less likely to be pulled in. The inspectors also tend to look at the general appearance and condition of the truck, such as its paint, cleanliness, and dents or broken trim, to pick out trucks where deficiencies exist.

Inspectors in New York use AirCard wireless modems to connect directly with Query Central and SAFER in an effort to focus their inspections. New York does not have an ES program in place. Because only about 1% of trucks have transponders, the state does not see a large benefit at this point in adopting ES capabilities.

NYSDOT is developing a dedicated "Port of Excellence" at the Champlain Border Crossing international border. The goal is to screen every truck for weight and credentials. NYSDOT will query a U.S. Customs Service data dump to FMCSA, then to SAFER. The port may also add an IR detector for suspect brake violations. The goal is to have the site built by 2008. It will be fully integrated with a credentialing facility and customer service facility. New York is also experimenting with WIMs, transponder technologies, and license plate readers at the Schodack Rest Area on westbound I-90 starting in late 2007. Through these efforts, New York State has proven to be very active in developing CVISN technologies to help with inspections.

New York does not have a CVIEW but uses a system called OSCAR (One-Stop Credentialing and Registration System) to provide EC support to motor carriers. They provide information to both IRP and IFTA clearinghouses. OSCAR does not exchange information with SAFER.

Ohio

Ohio has 15 fixed weigh scale sites that are used for inspections. There are no inspection barns at any of the sites. Rather, large parking areas behind the scale house are used for vehicle inspections. Ohio has one site that has a sorter lane with a WIM. They also have two sites with WIM on the mainline connected to PrePass. Ohio has ES established through PrePass at 13 sites . They also have mobile systems for size and weight enforcement maintained by the State Highway Patrol. They are set up at high-risk areas along major highways. At mobile locations along the roadside, the focus is more on driver inspections while at fixed locations, vehicle or full Level 1 inspections are the norm.

At fixed sites, most data is collected on the slow down ramp approaching the scale house. The truck is weighed using a static scale. At the same time, inspectors are visually inspecting the truck for obvious defects and looking for a CVSA sticker indicating a recent successful inspection. Visual inspections and inspector judgment are the main criteria used to decide which vehicles to inspect. ISS scores are run on about 10% of vehicles as a prescreening tool. The use of ISS in this manner varies by inspector with some not using it at all. Databases such as SAFER, L&I, and CDLIS are used to collect data during inspections. Ohio has a CVIEW system (PreVIEW) that allows inspectors to access most of these databases. Query Central is sometimes used but Ohio inspectors have experienced problems with having to log out of their state systems to get to Query Central. As a result, it is not used as much. At the time of the interviews, inspectors did not have wireless modem cards for faster connections but were scheduled to receive them in late 2006.

Ohio has experienced a few limitations when it comes to CVISN in their state. First, they would like the PrePass system to be tied more into their CVIEW product. This would help focus the inspection or better determine whether to inspect the vehicle. Also, Ohio is having difficulty

getting inspectors to use the CVIEW product. With the introduction of Query Central, inspectors are finding the two systems redundant in some ways. Since Query Central is more advanced, inspectors tend to use the federal database. Finally, inspectors recognize that ISS and PIQ are positive, helpful items but the systems take time to run and this takes away from the inspectors' productivity.

In the future, Ohio is looking into license plate reader technologies and the possibility of updating their CVIEW product. Ohio provides support for electronic IRP and IFTA credentialing and is exchanging information with IRP and IFTA clearinghouses. Ohio's PreVIEW also uploads IRP and IFTA information to SAFER.

Utah

Utah handles all inspections through the Utah Department of Transportation. The State Highway Patrol does some inspections at the roadside by pulling over trucks. There are nine port of entry fixed weigh scale sites used for inspection. The sites are configured slightly different based on size. For larger stations, the mainline exit ramp is longer. The smaller sites generally have smaller ramps and less people on staff. Ramp sorting is done with a WIM device. Six stations are equipped with ES via PrePass.

As trucks exit the highway they go over a WIM. From here, the truck is either diverted back to the mainline or directed to the scale house. Here a visual inspection of the truck is done to determine if a more thorough inspection is warranted. ISS is not used as a prescreening tool. Utah experimented with using ISS to prescreen trucks for inspection but found that it did not work well. There was not enough room on the slow down ramp to read the USDOT number and get an ISS score quickly enough to make an inspection selection decision in time.

Inspection decisions are made based on a visual inspection of the vehicle, inspector knowledge of the carrier, and random pull-ins. Once a vehicle is selected for inspection, inspectors collect the ISS score to help focus the inspections. Query Central is used to get past inspection results from SAFER as well as driver checks using CDLIS. Inspectors rely on Query Central to get them access to all databases they need. Inspectors also run a check on federal crime databases for criminal information. They support electronic IRP and IFTA credentialing and communicate with IRP and IFTA clearinghouses.

Utah feels the biggest limitations in implementing CVISN have been the geography of the state. Their communication systems have had problems because cellular coverage is not extensive. There is also not a lot of room on the slow down ramps to do a lot of work. They did not have a CVIEW system as of August 2006, but were working on having it ready later in the year. As of the time of the interview, Utah was striving for Core certification. They have since completed their Core deployment and have started to jump on board with expanded CVISN. They are interested in exploring ideas involving virtual weigh stations, barcode readers, license plate reader technologies, and EC.

Setting C: Planning States

This setting depicts states that are more basic in their CVISN capability development. They have started the CVISN planning process and are involved in at least one of the three main CVISN areas (SIE, ES, and EC) but have not yet achieved Core CVISN Deployment. Characteristics associated with these states include:

- State relies on using inspector judgment and experience to make most inspection decisions
- State infrequently uses federal data sources and tools such as SAFER, Query Central, and L&I
- State is active in the CVISN planning process
- State is looking for new ways to improve the exchange of safety information in their state by working toward Core CVISN Deployment.

A summary of features associated with the two interviewed states classified as Planning states is shown in Table C-7.

Table C-7. Major Features of Setting C (Planning) Interviewed States

	Oklahoma	**Texas**
CVISN Level	Core Deployment	Core Deployment
Number of Fixed Sites	9	103
E-Screening	PrePass (4 sites)	None
WIMs	No	Sorter lane
Primary Inspection Selection Method	Visual inspection, inspector experience and judgment	Visual inspection, inspector experience and judgment
CVIEW	No (in progress)	No (in progress)

Oklahoma

Oklahoma is a unique state in that there are two different agencies handling inspections. The Office of Corporate Communications (OCC) operates the fixed scale sites. Their main focus is on revenue. The fixed scales were designed around 1950 to be revenue collection facilities. OCC does a limited number of roadside screening and safety inspections but that is not their main focus. They only perform about 700 to 800 safety inspections per year.

The Department of Public Safety is responsible for size and weight enforcement. All of these activities are done in a mobile setting. Oklahoma has about 55 officers that perform about 15,000 inspections per year in addition to compliance reviews. These personnel split their time evenly between MCSAP (Motor Carrier Safety Assistance Program) enforcement and traffic enforcement. There are no sites with fixed scales in the ground. There are around 200 permanent roadside inspection-only sties and another 75 portable systems that can be used for vehicle inspections. Most of the mobile sites are wide areas on the side of the road where a semi-portable

scale would be used. Some areas are larger than others with some having an exit ramp. Others would just be large enough spaces where a law enforcement officer would pull over trucks for inspection. There are no WIM devices used in Oklahoma.

At the fixed sites, all trucks are required to enter when the station is open. For mobile sites, law enforcement officers and/or inspectors would wave trucks off the mainline. Some sites do not have ramps so officers would pull over vehicles and bring them to the inspection location. There are usually one to two inspectors at each site.

Vehicles are selected for inspection either randomly, based on the officer's knowledge of the carrier, a visible defect or traffic violation, or experience. ISS or other prescreening tools are not used for pre-selection. All this information is collected prior to the vehicle reaching the inspection site and is all done by eyesight. There is no data lookup or WIM information.

At most sites, inspectors can look at national criminal databases and sometimes CDLIS. A lot of sites cannot run ISS or access SAFER due to connectivity issues. It is possible to call in this request to someone who has a connection but it does not happen often. Some semi-permanent sites have a high-speed connection so ISS and SAFER queries can be run.

The state is developing its own CVIEW but did not have one as of mid-2006. The use of CVISN is very basic right now. The plan is to use CVIEW, L&I, CDLIS, and SAFER in the future when communications system are put in place. Although fixed sites have good communication systems, some mobile sites cannot upload their inspections to SAFER while in the field. In these cases, inspections are either uploaded at the end of a shift or the next day once the mobile units return to a fixed site with reliable communication.

ISS ratings are sometimes used after a vehicle has been selected for inspection to help focus the inspection but this is not a standard practice and varies by inspector. They have ES through PrePass at fixed sites. There are seven PrePass installations at sites with the highest traffic volume.

Oklahoma currently has an electronic data interface in place to allow large carriers to transmit IRP applications to the state electronically. However, most of the other processes are still manual. Oklahoma is currently working on developing a system to support electronic IRP and IFTA credentialing.

Oklahoma's CVISN use is still in the basic stage. Their future plans revolve around placing a mainline WIM on the Oklahoma Turnpike. In addition, they are considering an optical character reader to read the USDOT number and license plate number. These are more long-term plans.

Texas

Texas inspections are handled by the Department of Public Safety, which runs all of the fixed inspection stations in the state. There are 103 fixed sites in the state. Some are state-owned and some are county-owned. Some are more advanced in terms of technology. For the more

advanced, trucks exit the highway via an exit ramp and then pass over a WIM. From here they are directed to an entrance ramp to the highway (bypassing the station) or to a static scale for weighing. If a truck is then selected for inspection, it pulls over into a wider area. For the less advanced facilities, there is no WIM and no bypass. Trucks are pulled into the facility and weighed. There is less room for inspections. The less advanced facilities are space limited and fill up quickly resulting in temporary closing of the facility until the vehicles in the system can be cleared. There is a wide variation in site configuration.

If a truck is directed to the static scale based on WIM results, the trooper will talk to each driver and check the driver's credentials and log book. The trooper will visually inspect the truck and then use this visual inspection and/or judgment to make a decision to inspect. Sometimes, plate numbers and commercial driver licenses are collected to capture more information. At sites where no WIMs are present, all trucks that come through the station will stop, and the driver will talk to the trooper at the scales where similar checks will be performed.

There is not a lot of CVISN technology used at the stations. Texas uses a state-owned database called OASIS. Most troopers have laptops and can access this. Through OASIS, troopers can check for criminal records, outstanding warrants, and credentials by inputting the license plate and driver license information. They also have some locations that have driver's license readers where you can check CDLIS, NCIC (National Crime Information Center), and other sources for criminal activity. They do not access SAFER at all to pull information. Their goal is to eventually be connected to SAFER to retrieve ISS scores and other safety information.

Their CVIEW is still a work in progress. There is currently no ES in Texas. The main criteria for deciding whether to select a vehicle for inspection are a visual review and inspector judgment. Once a month they do purely random selections of trucks to get a better idea of OOS rates.

Texas supports both electronic IRP and IFTA credentialing through an electronic data interface program available to motor carriers via internet download. Although the IFTA process is not fully automated, it allows carriers to submit quarterly IFTA returns electronically. Texas currently exchanges information with IRP or IFTA clearinghouses.

As of February, 2008 TxDOT is constructing eight BSIFs at the Texas-Mexico border incorporating various ITS technologies to facilitate BSIF operations and the flow of commercial vehicles from Mexico through each facility and into Texas. RFID readers compatible with the U.S. Customs Free and Secure Trade program are installed at the Bridge of the Americas (BOTA) facility in El Paso, Texas. Commercial vehicles wishing to participate are issued the same types of radio frequency identification (RFID) tags as are issued by U.S. Customs. While these tags are not CVISN-compliant, they do allow for the automated identification of registered vehicles, and subsequent access of data related to those vehicles and associated carriers.

Commercial vehicles crossing the border first pass through the federal inspection facility, then enter the state BSIF. Vehicle size and weight are measured via WIM devices supporting length and height detectors. Automated vehicle identification via the RFID tag allows automatic lookup of a bypass/pull-in flag related to that vehicle and/or carrier. Initial deployment includes ES for vehicle dimensions, weight, and ISS safety rating. Other safety and credentials checks are being

considered for future deployment. The technology is directly convertible for CVISN deployment: transponder readers can be upgraded to support CVISN-compliant active (bi-directional) transponders and the WIM equipment can be upgraded from slow speed to high speed.

4.0 Field Observational Study Data Collection

Field studies were conducted in four states: Colorado, Kentucky, New York, and Ohio. These states were chosen mainly because the sites included geographic diversity (each state from the other, and compared with the states that were central to the CVISN MDI evaluation), and the variety of CVISN deployment approaches in each state. Also, CVISN officials at the departments of transportation and law enforcement agencies from each state were supportive of the safety study and expressed an interest in participating. Another reason for Ohio's inclusion was their relatively high level of commercial vehicle inspection activity as reported in the CVISN Self-Evaluations. Colorado has an active program of truck crash analysis and collects an abundance of truck data at inspection stations allowing for a convenient way to identify high-risk carriers and trucks. Furthermore, the roadside operations of Ohio and Colorado represent the operations of a large number of similar states. New York expressed interest in linking carrier information to specific vehicles. New York performs all commercial vehicle inspections at temporary or mobile sites, having no permanent weigh/inspection facilities. This unique facet made New York an attractive choice as it provided a different perspective on mobile inspection methods and safety enforcement. Kentucky was chosen in conjunction with a separate FMCSA/FHWA task order, "Kentucky Commercial Vehicle Safety Applications Evaluation" (BA34018). Data from this evaluation was used to augment data collected in the CVISN National Deployment Evaluation safety analysis task.

Table C-8 summarizes the inspection features and practices of the four field study location sites. The sections that follow discuss the information presented in Table C-11 as well as detail the data collection procedures conducted at the four field observational test site locations.

Table C-8. Summary of Inspection Features and Practices of Field Study Sites

	Colorado	Kentucky	New York	Ohio
Dates of Field Study	June 11-22, 2007	June 11-22, 2007	May 8-10, 2007	Oct 31 – Nov 2, 2006
Location of Field Study	North and Southbound Monument, CO Port of Entry, I-25, South of Denver	Laurel County Northbound Weigh Station, I-75	Schodack, Clifton Park, and Queensbury rest areas near Albany	Preble County weigh station, Eastbound I-70 on Ohio/Indiana border
Nature of Site	Fixed	Fixed	Mobile	Fixed
Electronic Screening	PrePass	Norpass	None	PrePass
Use of WIMs	Mainline	Mainline and Sorter Lane	None	Mainline
Use of ISS	Used as one tool to pre-screen vehicles	Used to focus inspections after truck has been selected	Used to focus inspections after truck has been selected	Used to focus inspections after truck has been selected
Primary Inspection Selection Method	ISS scores Inspector judgment and experience Visual inspection	Algorithm that screens on carrier OOS rates (not in use at Laurel County site during field study) Inspector judgment and experience Visual inspection	Inspector judgment and experience Visual inspection	Inspector judgment and experience Visual inspection
Federal and State Data sources used	Aspen, SAFER, Query Central, PIQ, Colorado Business System, Colorado Integrated Data System	Aspen, SAFER, Query Central, Kentucky Clearinghouse, ISSES infrared images (on occasion)	Aspen, SAFER, Query Central	Aspen, SAFER Query Central Ohio CVIEW

4.1 Ohio

The Ohio field observational study was conducted from October 31 to November 2, 2006 at the Preble County eastbound weigh station. The inspection site is located on eastbound Interstate 70 near the Ohio/Indiana border. This site was chosen because of the heavy truck volume that traverses the site and the presence of ES. Also, trucks traveling through this station should all have USDOT numbers because of the state border crossing.

Prior to the actual field data collection, pre-study activities for the Ohio site consisted of consulting with personnel at the Transportation Department of the Public Utilities Commission of Ohio (PUCO) and the Ohio State Highway Patrol to agree on the goals and a conceptual

approach to data collection. Alan Martin of PUCO (Ohio's CVISN Program Manager) and Captain Skip Dodd of the State Highway Patrol were the principal contacts. The evaluation team conducted a site visit at the I-70 inspection station in Preble County on September 20, 2006. Evaluation personnel met with Motor Carrier Enforcement supervisors and inspectors, load limit inspectors, and law enforcement and information technology personnel to understand the screening and inspection operations. Ohio Motor Carrier Enforcement supervisors provided a tour of the inspection station and described the procedures that the load limit and motor carrier enforcement staff follow when screening and inspecting vehicles. In addition, a Motor Carrier Enforcement inspector walked evaluation personnel through the steps followed in the inspection process by reviewing an inspection he had conducted earlier that day. He was interviewed to learn how he selects vehicles for inspection, what factors determine the level of inspection performed, and his process for performing and recording inspections. Through these conversations and demonstrations, the evaluation team was able to understand the practices, procedures, data sources, and data collection mechanisms that contribute to Ohio's screening and inspection process.

Besides gaining an understanding of the site's operations, a second goal of the site visit was to decide logistically how this first field study would be conducted relative to those operations. Decisions were made on methods for collecting data from vehicles as they traverse the station as well as collecting data from state databases that will assist with data analysis efforts after the study.

Data were collected over a three-day period at the Preble County site. Figure C-2 illustrates the layout of the inspection site while Figure C-3 shows a view from the front of the scale house as a commercial vehicle passes over the static scale.

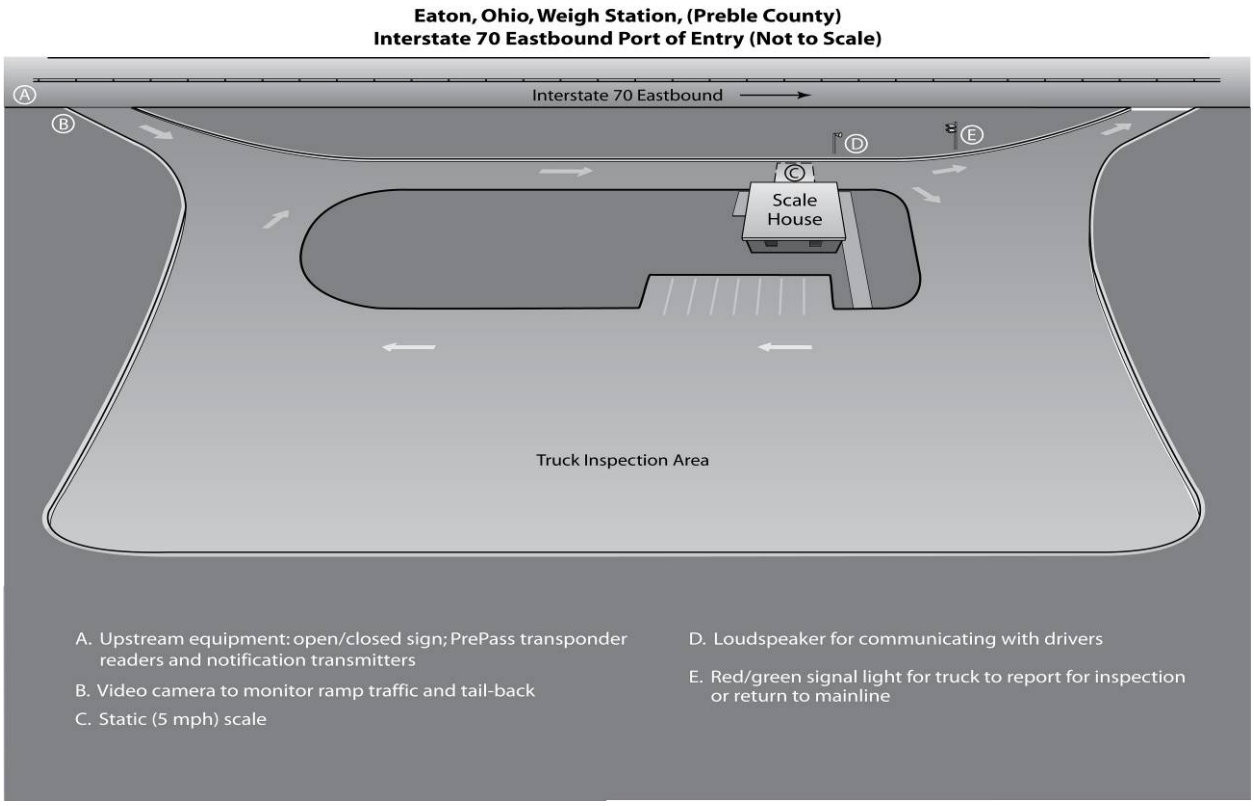


Figure C-2. Layout of Weigh-Inspection Station and Traffic Patterns at Eaton, Ohio. Illustration is not to scale.

Figure C-3. Preble County Scale House, Eaton, Ohio

This site is equipped with transponder-based ES via PrePass. The site has no mainline or sorter-lane WIM scales. The station is ordinarily open 24 hours a day for most of the week for load limit enforcement, and at various other times for safety inspections. All trucks are required to enter the station when it is open with the exception of those PrePass participants that are given permission to bypass. The layout for the site is such that there is one exit ramp from the highway leading directly to the scale house where the truck is weighed using a static scale. Trucks are directed to move slowly across the static scale, which weighs one axle set at a time and automatically sounds an alarm if the scale system detects a potential overweight condition. Once trucks have been weighed, inspectors make a decision whether to let the truck go back to the mainline if there are no problems or to have the truck turn right into an inspection lot behind the scale house for further examination by load limit or motor carrier enforcement personnel. This decision is communicated to the driver via a green or red signal light and through an outdoor loudspeaker system at the end of the scale house.

Beginning on October 31, 2006, a researcher was placed in the scale house to observe the vehicles entering the weigh station. At times, two researchers were needed depending on traffic flow to capture the necessary information. To the extent possible, each entering vehicle was identified by USDOT number and tractor front license plate number as well as the time the vehicle crossed the scale. This information was recorded via the researcher speaking the information into a digital voice recorder or recording it by hand on a data entry sheet. The digital voice recorder was the preferred medium for data capture as it allowed the researchers to capture both the USDOT and license plate numbers without having to take their eyes off the vehicle. The data were then transcribed to a Microsoft Access database application and quality checked. Trucks were going over the scale no more than 10 feet from the window and, for the most part, were going at a very low speed, thus enabling the research team to capture vehicle identification information for most of the vehicles. Based on feedback from the data collector, it is estimated that no more than 5% of the vehicles entering the station were missed. Mainly, truck information was missed when trucks were too closely spaced and traveling too fast as they passed the scale house window. It is assumed that the safety ratings and other characteristics for the missed trucks are no different from those for the complete population of trucks traveling on I-70 into Ohio.

It was desirable to characterize all vehicles that enter Ohio from Indiana via I-70 during the time of the field study so that the sample of trucks that can be identified could be considered a representative sample of all trucks that cross the border there. However, in certain cases vehicles can bypass the station, making it impractical to identify these vehicles visually because of their mainline speeds and the distance from the scale house. Vehicles can legally bypass the station because: 1) they were cleared as a result of PrePass; or 2) the station was closed temporarily to prevent queuing on the mainline as they approached. Vehicles can also bypass the station illegally by not stopping when the station is open or, in the case of e-screening participants, not entering the station when a red light signal is communicated to the driver.

Vehicles that are cleared by PrePass are believed to be safer and more likely to be in compliance with the safety and credentialing regulations than the general population of truck traffic, so they are of relatively lower interest to this study from a safety improvement perspective. By design, the PrePass system does not make available an abundance of vehicle or carrier information to

state personnel. According to the HELP/PrePass website, it is the policy of HELP to preserve bypass transaction data and all carrier business information with the utmost confidence. Truck and carrier-specific transaction data are not stored or publicly disclosed. Discussions were held with PrePass representatives in an attempt to determine if USDOT numbers or carrier names of trucks that bypassed the station during the field study could be obtained by the evaluation team for the purposes of describing the population of bypassing trucks in terms of risk. Within the scale house, a monitor displays information about each PrePass-participating vehicle that is identified by an antenna on the mainline prior to reaching the inspection station. According to HELP Inc., truck-specific transaction data are used only for the purposes of managing bypass events and are not retained beyond the bypassing event. It would be in violation of the privacy agreement between HELP Inc. and the states to record the information from the PrePass monitor in the scale house. Furthermore, HELP Inc. does not produce reports that examine the population of PrePass-enrolled carriers from a risk perspective (i.e., percent breakdown of enrolled carriers by ISS score). As a result of the e-screening system not permitting the evaluation team to identify particular carriers or vehicles receiving green lights to bypass, any detailed analysis of historical safety data on those carriers whose trucks were bypassing was not possible.

An assumption was made that the population of vehicles that bypass the station when it was temporarily closed is not significantly different from the population of trucks that went by when the station was open. Therefore, no identifying information was captured on vehicles that bypassed when the station was closed.

In addition to identifying each vehicle entering the scale house lane, researchers recorded whether it was directed to the inspection lot behind the scale house. For further inspection information, copies of inspection reports were obtained for all inspections performed at the site during the field study. This provided evaluators with a list of specific vehicles that were chosen for inspection from the truck traffic that traversed the station during the field study. These inspection reports detailed the level of inspection, results of the inspection, and any violations or OOS orders. PUCO also provided a database of all inspections performed at all fixed and mobile sites in Ohio for January through October 2006. Information from these inspection reports provided analysts with accurate information as to OOS rates for Ohio inspections for different classes of vehicles.

4.2 New York

The New York field observational study was conducted from May 8 to May 10, 2007. New York performs all commercial vehicle inspections at temporary or mobile sites, having no permanent weigh/inspection facilities. With the exception of New York City, the mobile sites are generally located in rest areas along major highways. There are over 100 mobile inspection sites throughout the state but most inspections are performed at a subset of 40 sites. Also, not all sites are open for motor vehicle inspections every day or even on a predictable schedule. The actual inspection locations for each day are scheduled one month at a time and rotated such that vehicle inspections rarely occur at the same site on consecutive days. As a result, data collection was carried out across multiple sites over a consecutive three-day period.

Prior to the actual field data collection, pre-study activities for New York consisted of consulting with personnel at the New York State Department of Transportation (NYSDOT) to agree on the goals and a conceptual approach to data collection. Steve Trudell, Brian Galvin, Rick McDonough, and Don Baker were the principal contacts. The evaluation team conducted a site visit at the Schodack Rest Area site on October 11, 2006. Mr. Galvin and Mr. Trudell led the inspection site visit. The visit involved observing truck traffic flow through the mobile inspection station set up at the rest area site and learning about the operating procedures. Two full Level I inspections performed by NYSDOT inspector Ray Gagnon were observed by the evaluation team. He provided insight into the steps taken for a Level I inspection as well as how the various CVISN tools such as Query Central, Aspen, and SAFER factor into the inspection. Mr. Gagnon was also interviewed to learn how he selects vehicles for inspection, what factors determine the level of inspection performed, and his process for performing and recording inspections. Through these conversations and demonstrations, the evaluation team was able to understand the practices, procedures, various data sources, and data collection mechanisms that contribute to New York's screening and inspection process. Figure C-4 shows a vehicle being weighed on portable scales by a New York State Police officer at the Schodack rest area.

Figure C-4. Portable Truck Scales in Use at the Schodack Rest Area on Westbound I-90 in New York

Besides gaining an understanding of the site's operations, a second goal of the site visit was to decide logistically how the field study would be conducted relative to those operations. Decisions were made on methods for collecting data from vehicles as they traverse the rest area as well as collecting data from state databases that will assist with data analysis efforts after the study.

Table C-9 lists the three sites where data collection occurred for the New York field study. Figure C-5 illustrates the layout of the Clifton Park Rest Area. Although there were slight differences in the size and layout of all three rest areas, the general configuration and inspection operations at these sites was very similar.

At the time of the field study, New York did not employ the use of ES or WIMs. Motor vehicle inspectors from both NYSDOT and the New York State Police were on hand at all three sites. The rest areas were open for inspection from 8:00 a.m. until about 2:00 p.m. each day. During this time, all trucks were required to enter the station. Trucks were alerted to enter the rest area via mainline signs upstream from the rest area. The layout for each site is such that there is one exit ramp from the highway leading directly to a large truck rest area parking lot. NYSDOT inspectors or State Troopers would then either wave the truck through the parking lot and back to the mainline or ask the truck to pull into one of the vacant parking spaces designated for CMV inspections for further inspection. During inspections, the rest area remained open to noncommercial vehicle traffic that had a separate parking area. There were also commercial vehicle parking spaces not being used for inspections that trucks could use to stop and rest.

Table C-9. Mobile Inspection Site Locations for the New York Field Study

Date	Location	Details
Tues. May 8, 2007	Schodack Rest Area	Located on westbound Interstate 90, between Exits 12 and 11, in the Town of Schodack, Rensselaer County. (12 miles from Massachusetts border)
Weds. May 9, 2007	Clifton Park Rest Area	Located on northbound Interstate 87 between exits 9 and 10 in the town of Clifton Park, Saratoga County
Thurs. May 10, 2007	Glens Falls (Queensbury) Rest Area	Located on southbound Interstate 87, also known as the Northway, between Exits 18 and 17, in the Town of Queensbury, Warren County.

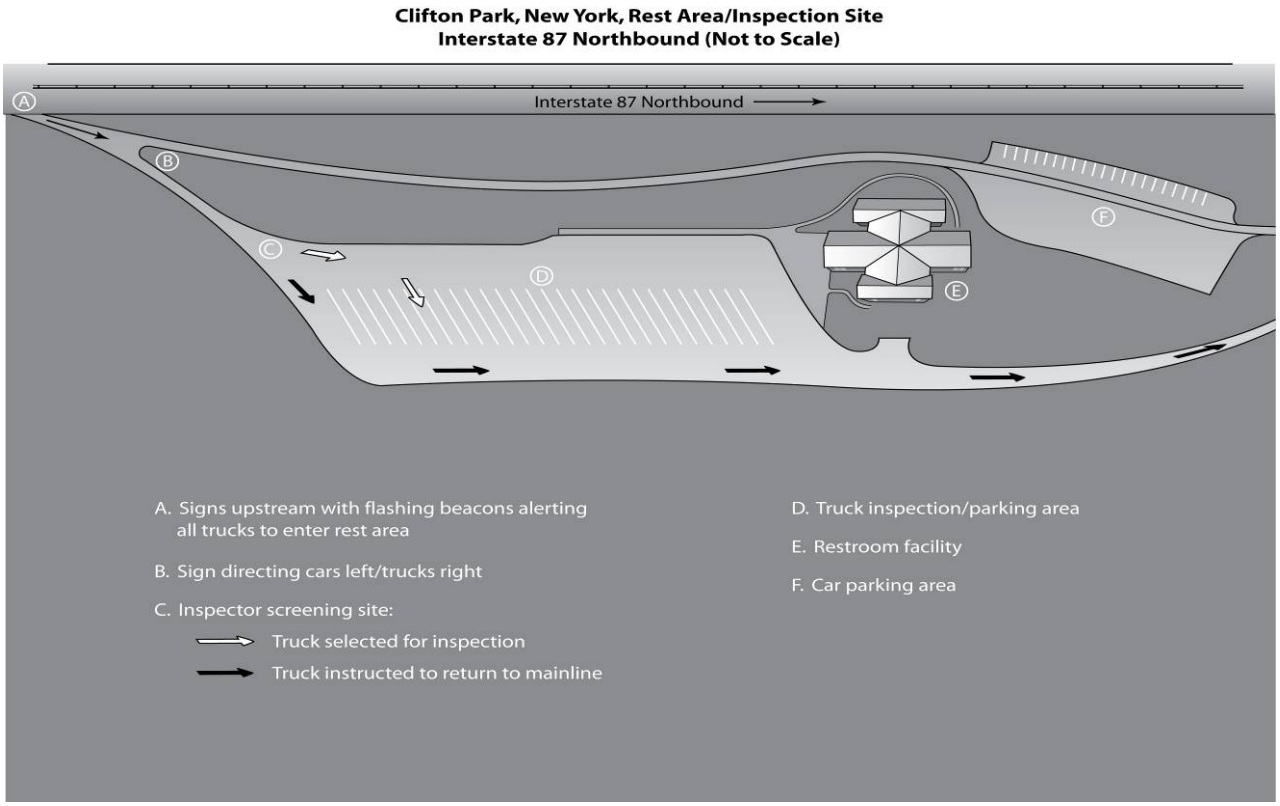


Figure C-5. Layout of Rest Area-Inspection Site and Traffic Patterns at Clifton Park, New York. Illustration is not to scale.

Beginning on May 8, 2007, a researcher was positioned off the rest area roadway on a sidewalk to observe the vehicles entering the rest area. To the extent possible, each entering vehicle was identified by USDOT number as well as the time the vehicle was observed. This information was recorded via the researcher speaking the information into a digital voice recorder. The data were then transcribed to a Microsoft Access database application and quality checked. Trucks traveled past the researcher at a low enough speed to enable the research team to capture vehicle identification information for most of the vehicles. Based on feedback from the data collector, it is estimated that no more than 1% of the vehicles going through the rest area were missed. Mainly, truck information was missed when many trucks were too closely spaced and traveling too fast as they passed the data collector.

On their respective days, all three inspection sites were open continuously during the hours of 8:00 a.m. to 2:00 p.m. Given this and the lack of ES available, researchers were able to capture the entire population of trucks traveling by the various rest areas as none were allowed to legally bypass the station. The few exceptions to this were those few trucks that bypassed the station illegally where no identification could be collected. These trucks represent a very small percentage of the truck traffic.

Electronic copies of all inspection reports performed at the three sites during the field study were collected from NYSDOT. These inspection reports detailed the level of inspection, results of the inspection, as well as any violations or OOS orders. In addition, NYSDOT provided a database

of all inspections performed at all fixed and mobile sites throughout New York State from 2003 through 2005.

4.3 Colorado

The Colorado field observational study was conducted from June 11 to June 22, 2007, at the Monument Interstate 25 north and southbound ports of entry near Monument, Colorado. The inspection sites are located at approximately milepost 162 on Interstate 25, south of Denver and north of Colorado Highway 105. The Monument port was chosen because of the heavy daily truck volume that traverses both north- and southbound Interstate 25.

Prior to the actual field data collection, pre-study activities for the Colorado site consisted of consulting with personnel at the Colorado Department of Revenue Motor Carrier Services Division to agree on the goals and a conceptual approach to data collection. Alan Rutledge of the Colorado Department of Revenue (Colorado's CVISN Program Manager) was the principal contact. The evaluation team conducted a site visit at the Monument inspection station on February 16, 2007. Evaluation personnel met with Mr. Rutledge and Jeff Byers, the district supervisor for the Monument port of entry, to understand the screening and inspection operations. Motor Carrier Services personnel provided a tour of the inspection station and described the procedures that the port counter officer and inspection staff follow when screening and inspecting vehicles. In addition, Mr. Byers walked the evaluation team through the steps followed in an inspection. He was interviewed to learn how he selects vehicles for inspection, what factors determine the level of inspection performed, and his process for performing and recording inspections. Through these conversations and demonstrations, the evaluation team was able to understand the practices, procedures, data sources, and data collection mechanisms that contribute to Colorado's screening and inspection process. Figure C-6 illustrates the layout of the Monument port while Figure C-7 presents an image of trucks going by the port building on the northbound site.

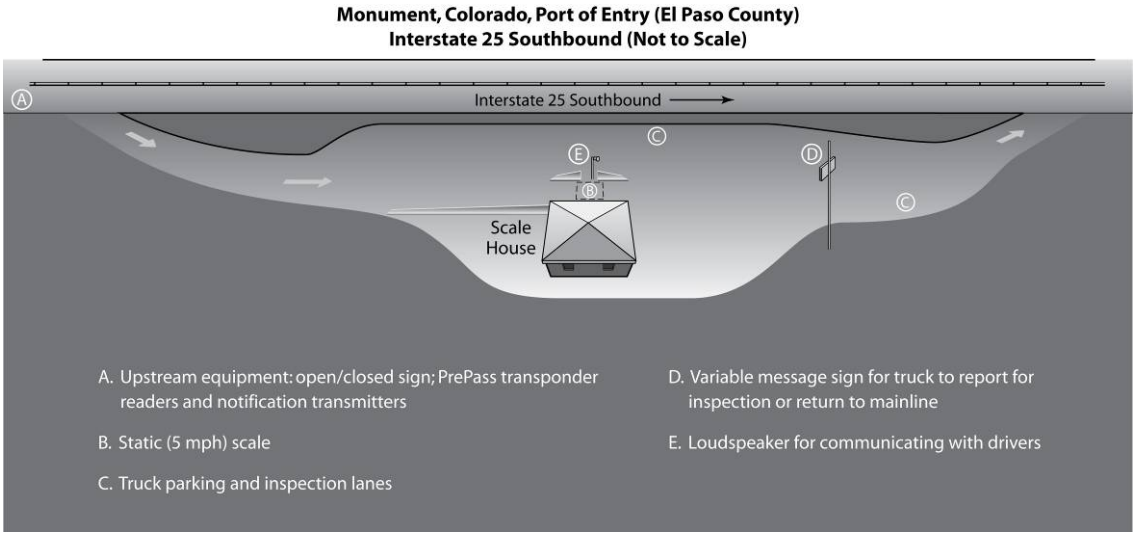


Figure C-6. Layout of Weigh-Inspection Site and Traffic Patterns at Monument, Colorado. Illustration is not to scale.

Figure C-7. Northbound Monument, Colorado Port of Entry Building on I-25

This site is equipped with transponder-based ES via PrePass and has a mainline weigh-in-motion scale tied to PrePass. There is no sorter lane at the Monument Port. All trucks are required to enter the station when it is open with the exception of those PrePass participants that are given permission to bypass. The layout for the site is such that there is one exit ramp from the highway leading directly to the scale house where the truck is weighed using a static scale. Trucks are to proceed across the scale at 10 to 15 MPH, during which time a counter officer visually reads the last eight characters of the VIN from the side of the tractor and types this sequence into a computer terminal in the scale house that is connected to the Colorado Business System. The computer screen in the port building instantly shows data on the tractor that is on the scale. The local database driving this lookup function relates the partial VIN with the USDOT number, which in turn displays the ISS inspection recommendation and other vehicle parameters such as vehicle weight, carrier name and address, base state, truck class, license plate number and information on registration and credentials.

Once trucks have been weighed, inspectors make a decision whether to let the truck continue back to the mainline if there are no problems or to have the truck pull over into an inspection lane just beyond the port building for further examination by motor carrier enforcement personnel. This decision is communicated to the driver via a variable message sign located just past the port building.

Besides gaining an understanding of the site's operations, a second goal of the site visit was to decide logistically how the evaluation team would obtain the necessary data for the field study. Decisions were made on methods for collecting data from vehicles as they traverse the station as well as collecting data from state databases that will assist with data analysis efforts after the

study. Colorado has a database system called the IDS. This database contains clearance information on every truck that has ever cleared a Colorado port. The clearance information from the Colorado Business System populates IDS. Rather than place a researcher on site to collect truck identification information, the evaluation team obtained a download from the IDS that contained all trucks that cleared the Monument port during the two-week period from June 11 to June 22, 2007. Data obtained from IDS included the USDOT and front tractor license plate number of each cleared truck, date and time for each clearance, and the specific port cleared (north or southbound).

It was desirable to characterize all vehicles that traversed the Monument port during the time of the field study so that the sample of trucks that can be identified could be considered a representative sample of all trucks that travel along this portion of Interstate 25. However, in certain cases vehicles can bypass the station, making it impractical to identify these vehicles visually because of their mainline speeds and the distance from the scale house. Vehicles can legally bypass the station because: 1) they were cleared as a result of PrePass; or 2) the station was closed temporarily to prevent queuing on the mainline as they approached.

Vehicles that are cleared by PrePass are believed to be safer and more likely to be in compliance with the safety and credentialing regulations than the general population of truck traffic, so they are of relatively lower interest to this study from a safety improvement perspective. By design, the PrePass system does not make available an abundance of vehicle or carrier information to state personnel. As was the case with the Ohio data collection, no information on trucks that bypassed the station through PrePass was available. As a result of the e-screening system not permitting the research team to identify particular carriers or vehicles receiving green lights to bypass, any detailed analysis of historical safety data on those carriers whose trucks were bypassing was not possible.

An assumption was made that the population of vehicles that bypass the station when it was temporarily closed is not significantly different from the population of trucks that went by when the station was open. Therefore, no identifying information was captured on vehicles that bypassed when the station was closed.

To obtain the list of trucks that were inspected during the field study, the Colorado State Patrol provided an extraction of the state's SafetyNet database containing the inspection reports for all vehicles inspected at the Monument port during the two-week study period. These inspection reports detailed the level of inspection, results of the inspection, as well as any violations or OOS orders. The Colorado State Patrol also provided an extraction of the SafetyNet database containing all inspections performed at all fixed and mobile sites in Colorado in 2006. Information from these inspection reports provided analysts with accurate information as to OOS rates for Colorado inspections or different classes of vehicles.

4.4 Kentucky

The Kentucky field data collection was conducted from June 11 to June 22, 2007 at the Laurel County northbound weigh station, as part of a separate but related USDOT-sponsored evaluation task order (BA34018). Prior to the actual field data collection, introductory visits to the site were

made by evaluation personnel in July and August, 2005, shortly after the system had been deployed. A preliminary site visit was also made on January 24, 2007, to both the Laurel County northbound I-75 and the Kenton County southbound I-75 ISSES sites. Personnel from the Kentucky Transportation Center and the system vendor were the principal contacts. The main goal of this January visit was to observe the operations at the stations and consult with members of the deployment team and inspectors. Of particular interest to the Inspection Efficiency portion of the evaluation was to understand the truck movements through the stations, the information available to inspectors to make decisions on which trucks to inspect, and how inspectors use this information to make inspection decisions. A second goal of the preliminary site visit was to determine how data can be extracted from the ISSES and other IT systems on-site and how best to locate researchers within the scale house at Laurel County to capture vehicle identification information visually. Researchers met with inspectors and officers from KVE as well as information technology personnel to understand the screening and inspection operations and took tours of both inspection stations.

Figure C-8 shows the layout of the Laurel County ISSES site. The Laurel County ISSES site is equipped with transponder-based ES via Norpass and has a mainline WIM scale linked with the Norpass system. There is also a low-speed WIM on the sorter lane leading from the mainline to the scale house. All trucks are required to enter the station when it is open, with the exception of those Norpass participants that are given permission to bypass. The layout for the site is such that there is one exit ramp from the highway that leads to a sorter-lane WIM. Trucks on the ramp with an acceptable WIM reading are directed to a lane on the west (highway) side of the scale house, which is the lane that contains the ISSES equipment. Overweight or oversize trucks are directed to a static scale on the east side of the scale house.

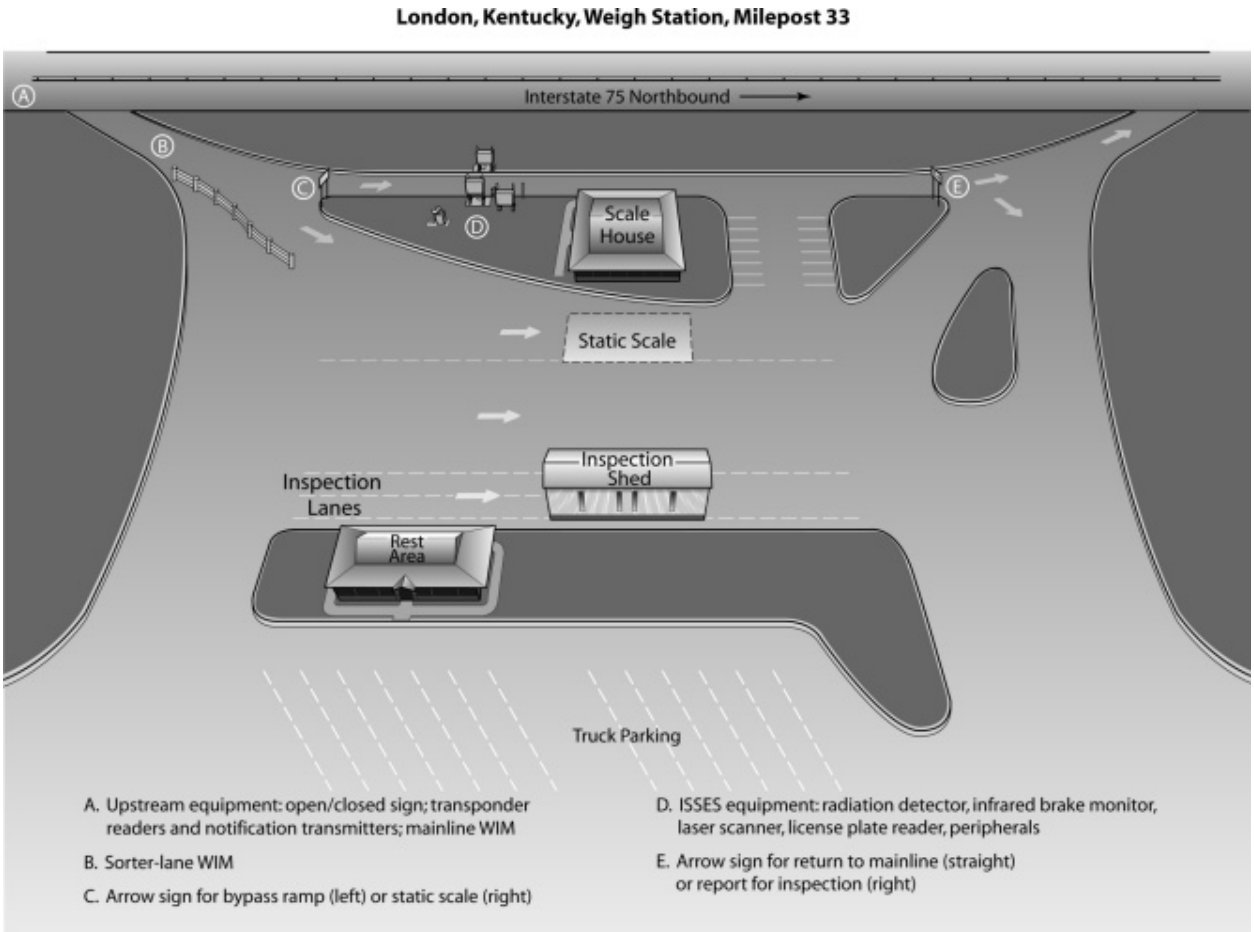


Figure C-8. Layout of Weigh-Inspection Station and Traffic Patterns at London, Kentucky (Laurel County). Illustration is not to scale.

For trucks that pass through the ISSES equipment, information from the bulk radiation detection monitor, thermal imaging inspection system, vehicle classification system, USDOT number reader, and license plate recognition system are communicated to officers in the scale house. At the time of the field observation, these systems were not fully integrated with any legacy Kentucky or federal safety data source. As such, ISSES information was generally not used in the inspection selection decision. Figure C-9 shows the ISSES system in operation.

Once trucks have been weighed on the sorter-lane WIM and/or the static scale, inspectors make a decision whether to let the truck continue to go straight back to the mainline if there are no problems or to have the truck pull around to the back of the station into the inspection area or shed for further examination by motor carrier enforcement personnel. This decision is communicated to the driver via lighted arrow signs located on both sides of the scale house.

Figure C-9. Laurel County, Kentucky, ISSES deployment. System control cabinet at left; elevated radiation detection panels close to truck lane on either side; visible lighting and identification camera apparatus in foreground.

Beginning on June 11, 2007, a researcher was placed in the scale house to observe the vehicles entering the weigh station during normal daylight hours while inspectors were present. To the extent possible, each entering vehicle was identified by USDOT number. Periodic time values were also recorded for reference and data matching purposes. This information was recorded via the researcher speaking into a digital voice recorder. The audio data were then transcribed to a Microsoft Access database application and quality-checked. Trucks passing by the scale house during daylight hours were no more than 10 feet from the window and, for the most part, were going at a very low speed through the ISSES, thus enabling the research team to capture vehicle identification information for most of the vehicles. Based on feedback from the data collector, it is estimated that no more than 5% of the vehicles going through the ISSES were missed. Mainly, truck information was missed when many trucks were too closely spaced and traveling too fast as they passed the scale house window for the data collector to capture all information. It is assumed that the safety ratings and other characteristics for the missed trucks are no different than those for the complete population of trucks traveling on this section of I-75 in Kentucky.

Table C-10 shows the dates and times that a researcher was on duty during the field study. For the most part, a researcher was collecting USDOT information from passing trucks during normal business hours while at least one inspector was at the station inspecting vehicles. One exception was on Tuesday, June 12, where no data collection occurred due to an unplanned

absence. Also, the station was closed at 11 AM on Tuesday, July 19 for a meeting of KVE officials, so data collection on that day was limited to the morning.

Table C-10. Times When USDOT Numbers were Captured from Truck Traffic Passing Though ISSES Equipment

Date	Time	Comment
Monday, June 11	8:00 AM – 4:00 PM	
Tuesday, June 12	Not applicable	No USDOT number data were collected; researcher unavailable
Wednesday-Friday, June 13-15	8:00 AM – 4:00 PM	
Monday, June 18	8:00 AM – 4:00 PM	
Tuesday, June 19	8:00 AM – 11:00 AM	Station closed at 11:00 AM for staff meeting. It was not reopened until 6:00 PM
Wednesday-Thursday, June 20-21	8:00 AM – 5:00 PM	
Friday, June 22	8:00 AM – 4:00 PM	

It was desirable to characterize all vehicles that traversed the Laurel County station during the time of the field study so that the sample of trucks that can be identified could be considered a representative sample of all trucks that travel this section of the highway. However, in certain cases vehicles can bypass the station, making it impractical to identify these vehicles visually because of their mainline speeds and the distance from the scale house. Vehicles can legally bypass the station because: 1) they were cleared as a result of Norpass; or 2) the station was closed temporarily to prevent queuing on the mainline as they approached. Vehicles can also bypass the station illegally by not stopping when the station is open or, in the case of e-screening participants, not entering the station when a red light signal is communicated to the driver.

The Kentucky Transportation Cabinet provided a file of all Norpass-participating trucks that traversed the highway where the Laurel County inspection station was located for the second week of the two-week study. Information provided in the file for the second week of the field study included:

- Time and date when the vehicle's transponder was read
- Decision made on truck (bypass or pull in)
- Reason for decision
- Carrier name
- USDOT number
- Vehicle unit number
- State
- Vehicle license plate number.

The trucks that were given a bypass signal during the hours of data collection at the site were added to the list of trucks that were captured by the on-site data collector to get a more complete list of truck traffic that went by the inspection station during the second week of the field study. E-screening participating trucks that were pulled in and went through the ISSES portal would

already have been captured by the data collector. Kentucky Vehicle Enforcement (KVE) personnel estimated that approximately 8% of the trucks that enter the Laurel County weigh station cross the static scale, instead of going through the ISSES portal. These "static scale" trucks, most likely overwidth or flagged as potentially overweight on the low-speed ramp WIM, are not accounted for in this analysis.

An assumption was made that the population of vehicles that bypass the station when it was temporarily closed is not significantly different from the population of trucks that came in when the station was open. Therefore, no identifying information was captured on vehicles that bypassed when the station was closed. The major closure was on Tuesday, June 19. Based on hourly truck counts observed on that day, it is estimated that approximately 1,000 trucks bypassed the weigh station during the late morning/afternoon station closure. There were instances where the station was closed for very short periods of time due to excessive backups on the ramp leading from the mainline to the weigh station. The amount of trucks that bypassed the station during these brief closures was minimal. Also, it is unknown what proportion of vehicles bypass the station illegally, although it is assumed to be a low percentage of the truck traffic for purposes of this study.

Electronic copies of reports from all inspections conducted at the Laurel County station during the two-week field study were obtained from KVE at the conclusion of the study. This provided evaluators with a list of specific vehicles that were chosen for inspection from the truck traffic that traversed the station during the field study. These inspection reports detailed the level of inspection, results of the inspection, and any violations or OOS orders. KVE also provided a database of all inspections performed at all fixed and mobile sites in Kentucky for the 32-month period from January 2005 through September 2007. Information from these inspection reports provided analysts with accurate information as to OOS rates for Kentucky inspections or different classes of vehicles.

The Kentucky Department of Motor Vehicles also provided a copy of the Kentucky Clearinghouse Database. The data in the Clearinghouse changes daily, so it not possible to know the exact contents of the Clearinghouse for each day of the field study. Rather, an attempt was made to get a copy of the database as close to the time of the field study as possible. Due to a delay in making the file available to researchers, a snapshot of the database was obtained by researchers in August 2007, reflective of information as of July 17, 2007, roughly one month after the field study. It is unknown to what degree the contents of the Clearinghouse changed between the end of the field study and July 17. However, for purposes of this study it is assumed that any changes to a carrier's profile would be minimal. Registration and insurance status about each carrier was extracted so that it could be combined with other safety-related information to form a more complete picture of each motor carrier.

Unfortunately, video images from the infrared/thermal imaging camera during the field study at the Laurel site were not available to the evaluation team. For more information on the Kentucky evaluation, see the separate final report on Task Order BA34018 (FMCSA 2008a,b).

5.0 Field Observational Study Results

This section demonstrates the effectiveness of current CVISN deployments in Ohio, Colorado, Kentucky, and New York at increasing the efficiency of inspections in terms of focusing on high-risk vehicles (Objective 1.2).

A quantitative, statistically rigorous baseline picture of the commercial traffic that traverse the field study inspection sites is important in preparing strategies for helping vehicle inspectors to focus on higher-risk carriers and vehicles. First, summary information on truck traffic that traversed the inspection station during the field study were collected to get an idea of the amount of truck traffic at the station as well as a description and understanding of the relative safety risk of trucks that traverse each inspection site. The trucks observed entering the site during the field study were used as an estimate of the overall truck population traveling in this area both in terms of demographic information and safety risk.

Then, inspection efficiency was calculated for each inspection site. For purposes of this evaluation, inspection efficiency is defined by the degree to which inspectors choose high-risk trucks for inspection. A high-risk truck is one where there is a high likelihood that the truck is operating with a serious OOS condition. The carrier's ISS score was used to assign each vehicle to a safety risk category. ISS is a rating system promoted by USDOT.

In this section, summary results are presented for all four field study locations on the various data collected during the field studies followed by observed differences in OOS rates and safety risk distributions. In addition, inspection efficiency results are shown. Detailed calculations and results for the four states are provided in Appendices C.2 through C.5.

5.1 Summary of Field Data Collected

Table C-11 provides a summary of information collected from each of the four field studies. The number of trucks observed ranged from 1,549 during the three-day study in New York to 17,404 during the two-week study in Colorado. Kentucky was the only state where identifying information for trucks that bypassed the station due to ES programs were available to the evaluation team. The number of inspections performed during the field studies ranged from 41 in Colorado to 100 in Ohio. Historical inspection reports were provided by the states to provide a more robust picture of inspections performed in the state. Kentucky and New York provided three years' worth of inspection data while Colorado and Ohio provided one year and ten months, respectively.

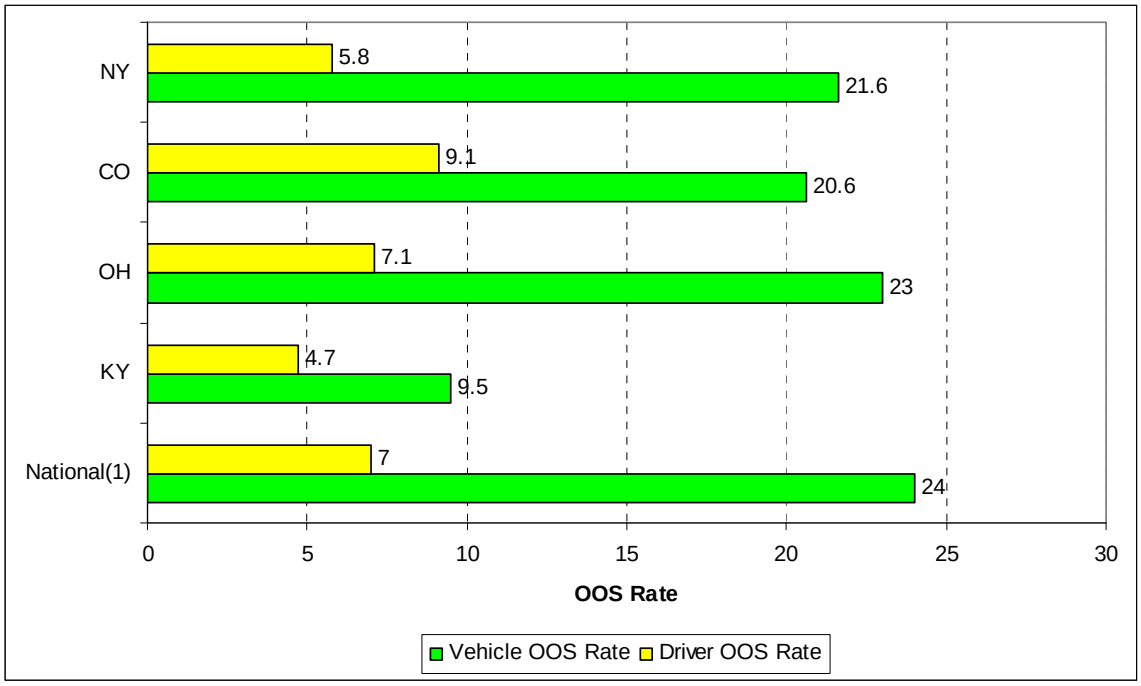
Table C-11. Summary of Data Collected from Field Studies

	State			
	Colorado	**Kentucky**	**New York**	**Ohio**
Field Data Collection				
Number of Days	10	9	3	3
Number of Observed Trucks	17,404	12,824*	1,549	2,044
Average Truck Traffic Rate (Trucks/Hour)	67	161	74	85
Number of Inspections Performed	41	93	64	100
Historical Inspection Reports				
Time Period	2006	2005 – September, 2007	2003 - 2005	2006 (Jan-Oct)
Number of Inspections Performed	32,790	222,452	294,522	76,725

5.2 Carrier OOS Rates and Safety Risk Level

Figure C-10 displays the carrier's vehicle and driver OOS rate for the nation as well as each field study state. All state OOS rates were calculated based on data received on past inspections from the respective states. A cross-reference of these rates was performed with the annual OOS rates published by NAFTA (North American Free Trade Agreement) on the FMCSA's A&I (Analysis and Information website to ensure accuracy (USDOT 2005). OOS rates from website were consistent with rates calculated from the state past inspection data.

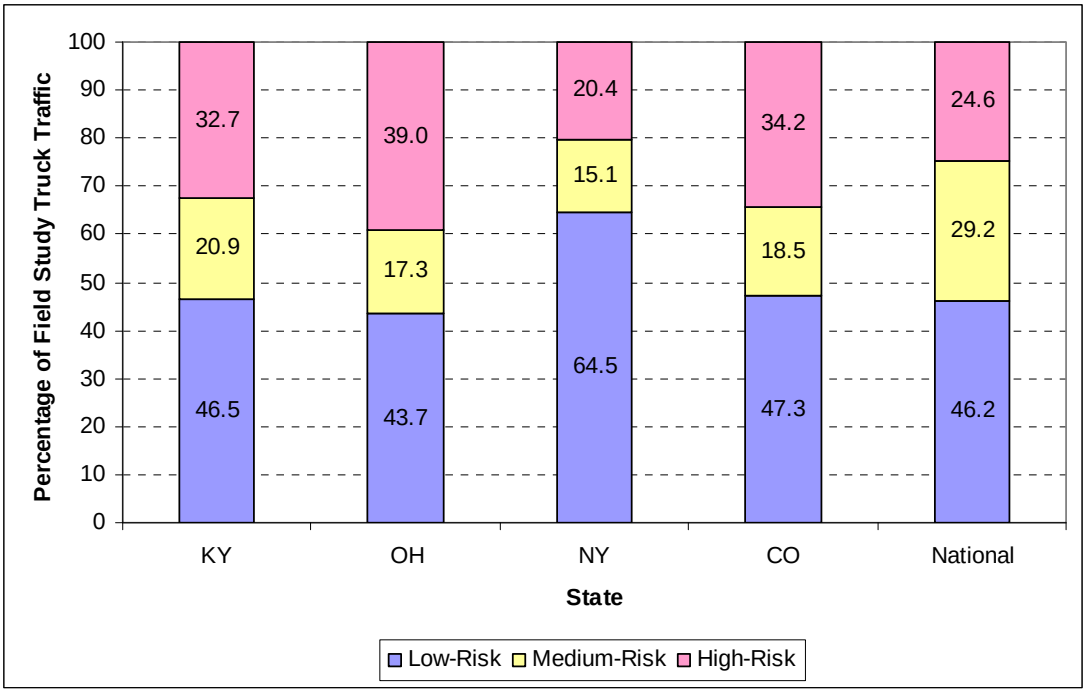
National rates were obtained from NAFTA safety statistics. The figure illustrates that Kentucky's vehicle and driver OOS rates are both lower than their respective national averages as well as being lower than the rates for each of the other three. Although there are differences in both vehicle and driver OOS rates, the difference in vehicle OOS rates is more profound. The Kentucky driver OOS rate of 4.7% is only slightly lower than the 7% rate estimated from the 2005 NAFTA summary. Colorado, New York, and Ohio all have more consistent vehicle and driver OOS rates.



(1) National statistics obtained from 2005 NAFTA Safety Statistics

Figure C-10. Vehicle and Driver OOS Rates for the Nation and Various States Participating in National CVISN Deployment and Kentucky CVSA Evaluations

This lower vehicle OOS rate for Kentucky could be due to many factors. First, trucks traveling in Kentucky may be safer compared to those traveling in other states due to Kentucky laws and regulations. However, Figure C-11 illustrates that—based on data collected from the field studies and SAFER—Kentucky's safety risk, as defined by ISS score, was similar to the truck populations in Colorado, New York, Ohio and the nation.



1. Ohio truck traffic based on about 2,000 observed trucks during Oct 31 – Nov 2, 2006
2. New York truck traffic based on about 1,500 observed trucks during May 8-10, 2007
3. Colorado truck traffic based on about 17,000 observed trucks during June 11-22, 2007
4. Kentucky truck traffic based on about 12,000 observed trucks during June 11-22, 2007
5. National data based on about 219,000 carriers in SAFER Carrier Table with sufficient information to calculate ISS score

Figure C-11. Risk Distribution for Kentucky, Ohio, New York, and Colorado Field Study Truck Traffic as well as National Risk Distribution from SAFER

A second explanation could be that there may be different inspection selection priorities or differences in truck traffic during scheduled versus randomly selected times. Joe Crabtree of the Kentucky Transportation Center (University of Kentucky) acknowledged that Kentucky's OOS rates are below the national average and that FMCSA and the Commissioner of KVE have identified this fact as a priority. The Kentucky Transportation Center has been performing a detailed analysis of Kentucky's OOS rates in an attempt to better understand the difference in OOS rates between Kentucky and the rest of the nation. At the time of this evaluation, no results or conclusions from this analysis were available.

Another observation from Figure C-11 is that New York has a larger percentage of low-risk trucks (65%) compared to the other states. The truck traffic observed during the four field studies showed similar results as 56% of the vehicles in New York were classified as low-risk. The reason for this is unknown. However, NYSDOT commented that trucks with poor safety records tend not to travel along sections of interstates and highways in New York on days where inspections are being performed. Since New York rotates their inspection sites daily, trucks have the ability to find alternate routes to avoid rest areas where inspections are taking place on a given day. Although the location of the inspection sites is not known to the truck population in

advance, NYSDOT mentioned that word travels fast among the drivers on the road once a mobile site is open for inspections. This type of behavior is not as easy in other states where inspections occur at fixed locations daily and could be an explanation for the lower percentage of high-risk carriers observed in New York.

5.3 Inspection Efficiency

Table C-12 summarizes the inspection efficiency for the other three field study inspection stations in terms of the probability of selecting high-risk trucks (Ohio results are presented again for comparison). For the inspected and truck traffic vehicles, the probability of a truck being high-risk is shown. The ratios for Colorado and Kentucky (along with Ohio) are all statistically significantly greater than 1 (the value expected if there was no difference between random inspections and current practices). Current inspection practices in Colorado, Kentucky, and Ohio yield 50, 16, and 42% more high-risk trucks than random selection would, respectively. Inspection practices in New York did not result in a significant increase in high-risk trucks. Of all four states, New York's inspection practices were the closest to a random selection with no ES, WIMs, or static scales to screen vehicles.

Table C-12. Inspection Efficiency at Field Study Inspection Stations

Vehicle Data	Percent of High-Risk Carriers			
	Colorado	**Kentucky**	**New York**	**Ohio**
Inspected(1)	40.95%	33.94%	18.72%	49.56%
Truck Traffic(2)	27.35%	29.32%	17.62%	34.93%
Inspected vs. Truck Traffic	1.50(3)	1.16(3)	1.06	1.42(3)

(1) Inspection figures based on inspections performed at the inspection site during previous 1 to 3 years (depending on state).
(2) Truck traffic numbers based on trucks observed during the state's field study.
(3) Ratio is statistically significantly greater than 1 with 95% confidence

Columns 2 through 4 of Table C-13 present the number of OOS orders that would be expected under each of the following three scenarios: (1) trucks are selected randomly for inspection; (2) current inspection practices; and (3) the use of full ES. For example, Colorado would expect about 26 OOS orders per 100 inspections when trucks are selected randomly and also when their current inspection practices are used. The number of OOS orders would increase to about 36 when full ES was employed. The number of OOS orders expected under each of the three scenarios is significantly lower for Kentucky compared to the other states. This is a result of Kentucky's OOS rate being significantly lower than the other three states (as well as being lower than the national average). The other three states show more consistent results with Ohio having a slightly larger number of OOS orders than Colorado or New York.

Table C-13. Inspection Efficiency Summary Results (In Terms of Increased OOS Orders) at Field Study Inspection Stations

State	No. OOS Orders per 100 Inspections			% Increase in OOS Orders per 100 Inspections		
	Random Selection	Inspected	Full ES	Inspected vs. Random Selection	Full ES vs Random Selection	Full ES vs Current Inspection Practices
Colorado	25.59	25.86	35.84	1.1%	40.1%	38.6%
Kentucky	13.00	12.55	18.81	- 3.5%	44.7%	49.9%
New York	22.02	23.36	31.29	6.1%	42.1%	33.9%
Ohio	26.73	28.55	35.55	6.8%	33.0%	24.5%

The last three columns of Table C-13 show the percent increase in OOS orders per 100 inspections when comparing scenarios. For instance, the percent increase in OOS orders when full ES is used as opposed to current inspection practices ranges from about 25% (Ohio) to almost 50% (Kentucky). Kentucky's higher increase again is due to their lower than normal OOS rate based on their current inspection practices.

Overall, the results presented in Tables C-12 and C-13 demonstrate that the availability of real-time safety information at the roadside would help inspectors more effectively target higher-risk carriers, vehicles, and drivers, yielding more OOS orders.

Because of the below-average OOS rates, Kentucky historical inspection data was not used in Section 6.0 to assess safety benefits associated with various levels of CVISN deployment. Inspection data from Colorado, New York, and Ohio was instead combined for this purpose, since those states were more consistent with national OOS rate estimates. Safety benefits associated with Kentucky data can be found in the final report of the FMCSA/FHWA task order, "Kentucky Commercial Vehicle Safety Applications Evaluation" (USDOT, 2008).

6.0 Safety Benefits

In 2005[3], 5,212 people were killed and approximately 114,000 were injured in crashes involving approximately 441,000 large commercial motor vehicles (CMVs). The most important benefit expected from the deployment of CVISN technologies, especially ES and SIE, is a reduction in CMV-related crashes through improved enforcement of the Federal Motor Carrier Safety Regulations (FMCSRs). The principal hypothesis to be tested is that CVISN technologies will help enforcement staff focus inspection resources on high-risk carriers. This will result in more OOS orders for the same number of inspections—thereby removing from service additional trucks and drivers that would have caused crashes because of vehicle defects and driver violations of safety regulations.

[3] Although more current crash statistics are available, the safety benefits analysis is performed using a baseline year of 2005 because that was the last year for which complete data were available from all of the relevant sources.

6.1 Technical Approach

The following sections describe (1) the sources of data obtained from the literature and the field studies to quantify the impacts of CVISN on roadside safety enforcement, (2) the crash avoidance model used to estimate safety benefits, and (3) various roadside enforcement scenarios used to illustrate the safety benefits. The safety benefits estimation method was adapted from the approach used in the CVISN Model Deployment Initiative evaluation (USDOT 2002).

Data Sources

Table C-14 lists some key safety statistics obtained from the published literature. Most of these data are used in the crash avoidance analysis; others are provided for reference. According to FMCSA, 8.5 million large trucks (>10,000 pounds gross vehicle weight) in 2005 traveled approximately 233 billion miles in the U.S. Also in 2005, the last year for which complete statistics are available, 441,000 trucks were involved in crashes, resulting in approximately 114,000 injuries and 5,212 deaths. The corresponding rates per vehicle mile traveled are derived from these values. Other relevant statistics provided in Table C-14 include the number of national commercial vehicle inspections performed in 2005 and the actual percentages of OOS orders issued. In 2003 FMCSA sponsored the National Truck Fleet Safety Survey (TFSS), in which approximately 2,800 trucks were selected at random for inspection in order to estimate the percentages of trucks and drivers that operate with OOS conditions (i.e., violation rates). These estimates differ from the actual OOS rates because inspectors choose vehicles for inspection based on vehicle appearance and apply their knowledge and experience. The estimated OOS rates reported by the TFSS were 28% for vehicles and 5% for drivers (FMCSA 2006).

In order to determine the impact of removing OOS violators from the roadway on the number of crashes, it is necessary to estimate certain probabilities associated with crash causation. One important component to the statistical crash reduction model is being able to estimate the relative risk of driver and vehicle OOS violations in truck crashes. Specifically, we would like to know the probability that an OOS condition exists on a truck given a crash has occurred involving that truck. Before the LTCCS, there were not reliable estimates of this probability for either vehicle or driver OOS violations, as there had not been sufficient data to support calculation of reliable estimates. By focusing on the pre-crash condition of the truck, the LTCCS provides the right type of data for this analysis. The LTCCS data were used to calculate various probabilities that were used as inputs to the crash avoidance model. These data are discussed more fully in the next section along with the explanation of the crash avoidance model.

Table C-14. Relevant National Safety and Safety Enforcement Statistics on Large Trucks

Statistic Description	Value	Source [1]
Number of large trucks	8.5 million	Large Truck Crash Facts 2005 (USDOT 2007b)
Large truck annual vehicle miles traveled (VMT)	233 billion	Large Truck Crash Facts 2005 (USDOT 2007b)
Large trucks involved in crashes (2005) Injuries from large truck crashes (2005) Fatalities from large truck crashes (2005)	441,000 114,000 5,212	Large Truck Crash Facts 2005 (USDOT 2007b)[2]
Large trucks involved in property damage-only crashes Large trucks involved in injury-only crashes Large trucks involved in fatal crashes	354,000 82,000 4,932	Large Truck Crash Facts 2005 (USDOT 2007b)
Large truck crash rate (truck crashes/100 million VMT) = 441,000 truck crashes/233 billion VMT	189.3	Derived
Commercial vehicle (non-bus) vehicle inspections performed (2005) Commercial vehicle (non-bus) driver inspections (2005) Total CV (non-bus) inspections (driver or vehicle) (2005)	1,949,375 2,669,679 2,708,856	Annual Summary of Roadside Inspections – NAFTA Safety Stats (A&I website)
Percent of vehicles placed OOS (2005) Percent of drivers placed OOS (2005)	24.0% 7.0%	Annual Summary of Roadside Inspections – NAFTA Safety Stats (A&I website)
Percent of VMT with vehicle OOS conditions (2003) Percent of VMT with driver OOS conditions (2003) Percent of inspections that found at least one OOS vehicle violation given a OOS driver violation was found Percent of VMT with brake-related OOS conditions	28% 5% 49% 14%	2003 National Truck Fleet Safety Survey (TFSS) (USDOT 2006f) 1996 National Survey (Star 1997)
Percent of large CMV crashes with vehicle OOS condition present	28.62%	Derived from LTCCS (USDOT 2006g)
Percent of large CMV crashes with driver OOS condition present	12.2%	Derived from LTCCS (USDOT 2006g)

1 Full reference citations are presented in Section 8 below, Safety Analysis References.
2 The value of approximately 441,000 large trucks involved in crashes includes 4,932 fatal crashes; 82,000 injury crashes; and 354,000 property damage-only crashes.

While these data provide much of the necessary information needed to estimate safety benefits, additional data from the inspection efficiency field studies were needed to supplement the data in Table C-14. Specifically, information on the rate at which OOS orders were issued at the field study inspection sites were used as well as the calculated increase in the OOS order rate under different roadside enforcement scenarios.

Crash Avoidance Model

Ultimately, safety benefits will be realized only to the extent that targeted inspections and improved compliance translate into reductions in numbers of crashes. The premise of targeted inspections is that, for the same number of inspections performed, additional drivers and vehicles operating with OOS conditions will be removed from the roadway. Furthermore, all of the conditions leading to the OOS order will be fixed and "stay fixed" for a period of time after the inspection. Therefore, crashes that would have occurred during this period are prevented because the OOS conditions that would have caused the crashes were eliminated. The safety

benefit of CVISN technologies is determined by comparing the number of crashes avoided under a baseline scenario (i.e., with pre-CVISN roadside enforcement strategies and technology) with the number of crashes avoided under a number of deployment scenarios involving CVISN. It is assumed under each scenario that the corresponding number of injuries and fatalities avoided are proportional to the number of crashes avoided.

The basic principle of the crash avoidance model, as well as certain assumptions about how roadside enforcement affects crash rates, were motivated by research on the Safe-Miles model developed for FMCSA to estimate the benefits of MCSAP, the Motor Carrier Safety Assistance Program (VNTSC 1999a). Although the model used in the CVISN analysis is different from the one used in Safe-Miles, certain model parameters such as the number of "safe miles" a truck travels following an OOS order, are used in this analysis.

In simplest terms, the number of crashes avoided can be written as

$$\#\ Crashes\ Avoided = \#\ inspections * P(V \mid I) * [P(C \mid V) - P(C \mid \overline{V})] \tag{1}$$

where

- $P(V|I)$ is the probability that a truck has an OOS violation given that it was inspected
- $P(C|V)$ is the probability of a crash given that a vehicle has an OOS violation
- $P(C \mid \overline{V})$ is the probability of a crash given that a vehicle does not have an OOS violation

This model is based on the assumption that trucks are selected for inspection (I) according to specified inspection selection criteria. If an OOS violation (V) is found, the truck is taken out of service until the violation can be corrected. According to the Safe-Miles model, crashes (C) are avoided because the truck will be operating without the violation for a specified number of miles. (The number of miles depends on the nature of the violation).

As written, Equation (1) contains an implicit assumption that, conditioned on the presence or absence of a violation, the likelihood of a crash does not depend on whether the truck was selected for inspection. Certainly this is true if inspections are performed at random; but this assumption may not be true under other inspection selection criteria. Equation (1) is used for the benefits estimation because it greatly simplifies the calculations and it makes use of available data. Appendix C.10 presents the more complete model, provides some justification for making the simplifying assumption, and suggests potential sources of data for further investigation.

While the number of inspections and the probability of a violation given an inspection are easily obtained, the probability of a crash given that a vehicle has an OOS condition as well as the probability of a crash given that a vehicle does not have an OOS condition are more complicated. Using Bayes Theorem, we rewrite $P(C|V)$ and $P(C \mid \overline{V})$ as

$$P(C \mid V) = \frac{P(V \mid C) * P(C)}{P(V)} \tag{2}$$

$$P(C \mid \overline{V}) = \frac{P(\overline{V} \mid C) * P(C)}{P(\overline{V})} \tag{3}$$

where

- *P(V|C)* is the probability that a vehicle has an OOS violation given it is in a crash
- *P(V)* is the probability that a vehicle has an OOS condition
- $P(\overline{V} \mid C)$ is the probability that a vehicle does not have an OOS violation given it is in a crash
- $P(\overline{V})$ is the probability that a vehicle does not have an OOS condition

Substituting the new expressions for *P(C|V)* and $P(C \mid \overline{V})$ presented in Equations (2) and (3) into Equation (1) and performing some algebraic manipulation yields the following model for crashes avoided:

$$\#\,Crashes\ Avoided = \frac{\#\,inspections * P(V \mid I) * P(C)}{P(V)} * \frac{P(V \mid C) - P(V)}{1 - P(V)} \tag{4}$$

In this analysis, we are only concerned with crashes that are avoided because they would have been caused by a vehicle defect or driver violation that resulted in an OOS order. Also, it is generally assumed that crashes are rare events that follow a Poisson process. This means that the probability of observing a crash in a short interval of miles driven is approximately proportional to the number of vehicle miles traveled (VMT), regardless of the number of miles that have been traveled up until that point. Mathematically, this results in the Poisson distribution for the number of crashes that occur within a fixed driving distance. Therefore, the probability of a crash (among vehicles that would have been operating with defects or driver violations) can be estimated by the national crash rate for large trucks (denoted by λ) multiplied by the number of safe miles (SM) traveled as a result of "fixing" an OOS condition. This is the approach used in the Safe-Miles program. The values of SM used in the Safe-Miles program are 15,000 miles for vehicle OOS orders and 10,000 miles for driver OOS orders. Thus, the P(C) term in Equation (4) [estimated by λ*SM in Equation (5) below], refers to the probability of observing at least one crash in 15,000 (or 10,000) miles. Beyond the safe mile period, the safety benefits for "fixing" the OOS condition are assumed to diminish.

Thus, the final model for crashes avoided is the following:

$$\#\,Crashes\ Avoided = \frac{\#\,inspections * P(V \mid I) * SM * \lambda}{P(V)} * \frac{P(V \mid C) - P(V)}{1 - P(V)} \tag{5}$$

Equation (5) is used to estimate the safety benefits associated with various CVISN deployment scenarios presented in the next section. The national crash rate for trucks, λ, is 441,000 truck crashes divided by 233 billion vehicle miles traveled (VMT), or 1.89 crashes per million miles traveled.

Additional data needed for this model include *P(V|I),* the probability of an OOS violation given the truck was inspected, *P(V),* the probability that a vehicle will have an OOS violation, and *P(V|C)*, the probability that a vehicle has an OOS violation given it is in a crash. These values depend on the particular roadside deployment scenario or enforcement strategy under consideration. The LTCCS was used to estimate *P(V|C)* for various OOS violations and groups of violations. For example, given a crash, the probability of a specific OOS violation (such as brakes) or group of violations (e.g., vehicle or driver) present on the truck was estimated from the LTCCS data.

6.2 Deployment Scenarios

Truck traffic at most inspection sites is very heavy, and inspectors cannot inspect every commercial vehicle that passes by. Thus, there needs to be a sound methodology for narrowing down the pool of trucks from which inspectors have to choose. Six overall scenarios are presented in this section, a few of which have been divided into sub-scenarios. The six deployment scenarios present different methods for selecting vehicles for inspection with the goal being to select trucks that will yield the most OOS orders. Using the crash avoidance model given in Equation 5, these scenarios will illustrate the estimated safety benefits of CVISN technologies.

In the commercial vehicle law enforcement community, the term "electronic screening" signifies a transponder-based mainline preclearance system, such as Norpass, HELP/PrePass, Oregon Green Light, or equivalent. Such systems provide roadside enforcement personnel the ability to detect and identify and (optionally) weigh commercial motor vehicles at mainline speeds. For purposes of this report, Scenarios RE-3 through RE-5 expand the definition of "electronic screening" to include other means of achieving the same goal, namely to use computers and telecommunication technology to identify and prescreen vehicles in real time. In Scenarios RE-3 through RE-5, computer-based systems are used for identifying trucks moving slowly through a weigh station. The basic function is the same as transponder-based preclearance, the only difference being the truck's speed at the point of decision (red light, pull-in, green-light, bypass). In these three scenarios, it is assumed that some trucks will carry transponder tags and some will not. Furthermore, all trucks approaching the station will be subject to electronic or computer-based, real-time prescreening—at high or low speeds—as an aid to the inspector's decision process. These three scenarios also diverge from the usual definition of "electronic screening" in that, for purposes of modeling and analysis, they introduce screening decision criteria that are different from the criteria believed to be used in the prevailing mainline e-screening programs (Norpass, PrePass, and Oregon Green Light).

Table C-15 provides a high-level summary of the six scenarios presented in this section. A more thorough description of each scenario follows the table.

Table C-15. High-Level Overview of Roadside Enforcement Scenarios

Scenario Number	Screening Criteria Used in Scenario					
	Random Only	Inspector Experience and Judgment	Electronic Screening with Snapshots	Vehicle and Driver OOS Rates Using Threshold	Brake and Driver OOS Rates	Infrared Images and Driver OOS Rate
RE-0	X					
RE-1		X				
RE-2		X	X			
RE-3		X	X	X		
RE-4		X	X		X	
RE-5		X	X			X

RE-0: Random Selection. Enforcement officers (inspectors) select commercial vehicles for inspection in a random manner without using personal experience, judgment or any CVISN technologies. This is not one of the roadside enforcement strategies being considered, nor is it a realistic strategy to employ. However, the calculation of safety benefits under this scenario is useful for determining the contribution of the inspectors' knowledge and experience during the vehicle selection process.

RE-1: Baseline—Pre-CVISN. Inspectors select commercial vehicles for inspection using personal experience and judgment, but without the aid of most CVISN technologies. ES is assumed to be used at its current level as of June 2007.

RE-2: Mainline Electronic Screening based on ISS Score. State deploys ES with safety snapshots at all major inspection sites. All motor carriers that are classified as low- and medium-risk based on ISS scores (comprising approximately 60% of trucks on the road) enroll in the ES program, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors use current practices to select vehicles for inspections from the remaining 40% of trucks in the high-risk and insufficient data categories.

RE-3: Electronic Screening based on high vehicle and driver OOS rates. State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from SAFER. In this scenario, each truck is screened based on the vehicle and driver OOS rate of the carrier. A threshold OOS rate is established for both vehicles and drivers such that all trucks with OOS rates exceeding the corresponding thresholds will be brought into the inspection station for inspection while all others will be allowed to bypass inspection sites. The threshold rates are chosen such that only trucks with the highest OOS rates are candidates for inspection. The threshold values can vary depending on both the truck traffic and the rate at which inspections can be performed at the site. As part of RE-3, three specific threshold values are considered.

RE-4: Electronic screening based on high driver OOS and brake violation rates. State utilizes ES at all major inspection sites. Each truck is screened based on its OOS or violation rate for violations that have a high relative risk for crash. In this scenario, vehicles are screened based on

their brake violation and overall driver OOS rates as they appear in SAFER. A distinction is made here between violation and OOS rates. SAFER contains a *violation* rate for brakes but not a brake *OOS* rate. Thus, violation rates are used as a safety index for brake issues while the driver OOS rate is used to screen for driver issues. Both brakes and driver OOS violations have been found to have a high relative risk for crashes. This scenario differs from RE-3 in that vehicles are screened on their brake violation rate as opposed to their overall vehicle violation rate in an attempt to catch those vehicles that have a violation that has a higher relative risk for crash. Similar to RE-3, all trucks with violation rates exceeding the threshold will be candidates for inspection while all others will be allowed to bypass inspection sites. Moreover, the threshold rates are chosen such that only trucks with the highest rates are selected for inspection and the thresholds can vary depending on the amount of inspection personnel available at a given station. As part of RE-4, three specific threshold values are considered.

RE-5: Electronic screening based on infrared screening and high driver OOS violation rate. State utilizes the ISSES or some form of infrared screening at all major inspection sites. Each truck is screened via two criteria: the thermal (IR) imaging system on a system such as the ISSES deployed in Kentucky and the driver OOS rate of the carrier. In this scenario, vehicles are screened based on the presence of a brake violation through the infrared image produced by the infrared system and the driver OOS rate as it appears in SAFER. This scenario is similar to RE-4 in that both brakes and driver OOS violations are used as screening criteria. RE-5 differs from RE-4 in that vehicles are screened for brake violations via infrared imaging as opposed to brake violation rates obtained from SAFER. All trucks with a potential brake violation as detected from the infrared image or trucks with driver OOS rates exceeding various thresholds will be candidates for inspection, while all others will be allowed to bypass inspection sites.

Discussion of Scenarios

RE-0 is the most basic selection process of selecting vehicles randomly and is presented mainly to assess the contribution of the inspectors' knowledge and experience during the vehicle selection process, which is represented in the baseline scenario RE-1. The remaining four scenarios all make use of progressively more involved selection criteria. ES is employed in RE-2 to eliminate all low- and medium-risk carriers from selection consideration. Although this scenario helps improve inspection selection efficiency by allowing inspectors to focus only on high-risk vehicles or those with insufficient data, there are still too many vehicles remaining in these categories for roadside enforcement officials to inspect them all. As a result, scenarios RE-3 through RE-5 provide various methods to further narrow down the number of vehicles that inspectors have to choose from. RE-3 and RE-4 select only those vehicles with the highest probability of having particular kinds of OOS violations as measured by some safety index. RE-5 examines the benefits when infrared imaging is used to screen for brake violations. Each of the scenarios RE-2 through RE-5 implies that all states need to achieve CVISN Core Deployment and be actively involved in Expanded CVISN programs. These roadside deployment scenarios are based on states being advanced in two of the main areas of CVISN functionality: SIE and ES. A seventh deployment scenario, one that screens vehicles based on the carrier's ISS score, was examined as a supplementary analysis. The methodology and results for this new scenario are discussed in Appendix C.9.

The calculation of safety benefits for scenarios RE-0 through RE-2 is presented in Section 6.3. The calculations are straightforward, based on Equation (5), specific inputs contained in Table C-14, as well as results from the inspection efficiency analyses from the four field studies. Scenarios RE-3, RE-4, and RE-5 are more complicated and hence more information is provided in this section in advance of the results presentation in Section 6.3.

RE-3 and RE-4: Methodology for Selecting Vehicles for Inspection Based on Safety Index

The inspection selection strategy described in this section is based on the notion of selecting trucks for inspection based on the value of some safety index associated with the carrier. Any truck with a safety index above a given threshold would be pulled in for inspection while all other trucks would be allowed to bypass the station. The two main issues considered in this section are: 1) Determining the most appropriate safety index; and 2) Determining the threshold value for this index that should be used to decide which vehicles to inspect.

Choice of Safety Index. From an inspection efficiency standpoint, the best choice for a safety index is one that correlates well with the probability of finding an OOS violation on a vehicle chosen for inspection. Further, from a crash prevention standpoint, the OOS violations found should be for violations that pose a high relative risk for crashes. Both viewpoints were used in choosing safety indices. The first set of indices considered in this analysis was the carrier's vehicle and driver OOS rate. Results from an inspection efficiency analysis conducted in Kentucky as part of a separate FMCSA/FHWA task order, "Kentucky Commercial Vehicle Safety Applications Evaluation" (BA34018) suggested that screening vehicles using carrier OOS rates as opposed to ISS may provide a larger percentage of trucks being placed OOS (FMCSA 2008a,b). As a result, scenario RE-3 focuses on using the carrier's driver and vehicle OOS rate to select vehicles for inspection. However, because the ISS score is recommended by FMCSA and used by some states, a scenario where the ISS score is used to screen vehicles in a manner similar to RE-3 is presented in Appendix C.9.

Finding OOS violations during an inspection is crucial to keeping unsafe trucks off the road so that crashes can be prevented. Moreover, a larger number of crashes could be avoided by finding those OOS violations that have a higher relative crash risk. While taking trucks OOS for violations that do not pose a high crash risk serves a benefit, more benefits from a crash reduction and life saving perspective can be realized by focusing on violations related to crash risk. Data from the LTCCS were used to identify those OOS violations that present a high relative crash risk. Every truck involved in a crash within the LTCCS was subject to a full Level I inspection as part of the investigation of each crash. For every truck in the LTCCS, inspection reports contained in the LTCCS data were analyzed to record the presence of each type of OOS violation. From this information, the probability of a specific type of OOS violation being present on a truck given that the truck crashed could be calculated by dividing the number of trucks having the violation present by the total number of trucks in a crash. Survey weights associated with the LTCCS were used in these calculations to ensure nationally representative probability estimates.

It is also important to identify OOS violations that occur frequently in the population. A violation with a high relative risk for crash but that does not appear all that often is not of much use to

inspectors because trucks with that violation will be too difficult to find. Historical inspection data were analyzed for Colorado, Kentucky, New York, and Ohio to identify the most common OOS violations. For each inspection record, the presence of specific OOS violations was recorded. The probability of a truck having each specific OOS violation was calculated by dividing the number of inspections where the OOS violation was present divided by the total number of inspections.

Table C-16 presents the probability calculations for both the crash data and the historical state inspection data for vehicle and driver OOS violations overall as well as six specific types of OOS violations. These six violations were chosen as they were the most frequently occurring violations in both the LTCCS crash data as well as the historical state inspections. The second column presents the probability that a truck has a specific violation given the truck was in a crash. Columns 3 through 6 contain the probability that a truck has a specific violation in the population based on the historical inspection reports for the four states. The assumption here is that past inspections have been random. Now, past inspections are not truly random. However, inspection reports provide the best means of knowing the incidence of OOS violations in the population given the lack of other data. As discussed above, the Kentucky violation percentages are lower than those of the other three states.

Table C-16. Probabilities of Certain OOS Violations Occurring Among Vehicles Involved in a Crash and Among the General Population of Trucks

OOS Violation Categories	Probability of Violation Occurring				
	In a Crash (LTCCS)	In General Population (State Inspection Data)			
		KY	OH	CO	NY
All Vehicle	**28.6%**	**9.5%**	**23.0%**	**20.6%**	**21.6%**
Brake Violation	18.8%	4.4%	7.6%	13.0%	9.3%
Lighting	3.7%	2.3%	3.8%	3.3%	4.2%
Tires	2.4%	1.5%	5.2%	2.3%	3.0%
Load Securement	3.2%	1.5%	6.5%	4.3%	5.2%
All Driver	**12.2%**	**4.7%**	**7.1%**	**9.1%**	**5.8%**
Log Book	8.2%	2.3%	3.7%	5.1%	1.7%
Hours of Service	1.7%	1.3%	2.1%	1.8%	1.6%

An examination of vehicle violations shows that roughly 19% of trucks involved in crashes have a brake violation as compared to only 4% in the Kentucky truck population, 8% in Ohio, 13% in Colorado, and 9% in New York. Lighting, tires, and load securement all occur about as frequently in crashes as in the general state truck traffic populations. Driver OOS violations in general had a high relative risk for crash. About 12% of trucks involved in crashes have some sort of driver OOS violation as compared to anywhere from about 5 to 9% in the state truck population. Also, analysis of crash data from the LTCCS found that driver-related factors were important reasons leading to causes of crashes in a large majority of the cases (USDOT 2006g). As a result, vehicles are selected for inspection in scenario RE-4 based on their likelihood of having a brake violation or general driver OOS violation. Although violations involving the log book have the highest relative risk among driver OOS violations, it was decided to use the more

general driver OOS violation rate as opposed to the log book violation rate as an index since the relative crash risk for both measures were similar and this approach better reflects the LTCCS findings regarding general driver-related factors and crash risk. Table C-16 also shows that the probability of a particular violation occurring in the truck population varies by state. As mentioned previously, Kentucky finds a smaller number of violations per inspection than the nation at large. Moreover, Colorado has a higher incidence rate of brake violations but a smaller rate of lighting and tire violations than New York or Ohio.

The SAFER carrier table does not include a brake OOS rate for each carrier. Rather, a brake violation rate can be calculated from information contained in the carrier table. The brake violation rate is defined to be the number of brake violations in the past 30 months divided by the number of vehicle inspections in the past 30 months. Not all brake violations result in an OOS order. Thus, the brake violation rate for each carrier is associated with a probability of a brake OOS rate in the next section. In summary, the brake violation rate and driver OOS violation rate are used as indices in selecting vehicles for inspection in RE-4. The driver OOS violation rate is also used as an index in scenario RE-5, described later in this section.

Choice of Index Threshold for Pulling Vehicles in for Inspection. For each safety index used in scenarios RE-3 and RE-4, the next step was to determine a threshold by which any vehicle with a safety index at or above the threshold will be brought in for inspection while all vehicles with a safety index below the threshold will be allowed to continue on the mainline. The value of the threshold can neither be so high that very few trucks on the road will be brought in for inspection nor can it be too low, which would result in too many trucks being flagged for inspection than roadside enforcement resources can handle. Moreover, the appropriate value for the index threshold should be dependent on the number of inspectors available at a given inspection site. Consequently, scenarios RE-3 and RE-4 will consider three different threshold values for each index corresponding to the number of trucks that an inspection station could realistically inspect in a given day given its roadside enforcement resources.

Kentucky inspections were not included due to their lower response rates. The various indices (driver OOS rate, vehicle OOS rate, and brake violation rate) for each truck inspected were recorded. For each index, the values of the index were sorted from low to high and the resulting distribution of values was examined so that the 95th, 90th, and 75th percentiles of the distribution were obtained. The 95th percentile of the index distribution is the value where 5% of the trucks meet or exceed that value of the threshold. Since the index values are sorted from low to high, this index value represents the cutoff point for the 5% of trucks with the highest index value. For example, an inspection station with truck traffic of 1,000 trucks per day would expect to have about 50 trucks available for inspection if the 95th percentile of the index distribution was used. Using the 90th percentile would result in about 100 trucks available for inspection.

To use Equation (5) to estimate the number of crashes that would be prevented under these scenarios, it is essential to know the probability of a violation given that an inspection occurred for vehicles at or above the index threshold, [i.e., $P(V|I)$]. In order to obtain this probability, it is necessary to understand the relationship between the safety index of the truck and the presence of the specific OOS violation on the truck given an inspection. Each safety index relates to a specific type of OOS order. For instance, a carrier's brake violation rate should be a good

predictor that a truck belonging to that carrier has an OOS brake violation. Similarly a carrier's vehicle and driver OOS rate will be used to predict the presence of a vehicle or driver OOS violation, respectively.

To gain a better understanding of the relationship between each index and its corresponding OOS violation, a probit regression model was used to model the probability of an inspection having a specific OOS violation against the safety index. Probit analysis is a standard statistical approach to modeling a probability as a function of some continuous explanatory variable. The probit model has the form:

$$probit\,(p_i) = \phi^{-1}(p_i) = \beta_0 + \beta_1(x_i) \tag{6}$$

where

$i =$	1, 2, 3, … corresponding to the total number of distinct values of the index
p_i	is the ratio of the number of historical Kentucky inspections that resulted in a specific OOS violation to the number of inspections within each index value i
ϕ^{-1}	is the inverse of the standard Gaussian distribution function
β_0	is the intercept parameter of the probit regression line
β_1	is the slope parameter of the probit regression line
x_i	is the safety index.

Figure C-12 shows the general form of a probit regression relationship. Given a threshold value x_i, the corresponding probability of an OOS violation at that threshold value can be calculated from the probit regression model.

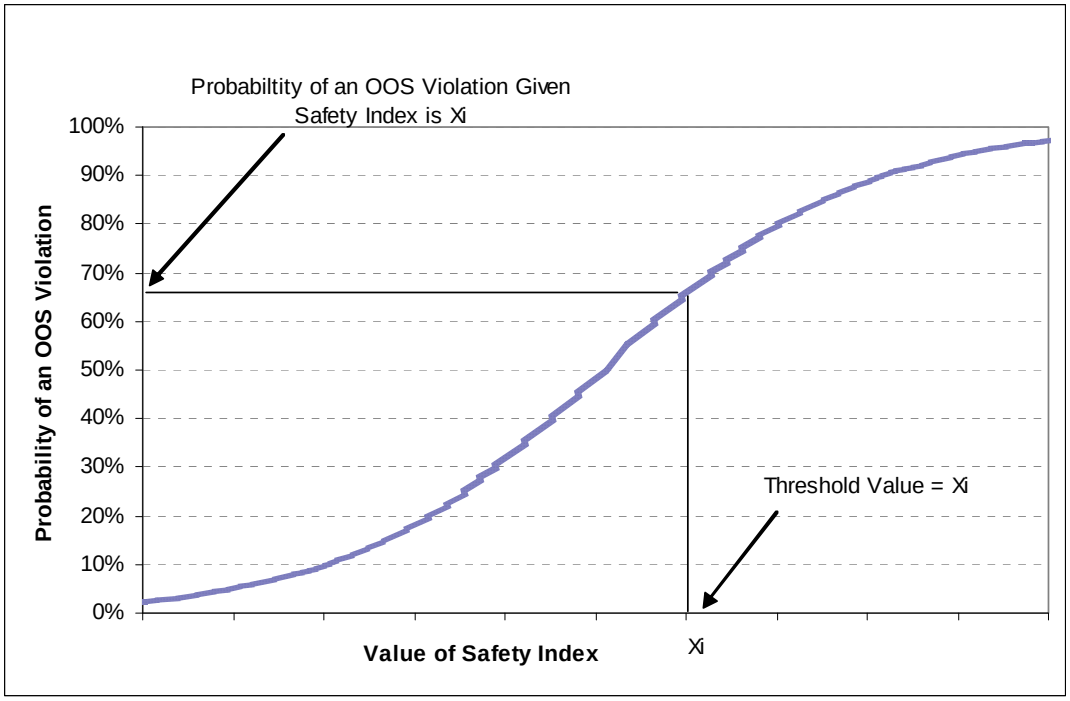


Figure C-12. Probit Relationship between Safety Index and the Probability of an OOS Violation

Historical inspection data from Colorado, New York, and Ohio were pooled and modeled separately for each of the three indices using the probit model in Equation (6). The probit model for each index was then used to estimate the probability of a corresponding OOS violation given an inspection for each of the three threshold safety index values corresponding to the top 5%, 10%, or 25% of the distribution of the safety index. These probabilities were then used in Equation (5) to capture safety benefits for scenarios RE-3 and RE-4.

RE-5: Methodology for Selecting Vehicles based on Infrared Imaging

Roadside scenario RE-5 is similar to RE-4 in that it focuses on identifying vehicles that have brake and driver OOS violations (violations with high relative crash risk). As in RE-4, the driver OOS rate associated with the truck's carrier will be used to identify those trucks with a high probability of a driver OOS violation. Threshold values for the driver OOS rate were again used to select an appropriate number of vehicles to bring into the station for inspection. Where RE-5 differs from RE-4 is the manner in which trucks are selected for inspection based on their chances of having a brake violation. Brake problems are difficult to detect with the human eye alone. As a result, alternative techniques have been developed to identify trucks with faulty or inoperative brakes. Scenario RE-4 utilizes historical brake safety information on each carrier to identify trucks that were the most likely to have brake problems. There are limitations to this approach as the presence of a high carrier brake violation rate does not guarantee that the specific truck operated by that carrier and now entering the weigh station has a brake violation, just that the vehicle is more likely to have such a violation based on the carrier's history.

Thermal imaging systems such as the ISSES in Kentucky provide inspectors with a tool to more accurately identify trucks with brake violations. This coupled with the fact that there is a high relative risk of a crash associated with brake violations, makes the prescreening of vehicles using infrared technology a powerful tool that may provide significant benefits in crash reduction. Unfortunately, because of the lack of infrared video imaging data during the period of the field study in Kentucky, the benefit of the ISSES thermal imaging system in terms of inspection efficiency and safety benefits cannot be assessed directly. However, prior research was conducted in 2000 for FMCSA on evaluating a similar, portable infrared imaging and video package, IRISystem (USDOT 2000). Results from the 2000 study were used to estimate the number of crashes, injuries, and fatalities that could be avoided if infrared technology was used to screen vehicles.

The objective of the FMCSA 2000 study was to evaluate the effectiveness of the IRISystem for use as a screening tool on commercial vehicles for detecting bad brakes and unsafe vehicles due to braking. A high-level summary of the research and findings, including the increase in OOS rates due to screening vehicles with infrared technology, is presented in Appendix C.6 to provide an understanding of the quantifiable benefits that can be realized through use of this technology. However, the key result from this analysis that pertains to scenario RE-5 is that the percentage of vehicles placed OOS due to brake violations after IRISystem screening was 47.2%. This figure was used as an estimate for the probability of a brake violation given that an inspection occurred, [P(V|Inspection)], in Equation (5).

6.3 Results

In this section the calculations of the numbers of truck crashes, injuries, and fatalities avoided under each of the roadside enforcement scenarios described in Section 6.2 are presented. These calculations, based on Equation (5), utilize inputs contained in Table C-14 as well as specific assumptions defined by the scenarios. Results from special studies are presented as needed to justify some of the parameter estimates used in these models.

Scenario RE-0: Random Selection

We begin by calculating the number of crashes that would be avoided were trucks to be selected for inspection randomly. This is not one of the roadside enforcement strategies being considered, nor is it a realistic strategy to employ. However, the calculation is useful for determining the contribution of the inspectors' knowledge and experience during the vehicle selection process. In 2005 1,949,375 commercial vehicle inspections and 2,669,679 commercial vehicle driver inspections were conducted nationally.

Under random inspections, the proportions of inspected vehicles and drivers that are given OOS orders are equal to corresponding FMCSR violation rates. Thus, by applying the results from the National Truck Fleet Safety Survey, 28% of the 1,949,375 vehicle inspections would result in vehicle OOS orders (FMCSA 2006f). From Equation (5), the number of crashes that are avoided due to vehicle OOS orders when random inspections are performed is equal to

$$\frac{1{,}949{,}375 * (0.28) * 15{,}000 * (1.89 / 1{,}000{,}000)}{0.28} * \frac{0.2862 - 0.28}{(1 - 0.28)} = 476$$

Similarly, 5% of the 2,669,679 driver inspections would have resulted in driver OOS order leading to

$$\frac{2{,}669{,}679 * (0.05) * 10{,}000 * (1.89 / 1{,}000{,}000)}{0.05} * \frac{0.1220 - 0.05}{(1 - 0.05)} = 3{,}824$$

crashes avoided. Note that these two numbers cannot be added to get the total number of crashes avoided because there is some overlap in vehicle and driver OOS orders. To get an estimate of the total number of crashes avoided, the TFSS found that 49% of the inspections that found at least one driver OOS violation also found at least one vehicle OOS violation (FMCSA 2006f). Because the impact of vehicle OOS orders is greater than the impact of driver OOS orders, the number of crashes avoided combined over vehicle and driver OOS orders can be determined by adding (a) the number of crashes avoided due to vehicle OOS orders and (b) 51% of the crashes avoided due to driver OOS orders. Thus, the total number of crashes avoided would be 476 + (0.51*3,824) = 2,426.

Using the injury and fatality data in Table C-14, there are on average 5,212/441,000 = 0.012 fatalities per crash and 114,000/441,000 = 0.259 injuries per crash. Therefore, if 2,426 crashes were avoided, it would be expected that 2,426*0.259 = 628 injuries would be avoided and 2,426*0.012 = 29 fatalities would be avoided. This relationship between the numbers of crashes, injuries, and fatalities is assumed to hold for all of the scenarios below.

Scenario RE-1: Baseline – Pre-CVISN

The calculation of crashes avoided in the baseline scenario is very similar to the calculation with random selection of vehicles, except instead of applying the results from the TFSS, the actual numbers of OOS orders for vehicles and drivers nationally are used. In 2005, 24% of the vehicles inspected resulted in a vehicle OOS order, and 7% of the driver inspections resulted in a driver OOS order according to NAFTA safety statistics. In this scenario (and all that follow), the probability of a vehicle and driver OOS violation in a crash as well as in the general population are based on national estimates.

Following the approach used with random selection, 24% of the 1,949,375 vehicle inspections would result in vehicle OOS orders. From Equation (5), the predicted number of crashes avoided due to vehicle OOS orders is equal to

$$\frac{1{,}949{,}375 * (0.24) * 15{,}000 * (1.89 / 1{,}000{,}000)}{0.28} * \frac{0.2862 - 0.28}{(1 - 0.28)} = 408$$

Similarly, 7% of 2,669,679 driver inspections would result in a driver OOS order leading to

$$\frac{2{,}669{,}679 * (0.07) * 10{,}000 * (1.89 / 1{,}000{,}000)}{0.05} * \frac{0.1220 - 0.05}{(1 - 0.05)} = 5{,}354$$

crashes avoided.

Applying the 51% adjustment factor used under random selection, the estimated number of crashes avoided is 408 + 0.51*5,354 = 3,139. The corresponding numbers of injuries and fatalities avoided are 813 and 38, respectively.

Note that the 2005 vehicle OOS rate of 24% is lower than the 28% OOS rate estimated by the TFSS, and the 2005 driver OOS rate of 7% is higher than the 5% rate from the TFSS. This could be due to many factors, including individual or state-specific inspection selection priorities or differences in truck traffic during scheduled versus randomly selected times. No specific explanation is available. Nevertheless, it is interesting to note that the estimated number of crashes avoided under current inspection practices is about 29% higher (3,139 versus 2,426) than the number that would be avoided under random selection of vehicles. This difference is due mainly to the larger driver OOS rate actually experienced by inspectors in 2005 than was estimated under the TFSS.

Scenario RE-2: Mainline Electronic Screening Based on ISS Score

Currently, 32 states use some form of mainline ES as part of their roadside enforcement. However, even in these states, carrier enrollment in ES is not sufficient to demonstrate any significant impacts on the inspection selection process. Therefore, to illustrate what could happen, the impact of using ES was simulated using results from the field studies in Colorado, New York, and Ohio. (Recall that Kentucky field study results are not used in the safety benefits analysis due to their significantly low OOS rates.) An analysis was performed under the scenario that: (1) all 50 states deploy ES at all major inspection sites; and (2) all of the motor carriers with ISS ratings in the low- or medium-risk categories (representing approximately 60% of all trucks) choose to enroll in the ES program.

Under this scenario, enforcement officials could choose to let the low- and medium-risk vehicles bypass the inspection site and focus all of their efforts on inspecting high-risk carriers and carriers with insufficient safety data. It is assumed that current inspection methods involving manual pre-screening (i.e., visual inspection and inspector experience/judgment) will be used as in scenario RE-1, on the 40% of trucks that are not allowed to bypass the inspection site. Section 5.3 presented an analysis demonstrating that, under this scenario, the number of OOS orders would increase by 32% compared to the average number that would be achieved under current inspection practices. The 32% estimate is based on the average increase among Colorado, New York, and Ohio. It is assumed that this 32% increase in OOS orders would apply equally to vehicle OOS orders and driver OOS orders, therefore translating into a 32% increase in the number of crashes avoided.

From here, the calculation of the numbers of crashes, injuries, and fatalities avoided under scenario RE-2 is straightforward. With a 32% increase in OOS orders, the number of crashes

that can be avoided under RE-2 is 1.32 * 3,139=4,143. This represents a reduction in the number of crashes (equivalent to an increase in the number of crashes avoided) of 1,004 crashes, compared to the baseline scenario. The corresponding number of injuries avoided is 1,073 (a difference of 260), and the number of deaths avoided is 50 (a difference of 12).

Scenario RE-3: Electronic Screening based on high vehicle and driver OOS rates

In this scenario, the state utilizes ES to screen all vehicles based on the vehicle and driver OOS rates of the carrier. This scenario is based on the premise that only trucks with the highest OOS rates are candidates for inspection while other vehicles are allowed to continue on the mainline.

Table C-17 shows the three levels of threshold values for both the vehicle and driver OOS rate safety index. One year's worth of state inspections from Colorado (2006), New York (2005), and Ohio (2006) together were used to determine the specific threshold values for a given index. The high threshold for the vehicle OOS rate index is 52.5%. This means that roughly 5% of the truck traffic has a vehicle OOS rate at or above 52.5%. The high threshold level would be used to pull in only the top 5% of vehicles in situations where a smaller number of inspectors were on duty. If more inspectors are available, a lower threshold can be used to pull more trucks into the station. The medium and low threshold values for the vehicle OOS rate safety index are 42.1% and 28.6%, respectively. The high, medium, and low thresholds for driver OOS rates are 21.0, 16.1, and 10.3%, respectively.

Table C-17. Vehicle and Driver OOS Rate Threshold Values Calculated from State Inspections in Colorado (2006), New York (2005), and Ohio (2006)

Percent Selected for Inspection	Safety Index Threshold	
	Carrier's Vehicle OOS Rate	Carrier's Driver OOS Rate
5%	52.5%	21.0%
10%	42.1%	16.1%
25%	28.6%	10.3%

To use Equation (5) to estimate the number of crashes that would be prevented, a probit regression model was used to estimate the probability of an OOS violation among vehicles at or above each value of the index threshold. This probability represents the term P(V|Inspection) in Equation (5), namely the probability of finding an OOS violation given the truck was inspected with an index value above the threshold. By plugging in the three threshold rates into the equation and solving for *p*, the probability of a violation given an inspection can be calculated for each level of the safety index. These probabilities are provided in Table C-18 alongside the threshold values.

Table C-18. Vehicle and Driver OOS Rate Threshold Values Along with Corresponding Probabilities of an OOS Violation Calculated from State Inspections in Colorado (2006), New York (2005), and Ohio (2006)

Percent Selected for Inspection	Carrier Vehicle OOS Rate		Carrier Driver OOS Rate	
	Threshold	P(V|Inspection)	Threshold	P(V|Inspection)
5%	52.5%	0.501	21.0%	0.178
10%	42.1%	0.379	16.1%	0.128
25%	28.6%	0.241	10.3%	0.084

From Equation (5), the number of crashes that are avoided due to vehicle OOS orders when the highest 5% of trucks in terms of vehicle OOS rate are brought into the station for inspection is equal to

$$\frac{1{,}949{,}375 * (0.501) * 15{,}000 * (1.89 / 1{,}000{,}000)}{0.28} * \frac{0.2862 - 0.28}{(1 - 0.28)} = 852$$

Similarly, 13% of the 2,669,679 driver inspections would result in an OOS order leading to

$$\frac{2{,}669{,}679 * (0.178) * 10{,}000 * (1.89 / 1{,}000{,}000)}{0.05} * \frac{0.1220 - 0.05}{(1 - 0.05)} = 13{,}614$$

crashes avoided.

Applying the 51% adjustment factor used under the other scenarios, the estimated number of crashes avoided is 852 + 0.51*13,614 = 7,795. The corresponding numbers of injuries and fatalities avoided are 2,019 and 94, respectively.

The calculation for the number of crashes avoided using the medium (top 10%) and low (top 25%) threshold values is similar and not shown. Rather, the number of crashes, injuries and fatalities avoided under all three threshold levels is presented in Table C-19.

Table C-19. Number of Crashes, Injuries, and Fatalities Avoided Under Scenario RE-3

Percent Selected for Inspection	Number of Safety Events		
	Crashes	Injuries	Fatalities
5%	7,795	2,019	94
10%	5,637	1,460	68
25%	3,686	955	44

As expected, the results indicate that the higher the threshold value for the safety index, the more crashes, injuries and fatalities can be avoided as a result of inspecting trucks with higher OOS rates. This is slightly misleading because this is mainly a function of calculating the number of safety events avoided based on a fixed number of inspections. The value in choosing a lower

threshold (e.g. top 10% or top 25%) is that it makes more trucks available for inspection when inspection resources are high at a given station. For example, suppose an inspection site sees 600 trucks per day traverse the station during normal inspection hours. If the highest threshold value is used, only about 30 trucks would be made available for inspection. If there are 5-7 inspectors on duty on a particular day, it may be advantageous to use a lower threshold level in an effort to inspect more than 30 trucks. In this case more inspections would be performed than would under the scenario where only the top 5% of trucks were inspected due to lower inspection resources. The figures in Table C-19 show the safety benefits achieved based on the number of commercial vehicle inspections performed nationally in 2005 (1,949,375 vehicle inspections and 2,669,679 driver inspections). Obviously if more inspections are performed under a lower threshold level, the total number of safety benefits would rise.

The high threshold level represents an increase of 4,656 crashes avoided compared to the baseline scenario (RE-1). Also, 1,206 more injuries and 56 more fatalities will be avoided under this scenario.

Scenario RE-4: Electronic screening based on high driver OOS and brake violation rate

This scenario is similar to RE-3 in that the state utilizes ES to screen all vehicles at all major inspection sites based on a safety index. This scenario differs from RE-3 in that vehicles are screened on their brake violation rate as opposed to their overall vehicle OOS rate in an attempt to catch those vehicles that have a violation that has a higher relative risk for crash. Brake violation rates are defined as the number of brake violations for the carrier in the past 30 months divided by the number of vehicle inspections in the past 30 months.

Table C-20 shows the three levels of threshold values for both the brake violation rate and driver OOS rate safety index. The high threshold for the brake violation rate index is 1.21. This means that roughly 5% of the truck traffic has a brake violation rate at or above 1.21. The high threshold level would be used to pull in only the top 5% of vehicles in situations where a smaller number of inspectors were on duty. If more inspectors are available, a lower threshold can be used to pull more trucks into the station. The medium and low threshold values for the brake violation rate safety index are 0.91 and 0.56, respectively. Note that the thresholds for the driver OOS rate are the same as in RE-3.

Table C-20. Brake Violation and Driver OOS Rate Threshold Values Calculated from State Inspections in Colorado (2006), New York (2005), and Ohio (2006)

Percent Selected for Inspection	Safety Index Threshold	
	Brake Violation Rate	Driver OOS Rate
5%	1.21	21.0%
10%	0.91	16.1%
25%	0.56	10.3%

To use Equation (5) to estimate the number of crashes that would be prevented, a probit regression model was used to estimate the probability of an OOS violation among vehicles at or above each value of the index threshold. This probability represents the term P(V|Inspection) in

Equation (5). By plugging in the three threshold rates into the equation and solving for *p*, the probability of a brake-related OOS violation given an inspection can be calculated for each level of brake violation rate. These brake-related probabilities are provided in Table C-21 along with the probabilities associated with the driver OOS rate index originally presented in RE-3.

Table C-21. Brake Violation and Driver OOS Rate Threshold Values Along with Corresponding Probabilities of a Brake-Related or Driver OOS Violation Calculated from State Inspections in Colorado (2006), New York (2005), and Ohio (2006)

Percent Selected for Inspection	Brake Violation Rate		Driver OOS Rate	
	Threshold	P(V|Inspection)	Threshold	P(V|Inspection)
5%	1.21	0.219	21.0%	0.178
10%	0.91	0.175	16.1%	0.128
25%	0.56	0.117	10.3%	0.084

From Equation (5), the number of crashes that are avoided due to brake-related OOS orders when the highest 5% of trucks in terms of brake violation rate are brought into the station for inspection is equal to

$$\frac{1{,}949{,}375 * (0.219) * 15{,}000 * (1.89 / 1{,}000{,}000)}{0.14} * \frac{0.1875 - 0.14}{(1 - 0.14)} = 4{,}775$$

It should be noted that this estimated number of crashes avoided is conservative. The calculation is based in part on the probability of finding a brake-related OOS condition in the population. According to the National Fleet Safety Study (NFSS) performed in 1996, 14% of vehicle miles traveled are with brake-related OOS conditions (Star, 1996). In reality, an inspector is going to place a truck OOS if any vehicle OOS violation is found, not just a brake-related one. Thus, the number of crashes, injuries, and fatalities reported under scenario RE-4 are conservative.

Thirteen percent of the 2,669,679 driver inspections would result in a driver OOS order leading to

$$\frac{2{,}669{,}679 * (0.178) * 10{,}000 * (1.89 / 1{,}000{,}000)}{0.05} * \frac{0.1220 - 0.05}{(1 - 0.05)} = 13{,}614$$

crashes avoided.

Note that these two numbers cannot be added to get the total number of crashes avoided because there is some overlap in brake and driver OOS orders. As reported in RE-0, the TFSS found that 49% of the inspections that found at least one driver OOS violation also found at least one vehicle OOS violation USDOT (2006f). Brake violations are a subset of all vehicle violations, so the percentage of trucks that have both brake and driver OOS orders will be smaller than the percentage of trucks that have both a vehicle and a driver OOS order (49%). The TFSS found that brake OOS violations represent 42% of all vehicle OOS violations. As a result, about 21% (0.49*0.42) of the inspections that found at least one driver OOS violation also found at least one

brake OOS violation. Because the impact of brake OOS orders is greater than the impact of driver OOS orders, the number of crashes avoided combined over brake-related and driver OOS orders can be determined by adding (a) the number of crashes avoided due to brake-related OOS orders and (b) 79% of the crashes avoided due to driver OOS orders. Thus, the total number of crashes avoided would be 4,775 + (0.79*13,614) = 15,530. The corresponding numbers of injuries and fatalities avoided are 4,022 and 186, respectively.

The calculation for the number of crashes avoided using the medium (top 10%) and low (top 25%) threshold values is similar and not shown. Rather, the number of crashes, injuries and fatalities avoided under all three threshold levels is presented in Table C-22.

Table C-22. Number of Crashes, Injuries, and Fatalities Avoided Under Scenario RE-4

Percent Selected for Inspection	Number of Safety Events Avoided		
	Crashes	Injuries	Fatalities
5%	15,530	4,022	186
10%	11,550	2,991	139
25%	7,626	1,975	92

As in RE-3, the results indicate that the higher the threshold value for the safety index, the more crashes, injuries, and fatalities can be avoided as a result of inspecting trucks with higher violation or OOS rates. This is slightly misleading because this is mainly a function of calculating the number of safety events avoided based on a fixed number of inspections that is the same for each threshold level. Obviously if more inspections are performed under a lower threshold level, the total number of safety benefits would rise.

The high threshold level represents an increase of 12,391 crashes avoided compared to the baseline scenario. Also, about 3,209 more injuries and 148 more fatalities will be avoided under this scenario.

RE-5: Electronic screening based on infrared screening and high driver OOS Violation Rate

Roadside scenario RE-5 is similar to RE-4 in that it focuses on identifying vehicles that have brake and driver OOS violations (violations with high relative crash risk). Where RE-5 differs from RE-4 is that brake violations are screened via infrared technology rather than the carrier's brake violation rate. Prior research conducted in 2000 for FMCSA on evaluating an infrared imaging and video package, IRISystem found that the percentage of vehicles placed OOS due to brake violations after IRISystem screening was 47.2%. This figure will be used as an estimate for the probability of a brake violation given that an inspection occurred, [P(V|Inspection)].

From Equation (5), the number of crashes that are avoided due to brake OOS violations when the thermal imaging system is used to select vehicles for inspection is equal to

$$\frac{1{,}949{,}375 * (0.472) * 15{,}000 * (1.89 / 1{,}000{,}000)}{0.14} * \frac{0.1875 - 0.14}{(1 - 0.14)} = 10{,}291$$

It should be noted that this estimated number of crashes avoided is conservative. The calculation is based in part on the probability of finding a brake-related OOS condition in the population. In reality, an inspector is going to place a truck OOS if any vehicle OOS violation is found, not just a brake-related one. Thus, the number of crashes, injuries, and fatalities reported under scenario RE-5 are conservative.

The number of crashes that are avoided due to driver OOS violations when the highest 5% of trucks in terms of driver OOS rate are brought into the station for inspection is equal to

$$\frac{2{,}669{,}679 * (0.178) * 10{,}000 * (1.89 / 1{,}000{,}000)}{0.05} * \frac{0.1220 - 0.05}{(1 - 0.05)} = 13{,}614$$

Applying the 79% adjustment factor used in RE-4, the estimated number of crashes avoided is 10,291 + 0.79*13,614 = 21,046. The corresponding numbers of injuries and fatalities avoided are 5,451 and 253, respectively.

The calculation for the number of crashes avoided using the medium (top 10%) and low (top 25%) threshold values for the driver OOS rate index is similar and not shown. Rather, the number of crashes, injuries and fatalities avoided under all three threshold levels is presented in Table C-23. While the driver OOS rate threshold change for each of the high, medium, and low, levels, the brake OOS rate of 47.2% when using infrared technology remains unchanged.

Table C-23. Number of Crashes, Injuries, and Fatalities Avoided Under Scenario RE-5

Threshold Level for Driver OOS Rate	Number of Safety Events Avoided		
	Crashes	Injuries	Fatalities
High (Top 5%)	21,046	5,451	253
Medium (Top 10%)	18,025	4,668	216
Low (Top 25%)	15,366	3,980	184

Using the high threshold level for driver OOS rate represents an increase of 17,907 crashes avoided compared to the baseline scenario. Also, about 4,638 more injuries and 215 more fatalities will be avoided under this scenario.

As in RE-3 and RE-4, the results indicate that the higher the threshold value for the safety index, the more crashes, injuries and fatalities can be avoided as a result of inspecting trucks with higher values of the safety index. This is slightly misleading because this is mainly a function of calculating the number of safety events avoided based on a fixed number of inspections that is the same for each threshold level. Obviously if more inspections are performed under a lower threshold level, the total number of safety benefits would rise.

6.4 Summary of Results

Table C-24 summarizes the major results of this safety benefits analysis. All values are expressed in terms of estimated numbers of safety events per year nationwide.

Table C-24. Estimated National Annual Safety Benefits of CVISN under Selected Deployment Scenarios and Assumptions

Scenario	Description		Numbers of Annual Safety Events Avoided[1]			Additional[2] Annual Safety Events Avoided (CVISN Benefit)		
			Crashes	Injuries	Fatalities	Crashes	Injuries	Fatalities
RE-0	Random Selection		2,426	628	29			
RE-1	Baseline – Pre CVISN		3,139	813	38			
RE-2	Mainline Electronic Screening Based on ISS Score		4,143	1,073	50	1,004	260	12
RE-3	Electronic Screening based on high vehicle and driver OOS rates[3]	5%	7,795	2,019	94	4,656	1,206	56
		10%	5,637	1,460	68	2,498	647	30
		25%	3,686	955	44	547	142	6
RE-4	Electronic screening based on high driver OOS and brake violation rates[3]	5%	15,530	4,022	186	12,391	3,209	148
		10%	11,550	2,991	139	8,411	2,178	101
		25%	7,626	1,975	92	4,487	1,162	54
RE-5	Electronic screening based on infrared screening and high driver OOS violation rate[3]	5%	21,046	5,451	253	17,907	4,638	215
		10%	18,025	4,668	216	14,886	3,855	178
		25%	15,366	3,980	184	12,227	3,167	146

1 The estimated number of crashes avoided is based on the assumption that crashes are avoided when vehicles and drivers with safety violations are placed OOS. For reference, in 2005, there were 441,000 truck-related crashes nationwide resulting in 114,000 injuries and 5,212 deaths (USDOT 2007b).

2 Compared to baseline scenario (RE-1).

3 Safety Benefits shown for strategies RE-3, RE-4, and RE-5 are dependent on the percentage of the truck population selected for inspection (top 5%, 10%, or 25% in terms of risk).

According to the model, current roadside enforcement strategies (RE-1) are responsible for avoiding 3,139 truck-related crashes, which represents about 0.7% of the 441,000 truck-related crashes nationwide that occur annually, based on 2005 crash statistics. Furthermore, it is estimated that current roadside enforcement activities are responsible for preventing 813 injuries and 38 deaths.

For reference, the number of crashes, injuries, and fatalities that would be avoided if vehicles were randomly selected for inspection (RE-0) were also calculated and shown in Table C-24. The differences between these numbers and the baseline numbers can be used to estimate the

benefits of current inspection selection strategies, which include the training, knowledge, and experience that the inspectors bring to the job. Specifically, the number of crashes, injuries, and fatalities that would be avoided if vehicles were selected based on current roadside enforcement strategies is 29% higher (3,139 versus 2,426) than the number that would be avoided under random selection of vehicles.

The safety benefits of CVISN are obtained by subtracting the numbers of crashes, injuries, and fatalities avoided under the baseline scenario from the corresponding numbers under scenarios RE-2 to RE-5. As shown in RE-2, if ES based on the ISS score were used to select vehicles for inspection such that all medium- and low-risk carriers are allowed to bypass the inspection site, an additional 1,004 crashes, 260 injuries, and 12 fatalities could be avoided.

Results for Scenarios RE-3 through RE-5 are presented at three different levels defined by the level of the threshold value of the safety index used. The value of the threshold can neither be so high that very few trucks on the road will be brought in for inspection nor can it be too low, which would result in too many trucks being flagged for inspection than roadside enforcement resources can handle. Moreover, the appropriate value for the index threshold will vary from site to site and should be dependent on the number of inspectors available at a given inspection site as well as the amount of truck traffic. For each scenario, results are presented when the top 5, 10, and 25% of trucks in terms of the safety index are brought in for inspection. For instance, the 5% threshold represents the cutoff point for the 5% of trucks with the highest index value. The largest benefits are associated with the 5% level. However, there must be sufficient truck traffic available at a site to use this high a level otherwise too few trucks will be brought in for inspection, leaving available inspectors idle. As the threshold percentage increases, more trucks of lower safety risk are brought into the station, thus resulting in a smaller safety benefit given a constant number of inspections.

The safety benefits increase with each scenario RE-3 through RE-5. At the 5% threshold level, using high vehicle and driver OOS rates to electronically screen vehicles (RE-3) would avoid 7,795 crashes nationally, a savings of 4,656 crashes from the baseline scenario. Using high brake violation and driver OOS rates (RE-4) would result in having 15,530 crashes avoided, a savings of 12,391 crashes from the baseline scenario. The maximum benefit is achieved with RE-5, where 21,046 crashes are avoided if the top 5% of vehicles in terms of driver OOS violations are inspected in conjunction with infrared screening. This implies that about 4.8% of the nation's 441,000 annual truck-related crashes could be avoided under RE-5.

To put this figure into perspective relative to crashes overall that are caused by OOS violations, the difference in violation rates between trucks involved in crashes and trucks not involved in crashes was examined. Examination of data from the LTCCS and the historical inspection reports from states involved in this evaluation have shown that there is a 7.2% increase in relative crash risk for driver OOS violations and a 0.6% increase in crash risk for vehicle violations. Since a vehicle could have a vehicle and driver violation, the two crash risk figures cannot be added to obtain the total increase in crash risk. However, these figures suggest that if there were no vehicle or driver OOS violations present in the population, no more than about 7.8% of the nation's 441,000 crashes involving large trucks could be avoided. This is the maximum possible benefit if all OOS violations were removed from trucks traveling on the road.

This fact helps to put the crash avoidance results into context and to provide an upper bound on the number of crashes that could be avoided due to elimination of all OOS conditions.

Overall, by deploying and utilizing CVISN infrastructure and technologies as outlined in the above scenarios, the number of truck-involved crashes, injuries, and fatalities could be avoided directly through the increased inspection efficiency gained as a result of the availability and use of the real-time safety information.

6.5 Uncertainty Analysis

The safety analysis uses a probability model to predict the number of truck-related crashes that would be avoided nationwide as CVISN deployment expands. Due to the variations in the pace and scope of CVISN deployment in different states, the relative rarity of large-truck crashes, and the wide variety of factors that contribute to truck crashes, it is not practical to perform longitudinal observational studies of CVISN safety benefits by simply comparing the number of motor vehicle crashes before and after CVISN deployment. The model used in this study is justified by basic principles of probability; however, its application relies on a variety of input parameters used to estimate impacts and benefits of CVISN. Some of the parameters were estimated using results from the open literature on crashes and highway statistics, and others were estimated with data collected in special studies involving participating CVISN states. Both types of estimates are subject to errors of unknown magnitude. For example, using the Safe-Miles model (VNTSC 1999a), it was estimated that a truck will drive a total of 15,000 "safe miles" following the correction of a vehicle violation and 10,000 "safe miles" following correction of a driver violation. The uncertainty in these estimates is unknown. Furthermore, while the four states involved in field studies were chosen to represent a cross-section of states in terms of CVISN deployment, it is not possible to determine statistically the degree to which these finding are representative of all states under full CVISN deployment. On the other hand, it is possible to characterize how the statistical errors in the estimates of certain input parameters affect the statistical uncertainty of the estimated numbers of crashes avoided under different deployment scenarios.

The terms in the crash avoidance model (Equation 5) were estimated using a variety of data sources. The national motor vehicle crash rate and the frequency of violations in the general population of trucks were estimated from hundreds of thousands of truck crashes and inspections. On the other hand, the frequencies of various types of violations among trucks involved in crashes was estimated using less than 1,000 truck crashes in the LTCCS database. So, from a statistical perspective, the latter terms will have the largest impact on the statistical uncertainty of the estimated numbers of crashes avoided. Using the "delta method" for propagation of errors, the standard errors of the estimated numbers of crashes were calculated as a function of the standard errors of the binomial estimates of $P(V|C)$ and $P(\overline{V} \mid C)$ based on data obtained from the LTCCS.

Table C-25 and Figure C-13 show the estimates and approximate 95% confidence limits for the number of crashes avoided under each of the deployment scenarios. In the table, the confidence limits are provided first in terms of the number of crashes and secondly as a percentage of the estimated number of crashes avoided found in the third column. The confidence intervals in

Figure C-13 refer to the margin of error in terms of number of crashes avoided. Confidence limits can be calculated for the estimated numbers of injuries and fatalities avoided under each scenario in a similar fashion. They are not presented here, because the estimates for number of injuries and fatalities avoided are directly proportional to the number of crashes avoided.

Table C-25. Estimated National Annual Number of Crashes Avoided Along with Approximate 95 Percent Confidence Limits under Selected Deployment Scenarios and Assumptions

Scenario	Description		Crashes Avoided	95 Percent Confidence Limits	
				Number of Crashes	Percentage of Crashes Avoided
RE-0	Random Selection		2,426	+/- 2301	+/- 95%
RE-1	Baseline – Pre CVISN		3,139	+/- 2071	+/- 66%
RE-2	Mainline Electronic Screening Based on ISS Score		4,143	+/- 2735	+/- 66%
RE-3	Electronic Screening based on high vehicle and driver OOS rates[3]	5%	7,795	+/- 4476	+/- 57%
		10%	5,637	+/- 3350	+/- 59%
		25%	3,686	+/- 2146	+/- 58%
RE-4	Electronic screening based on high driver OOS and brake violation rates[3]	5%	15,530	+/- 4028	+/- 26%
		10%	11,550	+/- 3027	+/- 26%
		25%	7,626	+/- 2003	+/- 26%
RE-5	Electronic screening based on infrared screening and high driver OOS violation rate[3]	5%	21,046	+/- 6276	+/- 30%
		10%	18,025	+/- 5884	+/- 33%
		25%	15,366	+/- 5632	+/- 37%

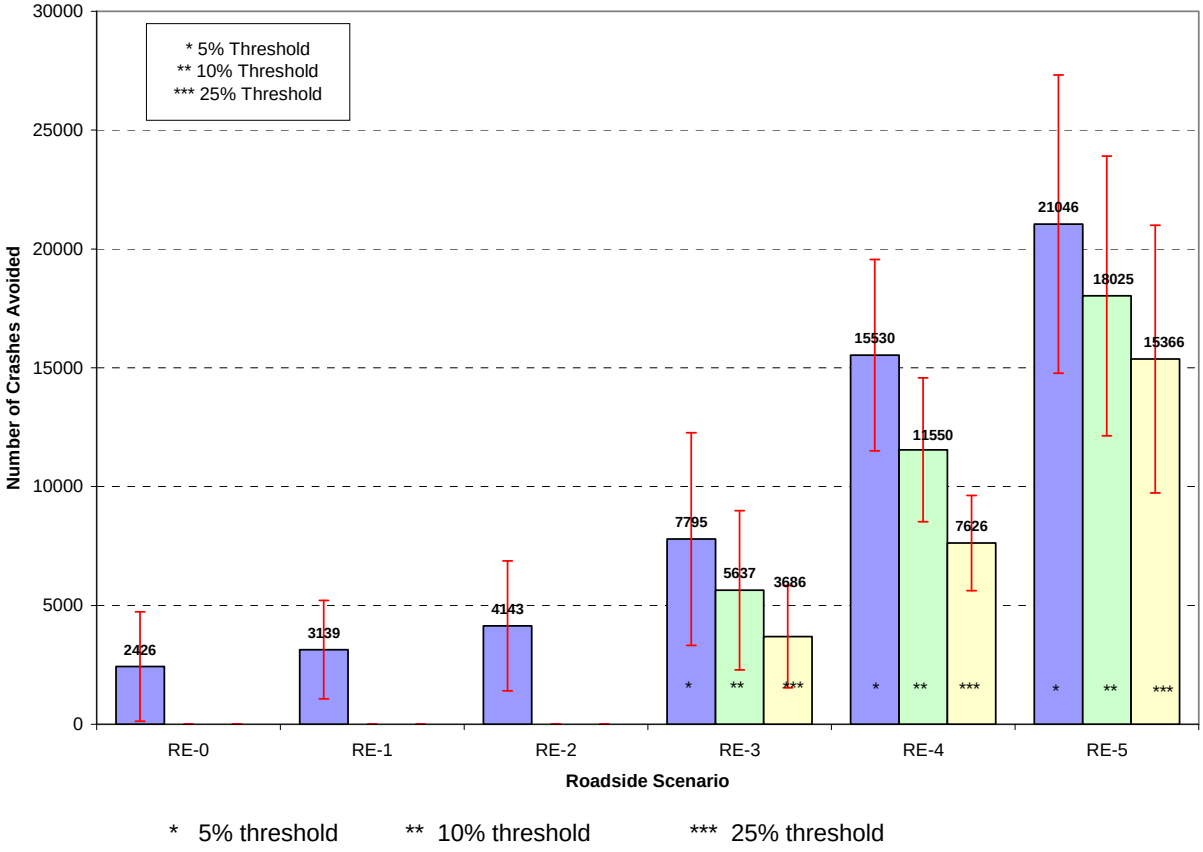


Figure C-13. Estimated National Annual Number of Crashes Avoided under Selected Deployment Scenarios and Assumptions (Mean Number of Crashes Avoided and 95 Percent Confidence Interval)

The estimate for the number of crashes avoided when trucks are selected randomly has a margin of error of +/- 2,301 crashes. This margin of error is 95% of the estimated 2,426 crashes avoided under RE-0. A 95% confidence interval for the number of crashes avoided under this scenario is (125, 4,727). The margins of error expressed as a percentage of avoided crashes generally get smaller as the scenarios become more sophisticated in their screening criteria. This is because as trucks are screened on factors that are more associated with crash risk: 1) the number of crashes avoided increases, resulting in a smaller relative margin of error; and 2) the difference in violation probability estimates for trucks that are involved in crashes versus those in the general population increases, yielding less statistical uncertainty in the crash avoidance estimates. Under RE-5, where the maximum safety benefit is achieved, a 95% confidence interval for the number of crashes avoided is given by (14,770, 27,322). This implies that as little as 3.3% and as much as 6.2% of the nation's 441,000 annual truck-related crashes could be avoided under RE-5 with 95% confidence.

As discussed in Section 6.1, another potential limitation to the analysis involves the simplifying assumption that, conditioned on the presence or absence of a violation, the likelihood of a crash

does not depend on whether the truck was selected for inspection. Given that roadside enforcement scenarios RE-3, RE-4, and RE-5 are based on inspectors using a specific set of criteria to select vehicles for inspection, this condition should be addressed in the probability model. Appendix C.10 discusses the appropriate model.

Further study is warranted in both of these areas using other data sources that would provide a larger sample of truck crash data. One possibility includes the MCMIS database, where trucks with post-crash inspections over a multi-year period could be utilized. Other potential resources include other FMCSA-sponsored studies into truck crashes such as an ongoing study by the Volpe Center that examines the relationship between OOS violations and truck crashes in terms of the frequency of crashes and their severity. At the time of this report, results from that study were not yet available.

Although additional data are needed, the safety analysis presented in this report helps to illustrate how the deployment of CVISN can affect highway safety in the future. The analysis can be easily modified as new data become available.

7.0 CONCLUSIONS AND IMPLICATIONS OF FINDINGS

The purpose of the safety analysis was to measure the effects of CVISN technologies on the safety of trucks and the general traveling public, through improved roadside enforcement and administrative processes. Section 7.1 captures the main conclusions from the evaluation as well as the implications of the findings. Section 7.2 provides some recommendations for potential research and next steps.

7.1 Conclusions

The following summarizes some conclusions from the safety analysis results:

- **Evaluation of Current and Potential Future Inspection Selection Methods:** There is a wide variation in CVISN capabilities among states and in the extent they use national and state data sources to access real-time, updated safety information to help make inspection selection decisions.

  Some states were well established in their CVISN programs and were expanding by deploying some state-of-the-art technologies in screening and data collection. States such as Colorado, Kentucky, Tennessee, and Washington rely heavily on computer-based safety and credential related information to make inspection decisions while regularly using federal and state data sources and tools such as SAFER, Query Central, or a CVIEW. They also are involved in developing or implementing new technologies to improve the data available to make inspection decisions and to improve the manner in which data is collected.

Other states, such as Florida, New York, Ohio, and Utah, are very involved in CVISN capability development and have put into practice most, if not all, of the Core CVISN Deployment capabilities. These states are active in the CVISN planning and deployment process and are proactively looking for new ways to improve the exchange of safety information in their state.

Other states, such as Texas and Oklahoma, are earlier in their CVISN development and are working to integrate CVISN technologies into their roadside practices. They have started the CVISN planning process and are involved in at least one of the three main CVISN areas (SIE, ES, and EC) but have not yet achieved Core CVISN Deployment. These states rely more on inspector judgment and experience to make inspection decisions, making infrequent use of federal data sources and tools. These states are looking for new ways to improve the exchange of safety information by working toward Core CVISN Deployment.

- **Effectiveness of CVISN at Increasing the Efficiency of Inspections.** States vary in the efficiency of their current inspection practices, i.e., their ability to select high-risk trucks for inspection. Current inspection practices in Colorado, Kentucky, and Ohio yield 50, 16, and 42% more high-risk trucks than random selection would, respectively. Inspection practices in New York did not result in a significant increase in high-risk trucks over random selection. Of all four states, New York's inspection practices were the closest to a random selection with no ES, WIMs, or static scales to screen vehicles.

  Because CVISN technologies are not fully deployed or utilized in the field study states, a series of hypothetical scenarios was constructed to compare current inspection selection methods with various progressive options for integrating CVISN screening technologies at the states' weigh stations. The scenarios also explored variations in the inspection selection criteria that states could use in trying to focus their finite resources on the highest-risk carriers, vehicles, and drivers. Substantial potential reductions in crashes, injuries, and fatalities were predicted from wider deployment of CVISN. Estimates were made using statistical modeling.

- **Safety Benefits Under CVISN Roadside Deployment Scenarios.** Current roadside enforcement strategies are responsible for avoiding 3,139 truck-related crashes, which represents about 0.7% of the 441,000 crashes in the nation that occur annually, based on 2005 crash statistics. Furthermore, it is estimated that current roadside enforcement activities are responsible for preventing 813 injuries and 38 deaths. For reference, these number of crashes, injuries, and fatalities that are avoided using current roadside enforcement strategies is 29% higher (3,139 versus 2,426) than the number that would be avoided under random selection of vehicles.

  Utilization of ES based on the carrier's ISS score to select vehicles for inspection such that all medium- and low-risk carriers are allowed to bypass the inspection site would result in 4,143 crashes avoided, a 32% increase over the baseline scenario of current CVISN practices. Under this scenario, an additional 260 injuries and 12 fatalities could be avoided.

Examination of data from the LTCCS and the historical inspection reports from four states selected for this evaluation showed that both driver and brake OOS conditions have a very high relative crash risk. Specifically, there is about a 7% increase in relative crash risk for driver OOS violations and a 5% increase in crash risk for brake violations. As such, inspection selection scenarios where only those vehicles with the highest probability of having driver or brake OOS violations are inspected resulted in the largest safety benefits. Selecting the highest 5% of carriers (i.e., those carriers posing the highest risk to safety) for inspection using either their driver OOS or brake violation rate of the carrier results in 15,530 crashes avoided. The number of injuries and fatalities avoided under this scenario are 4,022 and 186, respectively. Using the same scenario but screening brake violations via infrared technology at the inspection site rather than the carrier's brake violation rate, the maximum benefit is achieved with 21,046 crashes avoided. This implies that about 4.8% of the nation's 441,000 annual truck-related crashes could be avoided under this scenario. The number of injuries and fatalities prevented under this scenario is 5,451 and 253, respectively.

Table C-26 presents findings from this research in context of the evaluation objectives and hypotheses.

7.2 Implications of Findings and Potential Future Research

The following summarizes some implications based on the results and provides recommendations for potential research:

- **Technology Deployment Issues.** The findings from this safety analysis evaluation suggest that a significant number of crashes, injuries, and fatalities could be avoided by utilizing more advanced inspection selection algorithms when choosing vehicles for inspection. Use of these advanced selection methods require that technology be deployed to all inspection sites so that (1) inspectors could electronically identify every commercial vehicle that traverses the inspection station; (2) federal and state data sources such as SAFER and/or state CVIEWs are available at the site; and (3) algorithms to select vehicles for inspection are built into the technology systems at the inspection site so that the inspection selection decision is provided in real-time to inspectors. This implies that all states need to achieve CVISN Core Deployment and be actively involved in Expanded CVISN programs. The roadside deployment scenarios are based on states being advanced in two of the main areas of CVISN: SIE and ES.

  Since the number of trucks that have transponders used for ES is low relative to the total number of trucks on the road, FMCSA may consider incentives or regulatory requirements such that all commercial vehicles would have a transponder, or else some alternative means of truck identification will need to be adopted. Some current alternatives include USDOT or license plate readers such as those utilized in an advanced safety enforcement system in Kentucky. However, these technologies have not yet proven that they can identify a high percentage of commercial vehicles accurately. The challenge of vehicle identification in real time would need to be addressed.

Table C-26. Findings Compared to Evaluation Objectives and Hypotheses

Objectives/Hypotheses	Evaluation Findings
1.1 Evaluate current and potential future inspection selection methods	
Inspectors use national and state data at the roadside in different ways to help make inspection selection decisions	**Hypothesis supported -** There is a wide variation in CVISN capabilities among states and in the extent they use national and state data sources to access real-time, updated safety information to help make inspection selection decisions.
Various national and state data sources can be effectively integrated for efficient use by roadside inspectors	**Hypothesis supported –** A few expanded CVISN states have effectively integrated federal data sources with state CVIEWs to improve inspection selection efficiency. However, the number of states actively using this integrated data is still small.
If inspectors could have access to real-time, updated safety information based on accurate vehicle or carrier identity, then inspectors would use that information to help make inspection selection decisions	**Hypothesis results mixed –** Some inspectors rely heavily on computer-based safety and credential related information to make inspection decisions while regularly using federal and state data sources and tools such as SAFER, Query Central, or a CVIEW**.** However, other inspectors have been slow to utilize these resources, even if they are available.
Inspectors' use of visual cues and intuition to select trucks for inspections will decline as the ready availability of more accurate, convenient, historical data increases at the roadside check station	**Hypothesis results mixed** – Some inspectors rely heavily on computer-based safety and credential related information to make inspection decisions. However, other inspectors have been slow to utilize these resources, instead relying on their judgment, experience, and visual cues.
1.2 Determine effectiveness of CVISN at increasing the efficiency of inspections (i.e. focusing on high-risk on noncompliant carriers, vehicles, and drivers)	
The availability of real-time safety information at the roadside, combined with other available or developmental roadside measures will help inspectors more effectively target higher-risk carriers, vehicles, and drivers	**Hypothesis supported -** Results suggest that focusing on specific types of vehicle and driver OOS conditions could improve the inspection selection process by identifying trucks that are more likely to be involved in crashes
The availability of real-time credentials and licensing information at the roadside will help inspectors more effectively target noncompliant carriers, vehicles, and drivers	**Hypothesis not tested in detail** - Based on data from Kentucky, there appears to be a loose correlation with a carrier's credentialing status and their safety risk rating. However, due to the data limitations in the Kentucky Clearinghouse, a more thorough and complete analysis is needed to fully understand and assess the relationship between a carrier's safety and credentialing information.
1.3 Determine reductions in crashes, injuries, and fatalities nationwide under various deployment scenarios	
If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided directly, through increased inspection efficiency	**Hypothesis supported -** Real-time safety data, integrated with LTCCS data, can potentially help reduce the number of crashes, injuries, and fatalities. The maximum benefit that could be realized would result in an 4.8% reduction in annual nationwide crashes, according to statistical modeling.
If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided indirectly, through increased motor carrier compliance with safety and licensing regulations	**Hypothesis not tested** – The evaluation team recognized that an indirect effect may exist but this was not measured as part of this evaluation.

- **Inspector Training.** A majority of the inspectors encountered during this evaluation relied predominantly on visual cues, inspector judgment, and experience in deciding which vehicles to inspect. Although some states use safety data to support those decisions, most states do not. The scenarios presented in this report represent a departure from the current approach and rely more on giving inspectors access to real-time safety data to select trucks with a high relative risk for crashes. Inspectors would need extensive training to acclimate them both to the new technologies and to the benefits that can be achieved through more focused inspection selection algorithms.

- **Selection of Safety Indices.** One overall finding of this evaluation was that using an indexed safety measure will better help select vehicles with OOS violations. More research should be conducted to determine the most appropriate safety measure. From an inspection efficiency standpoint, the best choice for a safety index is one that correlates well with the probability of finding an OOS violation on a vehicle chosen for inspection. Analysis of the LTCCS showed that driver and brake OOS violations have a high relative risk for crash. As such, OOS rates were used in this analysis as safety indices when trying to identify vehicles with a probability of having a driver or brake OOS condition. This does not necessarily mean that OOS rates are more effective as safety indices than ISS scores or other measures, merely that OOS rates were chosen as a safety index in this analysis because they represented the quickest way to identify carriers with a history of driver or brake OOS conditions. This is because the OOS rate is a simple calculation (number of inspection resulting in OOS orders divided by the total number of inspections), whereas the ISS score is a compilation of various safety-related measures, and thus a more complex measure.

  Because the ISS score is recommended by FMCSA and used by some states, future study is warranted that examines the effectiveness of ISS at predicting driver or brake OOS conditions in vehicles at the inspection site and, if necessary, to recommend modifications to the ISS calculation to better account for brake and driver violations. To this end, a scenario where the ISS score is used to screen vehicles in a manner similar to RE-3 is presented in Appendix C.9.

- **Limitations of Findings.** The safety analysis uses a probability model to predict the number of truck-related crashes that would be avoided nationwide as CVISN deployment expands. Modeling was required in part because of the relative rarity of large-truck crashes and the wide variability in factors that contribute to truck crashes. Also, CVISN deployment varies widely from state to state. This makes naturalistic or longitudinal observational studies of CVISN safety benefits on a national scale impractical at present. Although the model used in this study can be justified by basic principles of probability, its application relies on a variety of input parameters used to estimate impacts and benefits of CVISN. Some of the parameters were estimated using results from the open literature on crashes and highway statistics, and others were estimated with data collected in special studies involving participating CVISN states. Both types of estimates—while intended to use the best current data available—are subject to errors of unknown magnitude.

Estimates of CVISN impacts and benefits obtained from the special CVISN studies should also be used with caution. Results are based on field studies in four states. This imposed constraints on the ability to determine precisely the statistical uncertainty of the estimates. Although additional data are needed, the safety analysis presented in this report helps to illustrate how the deployment of CVISN can affect highway safety in the future. The analysis can be easily modified as new data become available.

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Appendix C.1
Questions for Phone Survey Used to Select States for Participation in CVISN National Evaluation Safety Analysis Field Studies

Prior to the Evaluation of the National CVISN Deployment Program, some information had already been collected from some states as part of the CVISN Self-Evaluation process. The phone survey below was used to verify the accuracy of that information as well as build upon it to characterize how state inspectors utilize specific types of CVISN screening and SIE technologies to help them make inspection selection decisions. For states that did not complete the Self-Evaluation report prior to the interview, this survey attempted to gather some of the information requested in the Self-Evaluation data collection templates.

The questions below are phrased assuming that the state being surveyed did not complete its Self-Evaluation report. For states that have participated in the self evaluation, questions were modified accordingly. Some of the information requested may be available from existing databases, e.g., Question 9, on the numbers of inspections conducted per year in a state; interviews will be used to obtain the most recent information and any clarifications or qualifications states may offer on this existing information.

General Questions

1. How many permanent fixed weigh scale sites does your state operate that are used for vehicle safety inspections and/or credential or compliance checks?

2. How many mobile or portable scale systems does your state operate that are used for weighing in connection with vehicle safety inspections and/or credential or compliance checks?

3. How are the sites configured?

4. Are the configurations substantially the same for all sites in your state, or are there differences?

5. How many hours per week are the sites customarily open?

6. Do the actual times of day that the sites are open vary by day? By week?

7. What is the protocol for requiring trucks to enter the inspection station when open?

8. How many inspectors are generally working while the station is open?

9. In the past year, approximately how many commercial vehicles were inspected at all of the inspection sites?

10. How many full time equivalent (FTE) officers and/or inspectors does your state employ in a typical year to perform commercial vehicle safety inspections?

CVISN Deployment

11. Is CVISN technology used at any of your state's sites to aid in the inspection process?

*If **Yes,** then answer Questions 12-23. If **No,** then skip to Question 24.*

12. How many sites have this capability?

13. What specific data are collected from the commercial vehicle prior to making a decision on whether to inspect?

14. How is this information collected (sensors, WIM, cameras, eyesight, etc)?

15. At what points in time are the data collected (before truck reaches station, slow down ramp, stopped at station, etc.)?

16. Are any external data sources (SAFER, SafeStat, Query Central) used to supplement data collected at the site?

17. Are Inspection Selection System (ISS) ratings collected before the inspector decides which vehicle to inspect (to help in the selection process) or after the inspection decision has been made?

18. Based on all data collected, how are decisions related to inspections made? What methodologies play a role in the decisions (ISS algorithm, inspector judgment, etc.)?

19. Do sites have the capability to record the DOT number for every commercial vehicle traversing the inspection station?

20. Does your state now offer CVISN electronic screening to enable safe, registered, enrolled vehicles to bypass one or more open inspection stations?

21. If yes, in which electronic screening program or partnership does your state participate?

22. At how many sites does your state offer electronic screening?

23. Is there a specific site in your state that is advanced in terms of its CVISN capabilities?

24. If CVISN technologies are not used, what specific data are collected from the vehicle?

25. How is this information collected?

26. At what time point is it collected?

27. How does this information factor into the inspection decision-making process?

Attitudes Toward CVISN Roadside Technologies

28. How has CVISN helped you or your state's CV roadside operations within the past year?

29. What are the biggest limitations to using CVISN roadside technologies in your state?

30. What plans are there in the near future to expand your state's CVISN roadside capabilities?

31. Would you be interested in participating in a field study for the CVISN National Evaluation?

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Appendix C.2.
New York Field Study Results

This appendix presents results on inspection efficiency for New York based on data collected as part of a field study conducted at three separate inspection stations from May 8-10, 2007.

Overall, USDOT numbers were captured for 1,549 commercial vehicles entering the Schodack (May 8), Clifton Park (May 9), and Queensbury (May 10) inspection sites during the field study. A total of 64 trucks were inspected during the field study. Figure C.2-1 summarizes the number of trucks observed and inspected each day of the field study. Clifton Park saw more truck traffic than the other two stations as it was located on a portion of I-87 that is heavily traveled by commercial vehicles. The other two stations were located in more remote areas. The number of inspections, however, was roughly the same across the three days as the same amount of inspectors was on duty each day.

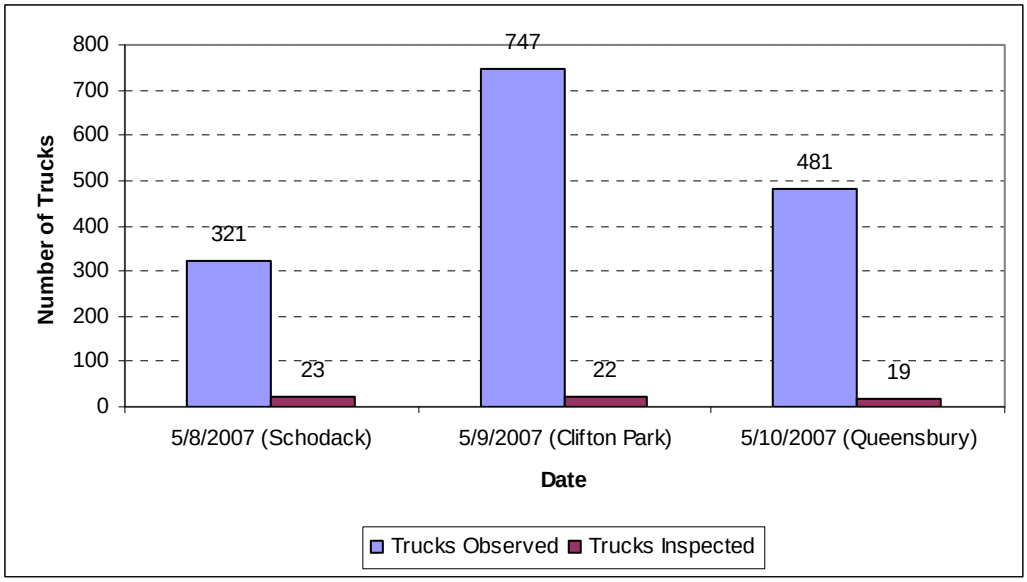

Figure C.2-1. Total Number of Trucks Observed by Data Collector During Each Day of New York Field Study

It should be noted that Figure C.2-1 contains only those trucks that were observed by the data collector. Identifying information was not captured on a small subset of vehicles. It is estimated that the researcher was unable to obtain identifying information on about 1% of the vehicles traveling through the rest area, mostly because consecutive trucks were traveling too fast past the data collector to capture all information. Also, identifying information for trucks that illegally bypassed the station was not captured due the distance from the rest area parking lot to the mainline. While such unidentified trucks are excluded from this analysis, it is assumed that the safety ratings and other characteristics for the small set of missed trucks are identical to those trucks from which identifying information was captured.

Carrier Demographics

The USDOT number for every truck observed during the field study was cross-referenced with the MCMIS Census File to obtain a few pieces of demographic information. A large percentage of the truck traffic, 80%, was interstate carriers, while the remaining 20% operated within the state of New York.

Table C.2-1 shows a breakdown of the trucks' home states. Since license plate information was not captured on field study trucks, the home state for each truck is defined to be the base state of the truck's carrier as listed in the MCMIS Census File. Roughly 34% of the truck traffic was based in New York. Another 9% of the trucks had carriers based in Pennsylvania. A large portion of the truck traffic hails from the Northeast with a small percentage based in southern states.

Table C.2-1. Distribution of Carrier Base State for New York Field Study Trucks

State	Number	Percent
New York	417	33.93
Pennsylvania	107	8.71
Massachusetts	59	4.80
New Jersey	52	4.23
Florida	44	3.58
Connecticut	43	3.50
Arkansas	42	3.42
Indiana	37	3.01
Vermont	35	2.85
All Others	836	31.98
TOTAL	**1,549**	**100.00**

Carrier Risk

The carriers' ISS scores were used to assess their safety risk. ISS is a decision aid recommended by FMCSA for commercial vehicle roadside driver/vehicle safety inspections, which guides safety inspectors in selecting vehicles for inspection. The underlying inspection value is based on data analysis of the motor carrier's safety performance record using information from FMCSA's Motor Carrier Management Information System (MCMIS). It is primarily based on SafeStat with an additional carrier-driver-conviction measure. SafeStat ranks all carriers by their safety performance in areas of crash history, inspection history, driver history, and safety management experience. (UGPTI 2004a,b). The system provides FMCSA with the capability to continuously quantify and track the safety status of motor carriers, especially unsafe carriers. This allows FMCSA enforcement and education programs to effectively allocate resources to carriers that pose a high risk of involvement in crashes. The ISS provides a three-tiered recommendation as shown in Table C.2-2.

Table C.2-2. ISS Values and Recommendations

Recommendation	ISS Inspection Value	Risk Category
Inspect (inspection warranted)	75 - 100	High
Optional (may be worth a look)	50-74	Medium
Pass (inspection not warranted)	1-49	Low

The USDOT numbers for the 1,549 trucks the traversed the inspection site were compared with a copy of the SAFER database obtained at the time of the field study to obtain the ISS score for each carrier that could be identified. Trucks were then placed into risk categories based on Table C.2-2. Carriers were placed into an "insufficient data" risk category if there was not enough information to generate an ISS score. Carriers with USDOT numbers that could not be found in SAFER were labeled as "unknown". The distribution of safety ratings was also generated for all inspections that were performed in the three-year period 2003 – 2005 both at the three New York field study inspection sites and throughout the state of New York. This was done to determine if the inspections performed at the New York field study sites are representative of inspections performed in the state in general. This helped to determine the degree to which the results from the field study inspection sites could be extrapolated.

The second column of Table C.2-3 shows the percent of New York field study truck traffic that fell into each risk category based on their carrier's ISS score. Also shown in columns 3 through 5 is the risk breakdown of: (1) all trucks inspected during the field study at the three inspection stations combined; (2) trucks inspected in 2003-2005 at the three inspection sites; and (3) trucks inspected in 2003-2005 in the entire state, respectively. Since only 64 trucks were inspected during the field study, the use of inspections conducted from 2003 to 2005 provided a more robust risk distribution of inspections.

About 18% of the New York field study truck traffic is considered high-risk based on ISS while 13% and 56% are considered medium- and low-risk, respectively. The percentage of high-risk trucks inspected during the field study was higher than the percentage inspected over the previous three years at both the field study inspection sites as well as the state overall but, as mentioned, there were only a small number of vehicles (64) inspected during the field study. From 2003 to 2005, the risk distribution of inspections performed at the three fields study inspection sites is similar to the risk distribution observed for New York state inspections. The only major difference was that the three sites had a larger percentage of low-risk trucks and a lower percentage of unknown trucks than the entire state. Because of this similarity, results obtained based on data from the field study can be considered representative of the state of New York.

Table C.2-3. Comparison of the Risk Distribution of New York Field Study Truck Traffic and Inspections Performed at the Schodack, Clifton Park, and Queensbury Sites as well as the Entire State of New York

Risk Class	Percent of Trucks or Inspections By Risk Class			
	Field Study Truck Traffic (1,549 Trucks)	Inspections		
		3 Sites Combined – Field Study(1)	3 Sites Combined - Historical(2)	New York State - Historical(3)
High	17.6%	31.3%	18.7%	19.0%
Medium	13.0%	14.1%	14.0%	11.2%
Low	55.8%	46.9%	48.4%	40.0%
Insufficient Data	11.2%	4.7%	12.3%	14.8%
Unknown	2.4%	3.1%	6.6%	15.0%
Total	100.0%	100.0%	100.0%	100.0%

(1) Percentages based on 64 inspections conducted during 3-day field study
(2) Percentages are based on 18,817 inspections conducted at Schodack, Clifton Park, and Queensbury sites from 2003 through 2005.
(3) New York percentages are based on 76,725 inspections conducted in New York from 2003 through 2005.

Figure C.2-2 shows the risk distribution of trucks inspected from 2003 through 2005 separately for the three field study sites. Schodack has a greater percentage of high-risk vehicles and a smaller percentage of low-risk vehicles than the other two sites. Although the specific inspectors can vary at each site on a daily basis, the same groups of NYSDOT and New York State Police inspectors generally perform inspections at each of the three sites. Therefore, any difference in risk distributions between the stations is more likely to be a result of the truck traffic population than any differences in inspection selection methodology. As a result, inspection efficiency results are presented using aggregate results across the three inspection stations.

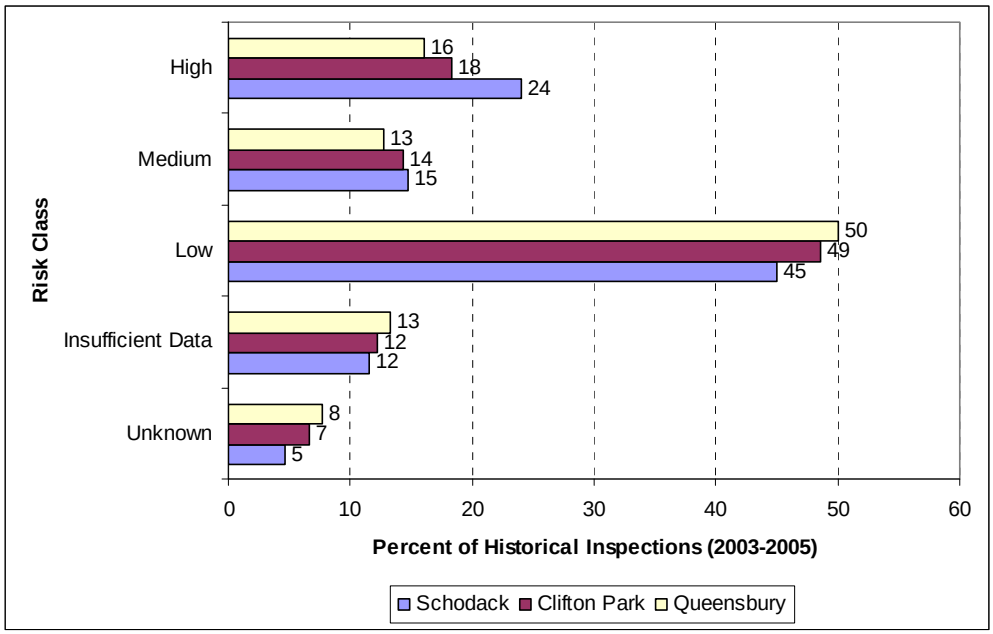

Figure C.2-2. Comparison of the Risk Distribution of Inspections Performed at Schodack, Clifton Park, and Queensbury Inspection Sites

Inspection Efficiency

The data that were needed to assess the efficiency of the current inspection practices included the following:

- ISS Risk classifications for trucks in the population at the inspection sites (based on observed truck traffic during field study);
- ISS Risk classifications for trucks that were inspected (based on approximately one year of state inspections); and
- OOS rates by ISS risk classification, historically, and during the field observational studies.

As discussed in the previous section, trucks that traversed the stations during the field study as well as trucks inspected in New York from 2003 to 2005 were placed into one of five risk categories based on the carrier's ISS score. In order to obtain OOS rates by risk category, the historical inspection records were used to determine whether each inspection in the three year period resulted in an OOS order being issued. OOS rates were calculated as the number of OOS orders given per 100 inspections for each risk category.

Table C.2-4 summarizes the inspection efficiency at the three New York stations in terms of the probability of selecting high-risk trucks. Actual vehicle inspection totals by risk category in the first row are based on 18,817 inspections performed from 2003 through 2005 at the three sites. The truck traffic vehicle totals in the second row are based on the total number of trucks that were observed traversing the sites during the field study. The vehicles selected for inspection as well as those in the truck traffic population were divided into high-, medium-, and low-risk, insufficient data, and unknown risk based on the ISS scores of the carrier and are shown in columns 2 through 5 of Table C.2-4.

It should be noted that for trucks inspected in New York from 2003 through 2005, the carrier's risk category at the time the inspection took place is based on information contained in a copy of the SAFER database at a single point in time (i.e. at the time of the field study). The carrier's risk rating at the time of the inspection may not be exactly the same as the rating in SAFER during the field study. However, absent any other information, it is reasonable to assume that the carrier's rating did not change significantly.

For the inspected and truck traffic vehicles, the probability of a truck being high-risk is shown. The probability of a truck being in the high-risk category is calculated as the number of high-risk trucks divided by the total number of trucks. About 18% of the truck traffic at the three inspection sites was considered high-risk while about 19% of the vehicles inspected at the sites were high-risk. The ratio of the proportion of high-risk vehicles inspected to the proportion in the truck traffic population is 1.06 (18.72% divided by 17.62%). This ratio is not statistically significantly greater than 1 (the value expected if there was no difference between random inspections and current practices). Thus, current inspection practices in New York yield about the same percentage of high-risk trucks that would be expected if trucks were selected randomly

for inspection. This result is not surprising as most trucks in New York selected for inspection are done so randomly.

Table C.2-4. Inspection Selection Efficiency at New York Field Study Sites

Vehicle Data	Number of Trucks by Risk Classification					Percent of High-Risk Carriers
	High	Med/ Low	Insuff. Data	Unknown	Total	
Inspected(1)	3,523	11,744	2,315	1,235	18,817	18.72%
Truck Traffic(2)	273	1,066	173	37	1,549	17.62%
Inspected vs. Truck Traffic						1.06

(1) Inspection numbers based on inspections performed at the Schodack, Clifton Park, and Queensbury sites from 2003 to 2005.
(2) Truck traffic numbers based on 1,549 trucks that traversed the three sites during the field study.

The analysis comparing OOS rates for different inspection selection strategies requires estimates of OOS rates across risk categories. Table C.2-5 shows statewide OOS rates by risk categories, which were calculated using all inspections performed in New York from 2003 to 2005. OOS rates were 16.1 per 100 inspections for low-risk trucks and 31.0 per 100 inspections for high-risk trucks. OOS rates for trucks with an unknown risk class were higher than those for high-risk trucks. The overall OOS violation rate was 25.3%.

Table C.2-5. New York Statewide OOS Violation Rates by Risk Category for Inspections Performed from 2003 through 2005

Risk Class (Based on ISS Score)	Number of Inspections	Number of Inspections with an OOS Violation	OOS Rate (No. per 100 Inspections)
High-Risk	55,943	17,342	31.0
Medium-Risk	33,389	8,401	25.2
Low-Risk	117,709	18,962	16.1
Insufficient Data	43,463	13,177	30.3
Unknown	44,018	16,766	38.1
Total	294,522	74,648	25.3

Table C.2-6 presents the results of the analysis of OOS rates. The expected number of OOS orders was calculated for two scenarios: if trucks were selected randomly for inspection, and if trucks were selected according to current practices. The expected number of OOS orders per 100 inspections under each of these scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. That is, the number of OOS orders per 100 inspections was equal to the proportion of those 100 inspections that would be expected to be in the risk category multiplied by the OOS rate for the risk category. For example, the table illustrates that about 18% of trucks observed during the field study were classified as high-risk compared to roughly 19% of the inspections conducted at the three field study sites. The state OOS rate for the high-risk category is 31.0%. Thus, the expected number of OOS orders per 100 random inspections of high-risk trucks would be 5.46 (17.62*0.310). Using current inspection

practices, the expected number of OOS orders per 100 inspections for high-risk trucks is 5.80 (18.72*0.310). Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Overall, if trucks were selected for inspection at random, one would expect about 22 OOS orders per 100 inspections. Using the current inspection selection procedure, the number of OOS orders per 100 inspections would be expected to add 1.34 OOS orders per 100 inspections. Thus, current inspection selection practices do not yield a significant improvement in the number of OOS orders over selecting trucks randomly. This is due mainly to the fact that the percentage of high-risk trucks selected with current inspection practices was not significantly higher than would be selected with random selection.

Table C.2-6. Comparison of Expected Number of OOS Orders Per 100 Inspections for New York Field Study Sites Random Selection Versus Current Inspection Practices

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Inspected(2)		Random Selection	Inspected
High	17.62	18.72	31.0	5.46	5.80
Medium	13.04	14.04	25.2	3.29	3.54
Low	55.78	48.38	16.1	8.98	7.79
Insufficient Data	11.17	12.30	30.3	3.38	3.73
Unknown	2.39	6.56	38.1	0.91	2.50
Total Expected OOS Orders per 100 Inspections				22.02	23.36

(1) Random selection percentages were determined from ISS Scores of more than 1,500 vehicles that traversed the Schodack, Clifton Park, and Queensbury sites during the field study.
(2) Actual selection percentages are based on more than 18,000 inspections performed at the field study sites from 2003 to 2005.

Table C.2-7 illustrates the impact on the number of OOS orders per 100 inspections where an inspection selection strategy is adopted that incorporates the use of full ES. Under this scenario, all commercial vehicles classified as low- and medium-risk enroll in an ES system, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors then use current practices to select vehicles for inspection from the remaining trucks in the high-risk and insufficient data categories. The second column again shows the risk distribution of trucks that would be expected if trucks were selected randomly for inspection. The third column shows the proportion that would be inspected if all low- and medium-risk trucks were allowed to bypass the site and if the numbers for the remaining risk categories were increased proportionally. For example, the percentage of high-risk trucks expected to be inspected under this strategy would be 56.51% {56.51% = 17.62% / [1-(0.1304+0.5578)]}, while no medium- or low-risk trucks would be inspected. As in the preceding table, the expected number of OOS orders per 100 inspections under each of these two scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. Within each inspection selection scenario, the

sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Table C.2-7. Comparisons of Expected Number of OOS Orders Per 100 Inspections for Field Study Inspection Sites—Random Selection Versus Electronic Screening Where Medium- and Low- Risk Carriers Are Allowed to Bypass Station

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Full ES(2)		Random Selection	Full ES
High	17.62	56.51	31.0	5.46	17.52
Medium	13.04	0.00	25.2	3.29	0.00
Low	55.78	0.00	16.1	8.98	0.00
Insufficient Data	11.17	35.82	30.3	3.38	10.85
Unknown	2.39	7.67	38.1	0.91	2.92
Total Expected OOS Orders per 100 Inspections				22.02	31.29

(1) Random selection percentages were determined from ISS Scores of more than 1,500 vehicles that traversed the Schodack, Clifton Park, and Queensbury sites during the field study.

(2) Distribution was derived from random selection percentages and the assumption that ES will eliminate low and medium-risk carriers from the selection process (e.g., for high-risk category 56.51% = 17.62% / (1-(0.1304+0.5578))

Again, if trucks were selected for inspection at random, one would expect about 22 OOS orders per 100 inspections. If ES were implemented to the point that all low- and medium-risk trucks would be allowed to bypass the site, the number of OOS orders per 100 inspections would be expected to rise to about 31. This last scenario represents an increase of OOS orders per 100 inspections of about 42% from the scenario where trucks are randomly selected for inspection from the population of traversing trucks. It also represents an increase of OOS orders per 100 inspections of about 34% compared to current inspection practices.

Appendix C.3
Colorado Field Study Results

This appendix presents results on inspection efficiency for Colorado based on data collected as part of a field study conducted at the north and south-bound Monument ports of entry from June 11 – 22, 2007. Any reference in this section to the Monument port of entry refers to both the north and south bound inspection sites unless otherwise specified.

Overall, USDOT numbers were captured for 17,404 commercial vehicles entering the Monument inspection site during the two week field study. Figure C.3-1 summarizes the number of trucks observed each day of the field study. The inspection stations cleared an average of 1,616 trucks per weekday. A lower number of trucks (about 620) traversed the stations per day on the weekend. The sites experienced higher truck volumes during the first week of the study.

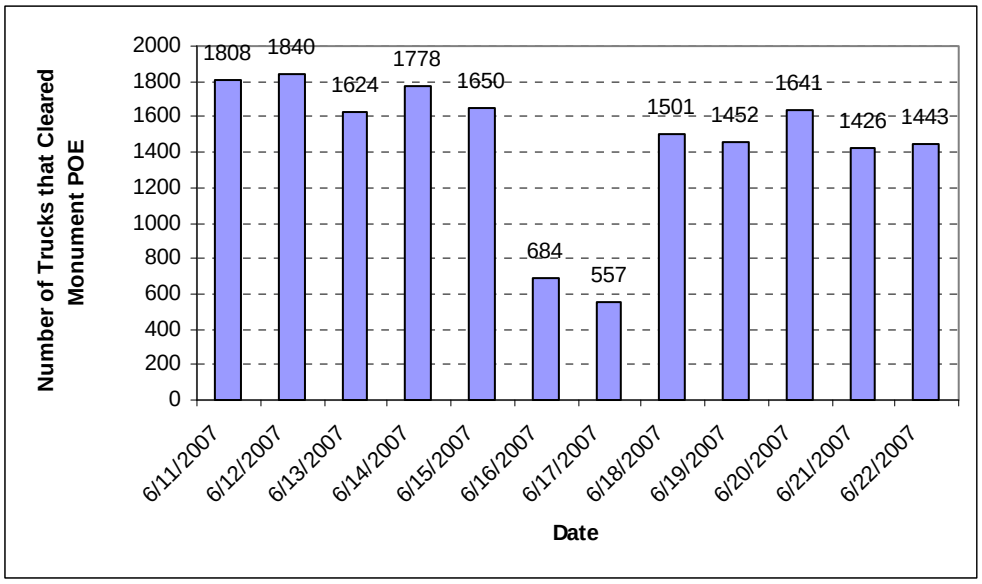

Figure C.3-1. Total Number of Trucks that Cleared the Monument, Colorado Port of Entry During Each Day of the Field Study

It should be noted that the daily truck volumes in Figure C.3-1 represent the number of trucks that cleared the stations in a 24-hour period. Counter officers are available throughout the day to capture identifying information for trucks that enter the stations. However, identifying information was not captured on a small subset of vehicles. For example, USDOT numbers for trucks that legally bypassed the stations via PrePass were not made available to the evaluation team. Also, identifying information for trucks that bypassed the stations due to temporary station closures to prevent trucks queuing on the mainline or trucks that illegally bypassed the stations are not captured by the Monument port staff, and thus were not available. While such unidentified trucks are excluded from this analysis, it is assumed that the safety ratings and other characteristics for the small set of missed trucks are identical to those trucks from which identifying information was captured.

Figure C.3-2 illustrates the number of inspections conducted per day at the stations. A total of 41 trucks were inspected during the field study. This small number of inspections was driven by the limited number of inspectors available in Colorado to conduct inspections and the number of locations to conduct inspections. Inspections are not conducted at every port every day.

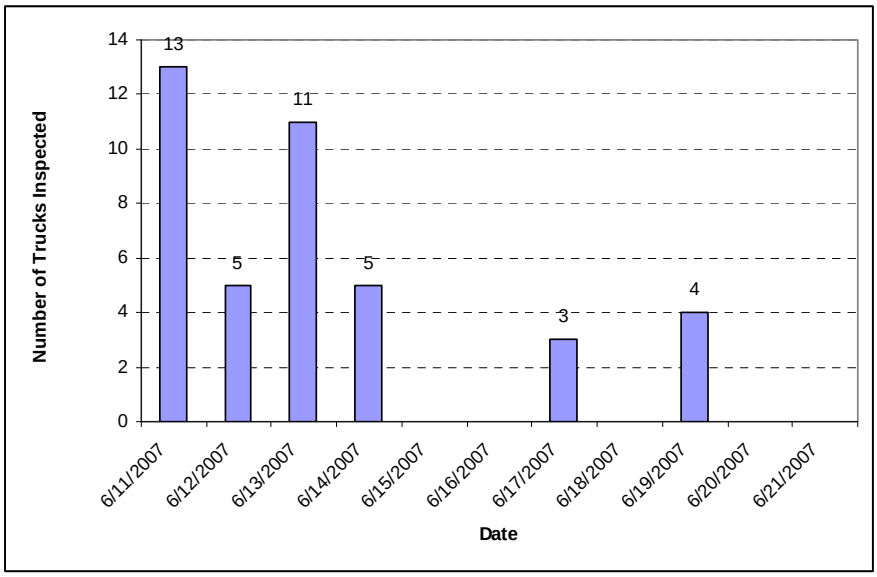

Figure C.3-2. Daily Number of Inspections during Colorado Field Study

Carrier Demographics

Table C.3-1 shows a breakdown of the trucks' home state. License plate information captured from each vehicle that cleared the port was used to associate a truck with a base state. Roughly 39% of the truck traffic was based in Colorado. Another 9% of the trucks had carriers based in Indiana. A large portion of the truck traffic hails from the West and Midwest.

Table C.3-1. Distribution of Carrier Base State for Observed Colorado Field Study Trucks

State	Number	Percent
Colorado	6,715	38.64
Indiana	1,599	9.20
Texas	975	5.61
Oklahoma	896	5.16
Illinois	837	4.82
Nebraska	585	3.37
California	552	3.18
Utah	543	3.12
Wyoming	367	2.11
All Others	4,309	24.80
TOTAL	**17,378**	**100.00**

Carrier Risk

The carriers' ISS scores were used to assess their safety risk. ISS is a decision aid recommended by FMCSA for commercial vehicle roadside driver/vehicle safety inspections, which guides safety inspectors in selecting vehicles for inspection. The underlying inspection value is based on data analysis of the motor carrier's safety performance record using information from FMCSA's Motor Carrier Management Information System (MCMIS). It is primarily based on SafeStat with an additional carrier-driver-conviction measure. SafeStat ranks all carriers by their safety performance in areas of crash history, inspection history, driver history, and safety management experience. (UGPTI 2004a,b). The system provides FMCSA with the capability to continuously quantify and track the safety status of motor carriers, especially unsafe carriers. This allows FMCSA enforcement and education programs to effectively allocate resources to carriers that pose a high risk of involvement in crashes. The ISS provides a three-tiered recommendation as shown in Table C.3-2.

Table C.3-2. ISS Values and Recommendations

Recommendation	ISS Inspection Value	Risk Category
Inspect (inspection warranted)	75 - 100	High
Optional (may be worth a look)	50-74	Medium
Pass (inspection not warranted)	1-49	Low

The USDOT numbers for the 17,404 trucks the traversed the inspection sites were compared with a copy of the SAFER database obtained at the time of the field study to obtain the ISS score for each carrier that could be identified. Trucks were then placed into risk categories based on Table C.3-2. Carriers were placed into an "insufficient data" risk category if there was not enough information to generate an ISS score. Carriers with USDOT numbers that could not be found in SAFER were labeled as "unknown". The distribution of safety ratings was also generated for all inspections that were performed in 2006 both at the Monument inspection sites and throughout the state of Colorado. This was done to determine if the inspections performed at the Monument sites are representative of inspections performed in the state in general. This helped to determine the degree to which the results from the single port of entry could be extrapolated.

The second column of Table C.3-2 shows the percent of Colorado field study truck traffic that fell into each risk category based on their carrier's ISS score. Also shown in columns 3 through 5 is the risk breakdown of: (1) all trucks inspected during the field study; (2) trucks inspected in 2006 at the Monument sites; and (3) trucks inspected in 2006 in the entire state, respectively. Since only 41 trucks were inspected during the field study, the use of inspections conducted in 2006 provided a more robust risk distribution of inspections.

About 27% of the Colorado field study truck traffic is considered high-risk based on ISS while about 15% and 38% are considered medium- and low-risk, respectively. The percentage of high-risk trucks inspected during the field study (42%) was very close to the percent of high-risk trucks inspected for the entire year at the Monument port. The percentage of high-risk carriers inspected at the Monument port, 41%, is higher than the state rate of 34%. Thus, it appears that either current inspection practices at the Monument port are more successful in choosing high-

risk trucks for inspection or more high-risk trucks traverse the Monument Port of Entry as compared to the remainder of the state. The exact reason is unknown.

Table C.3-3. Comparison of the Risk Distribution of Colorado Field Study Truck Traffic and Inspections Performed at the Monument North and South Bound Ports of Entry and the Entire State of Colorado

ISS Risk Class	Percent of Trucks or Inspections By Risk Class			
	Field Study Truck Traffic (17,404 Trucks)	Inspections		
		Field Study(1)	Monument Port(2)	Colorado(3)
High	27.4%	41.5%	41.0%	33.5%
Medium	14.8%	17.1%	18.4%	18.3%
Low	37.8%	26.8%	30.3%	28.7%
Insufficient Data	10.4%	14.6%	10.2%	15.7%
Unknown	9.7%	0.0%	0.2%	3.9%
Total	100.0%	100.0%	100.0%	100.0%

(1) Field study percentages based on 41 inspections conducted during two-week field study
(2) Monument Port percentages are based on 3,189 inspections conducted at North and South Bound Monument stations in 2006
(3) Colorado percentages are based on 57,450 inspections performed in Colorado in 2006

Inspection Efficiency

The data that were needed to assess the efficiency of the current inspection practices included the following:

- ISS Risk classifications for trucks in the population at the inspection sites (based on observed truck traffic during field study);
- ISS Risk classifications for trucks that were inspected (based on approximately one year of state inspections); and
- OOS rates by ISS risk classification, historically, and during the field observational studies.

As discussed in the previous section, trucks that traversed the stations during the field study as well as trucks inspected in Colorado in 2006 were placed into one of five risk categories based on the carrier's ISS score. In order to obtain OOS rates by risk category, the historical inspection records were used to determine whether each inspection in 2006 resulted in an OOS order being issued. OOS rates were calculated as the number of OOS orders given per 100 inspections for each risk category.

It should be noted that for trucks inspected in Colorado during 2006, the carrier's risk category at the time the inspection took place is based on information contained in a copy of the SAFER database at a single point in time (i.e. at the time of the field study). The carrier's risk rating at the time of the inspection may not be exactly the same as the rating in SAFER during the field

study. However, absent any other information, it is reasonable to assume that the carrier's rating did not change significantly.

Table C.3-4 summarizes the inspection efficiency at the Monument port in terms of the probability of selecting high-risk trucks. Actual vehicle inspection totals by risk category in the first row are based on the 3,189 inspections performed at the Monument sites in 2006. The truck traffic vehicle totals in the second row are based on the total number of trucks that cleared the Monument port during the field study. The vehicles selected for inspection as well as those in the truck traffic population were divided into high-, medium-, and low-risk, insufficient data, and unknown risk based on the ISS scores of the carrier and are shown in columns 2 through 5 of Table C.3-4.

For the inspected and truck traffic vehicles, the probability of a truck being high-risk is shown. The probability of a truck being in the high-risk category is calculated as the number of high-risk trucks divided by the total number of trucks. About 27% of the truck traffic at the Monument port was considered high-risk while 41% of the vehicles inspected at the site were high-risk. The proportion of high-risk vehicles inspected to the proportion in the truck traffic population is 1.50 (40.95% divided by 27.35%). This ratio is statistically significantly greater than 1 (the value expected if there was no difference between random inspections and current practices). Thus, current inspection practices such as inspector judgment, visual observation of vehicles, and use of PrePass for transpondered vehicles yields about 50% more high-risk trucks than if inspectors would simply choose trucks randomly.

Table C.3-4. Inspection Selection Efficiency at Monument Port of Entry

Vehicle Data	Number of Trucks by Risk Classification					Percent of High-Risk Carriers
	High	Med/ Low	Insuff. Data	Unknown	Total	
Inspected(1)	1,306	1,553	324	6	3,189	40.95%
Truck Traffic(2)	4,760	9,150	1,811	1,683	17,404	27.35%
Inspected vs. Truck Traffic						1.50

(4) Inspection numbers based on inspections performed at the Monument port in 2006.
(5) Colorado truck traffic numbers based on 17,404 trucks that traversed the Monument sites during the field study (June 11 – 22, 2007).

The analysis comparing OOS rates for different inspection selection strategies requires estimates of OOS rates across risk categories. Table C.3-5 shows statewide OOS rates by risk categories, which were calculated using all inspections performed in Colorado during 2006. OOS rates were 12.7 per 100 inspections for low-risk trucks and 33.4 per 100 inspections for high-risk trucks. OOS rates for trucks with insufficient data and for an unknown risk class were higher than those for high-risk trucks. The overall OOS violation rate for 2006 was 26.7%.

Table C.3-5. Colorado Statewide OOS Violation Rates by Risk Category for Inspections Performed in 2006

Risk Class (Based on ISS Score)	Number of Inspections	Number of Inspections with an OOS Violation	OOS Rate (No. per 100 Inspections)
High-Risk	19,244	6,431	33.4
Medium-Risk	10,498	2,703	25.7
Low-Risk	16,471	2,097	12.7
Insufficient Data	7,042	3,129	34.7
Unknown	2,382	975	43.9
Total	32,790	15,335	26.7

Table C.3-6 presents the results of the analysis of OOS rates. The expected number of OOS orders was calculated for two scenarios: if trucks were selected randomly for inspection, and if trucks were selected according to current practices. The expected number of OOS orders per 100 inspections under each of these scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. That is, the number of OOS orders per 100 inspections was equal to the proportion of those 100 inspections that would be expected to be in the risk category multiplied by the OOS rate for the risk category. For example, the table illustrates that about 27% of trucks observed during the field study were classified as high-risk compared to roughly 41% of the inspections conducted at the Monument inspection stations. The state OOS rate for the high-risk category is 33.4. Thus, the expected number of OOS orders per 100 random inspections of high-risk trucks would be 9.13 (27.35*0.334). Using current inspection practices, the expected number of OOS orders per 100 inspections for high-risk trucks is 13.68 (40.95*0.334). Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Overall, if trucks were selected for inspection at random, one would expect about 26 OOS orders per 100 inspections. Using the current inspection selection procedure, the number of OOS orders per 100 inspections would be expected to add only 0.27 OOS orders per 100 inspections. Although the number of OOS orders for high-risk trucks increases, the smaller overall increase in OOS orders is due mainly to the lower percentage of unknown safety risk carriers that are inspected compared to the percentage of carriers with unknown safety risk information in the truck traffic population. Moreover, the state OOS rate for unknown safety risk carriers is quite high at 43.9 OOS orders per 100 inspections. Thus, current inspection selection practices so not yield a significant improvement in the number of OOS orders over selecting trucks randomly.

Table C.3-6. Comparison of Expected Number of OOS Orders Per 100 Inspections for Monument Port
Random Selection Versus Current Inspection Practices

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Inspected(2)		Random Selection	Inspected
High	27.35	40.95	33.4	9.13	13.68
Medium	14.77	18.38	25.7	3.80	4.72
Low	37.81	30.32	12.7	4.80	3.85
Insufficient Data	10.41	10.16	34.7	3.61	3.53
Unknown	9.67	0.19	43.9	4.25	0.08
Total Expected OOS Orders per 100 Inspections				25.59	25.86

(1) Random selection percentages were determined from ISS Scores of more than 17,000 vehicles that cleared the Monument port during the field study.
(2) Actual selection percentages are based on more than 3,100 inspections performed at the Monument stations in 2006.

Table C.3-7 illustrates the impact on the number of OOS orders per 100 inspections where an inspection selection strategy is adopted that incorporates the use of full ES. Under this scenario, all commercial vehicles classified as low- and medium-risk enroll in PrePass, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors then use current practices to select vehicles for inspection from the remaining trucks in the high-risk and insufficient data categories. The second column again shows the risk distribution of trucks that would be expected if trucks were selected randomly for inspection. The third column shows the proportion that would be inspected if all low- and medium-risk trucks were allowed to bypass the site and if the numbers for the remaining risk categories were increased proportionally. For example, the percentage of high-risk trucks expected to be inspected under this strategy would be 57.68% {57.68% = 27.35% / [1-(0.1477+0.3781)]}, while no medium- or low-risk trucks would be inspected. As in the preceding table, the expected number of OOS orders per 100 inspections under each of these two scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Table C.3-7. Comparison of Expected Number of OOS Orders Per 100 Inspections for Monument Port Random Selection Versus Electronic Screening Where Medium- and Low- Risk Carriers Are Allowed to Bypass Station

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Full ES(2)		Random Selection	Full ES
High	27.35	57.68	33.4	9.13	19.27
Medium	14.77	0.00	25.7	3.80	0.00
Low	37.81	0.00	12.7	4.80	0.00
Insufficient Data	10.41	21.95	34.7	3.61	7.62
Unknown	9.67	20.39	43.9	4.25	8.95
Total Expected OOS Orders per 100 Inspections				25.59	35.84

(1) Random selection percentages were determined from ISS Scores of more than 17,000 vehicles that cleared the Monument port during the field study.

(2) Distribution was derived from random selection percentages and the assumption that ES will eliminate low and medium-risk carriers from the selection process (e.g., for high-risk category 57.68% = 27.35% / (1-(0.1477+0.3781))

Again, if trucks were selected for inspection at random, one would expect about 26 OOS orders per 100 inspections. If ES were implemented to the point that all low- and medium-risk trucks would be allowed to bypass the site, the number of OOS orders per 100 inspections would be expected to rise to about 36. This last scenario represents an increase of OOS orders per 100 inspections of about 40% from the scenario where trucks are randomly selected for inspection from the population of traversing trucks. It also represents an increase of OOS orders per 100 inspections of about 39% compared to current inspection practices.

Appendix C.4
Kentucky Field Study Results

This appendix presents results on inspection efficiency for Kentucky based on data collected as part of a field study conducted as part of a separate FMCSA/FHWA task order, "Kentucky Commercial Vehicle Safety Applications Evaluation" (BA34018, FMCSA 2008a,b).

Table C.4-1 provides an overview of the numbers of trucks that were observed during the two week field study.

Table C.4-1. Truck Traffic Volume Observed During Kentucky Field Study

	June 11 - June 15		June 18 - June 22		Complete Field Study	
	Number of Trucks	**Percent**	**Number of Trucks**	**Percent**	**Number of Trucks**	**Percent**
Entered Station and Captured by Data Collector	5,588	100.0	6,738	93.1	12,326	96.1
Bypassed Station via Norpass	NA*	NA	498	6.9	498	3.9
Total	**5,588**	**100.0**	**7,236**	**100.0**	**12,824**	**100.0**

* Norpass bypass information not available during first week of field study

Overall, USDOT numbers were captured for 12,326 commercial vehicles entering the Laurel County station during the two-week field study. Information on an additional 498 vehicles that legally bypassed the station during the second week of the study was captured via Norpass. Bypass information for the first week of the study could not be used because key pieces of information were missing from the Norpass file that reports truck bypass and pull-in information. The 498 trucks that bypassed in the second week were added to the 12,326 captured by the on-site researcher for a total of 12,824 vehicles used in the analysis. A total of 57 trucks were inspected during the first week of the field test, while 36 trucks were inspected the second week.

It should be noted that Table C.4-1 contains only those trucks that were observed either by the data collector or Norpass. Identifying information was not captured on a small subset of vehicles. For example, trucks that did not pass through the ISSES but were instead directed to the static scale were not captured by the data collector. Due to the rate at which trucks passed by the scale house window after going through the ISSES and the distance between the ISSES equipment and the static scale on the opposite side of the building, it was not possible for the data collector to capture USDOT numbers from both sets of vehicles. In consultation with KVE, the Kentucky Transportation Center estimates that, when the station is open, approximately 8% of the daily truck volume passes over the static scale as opposed to going through the ISSES. In addition, it is estimated that the researcher was unable to obtain identifying information on about 5% of the vehicles traveling through the ISSES, mostly because consecutive trucks were traveling too fast past the scale house window to capture all information. While such unidentified trucks are excluded from this analysis, it is assumed that the safety ratings and other characteristics for the small set of missed trucks are identical to those trucks from which identifying information was captured.

Figure C.4-1 summarizes the number of trucks observed each day of the field study. Since the amount of data collection time varied by day, the number of trucks per hour is also provided to be able to better compare truck volumes by day. The average number of trucks observed traversing the station per day over the two weeks of data collection was about 1,370. This equates to about 179 trucks per hour. Truck volume was greatest on Thursdays and generally higher towards the end of the week. Monday was the slowest day in terms of truck traffic. The figure shows that data were not collected on weekends. Also, no data collector was present on July 12 and raw truck counts are lower on July 19 due to the station being closed in the late morning and entire afternoon.

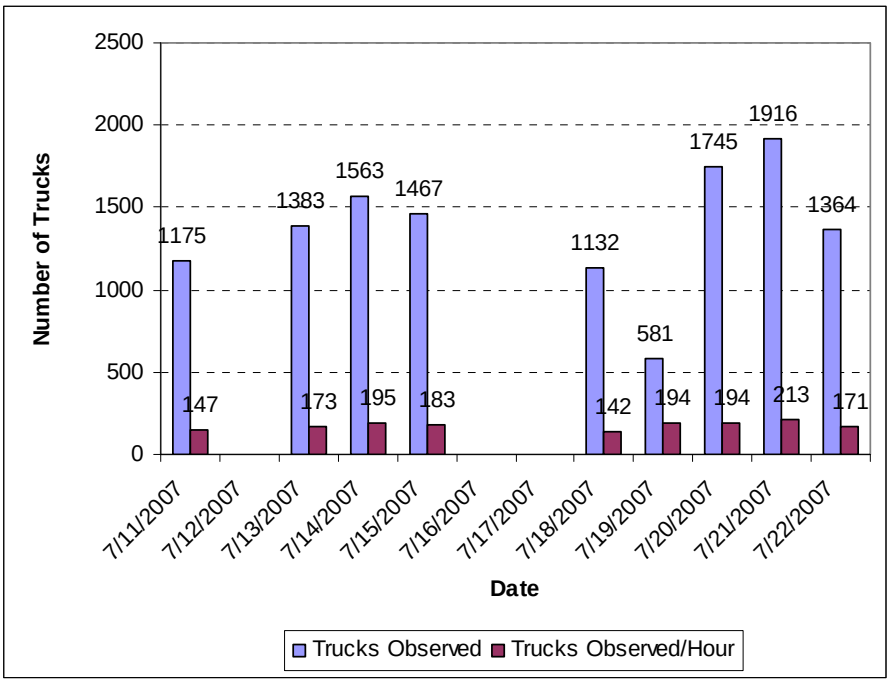

Figure C.4-1. Total Number of Trucks and Trucks per Hour Observed By Data Collector during Each Day of Kentucky Field Study

Figure C.4-2 shows the total number of trucks and the number of trucks per hour that bypassed the station via Norpass and hence were captured by the Norpass system and not by the data collector during the second week of the field study. An average of 13.5 trucks per hour bypassed the station via Norpass during the 37 hours of data collection in the second week. The largest number of bypasses occurred Wednesday through Friday.

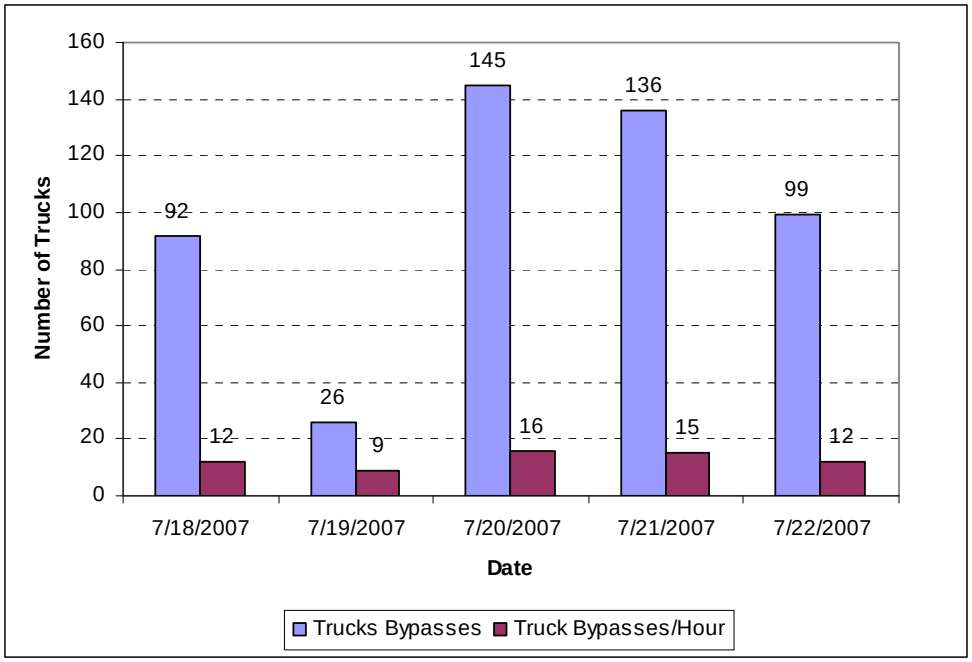

Figure C.4-2. Daily Number of Total Truck Bypasses and Bypasses per Hour for Second Week of Kentucky Field Study

Figure C.4-3 illustrates the number of inspections conducted per day at the station. The number of inspections per day varied throughout the course of the two-week study and was driven by the number of inspectors on duty on a given day. During the field study, Laurel County had two new inspectors working for the first time. Since no data collector was present on the weekend, no inspection data were collected either.

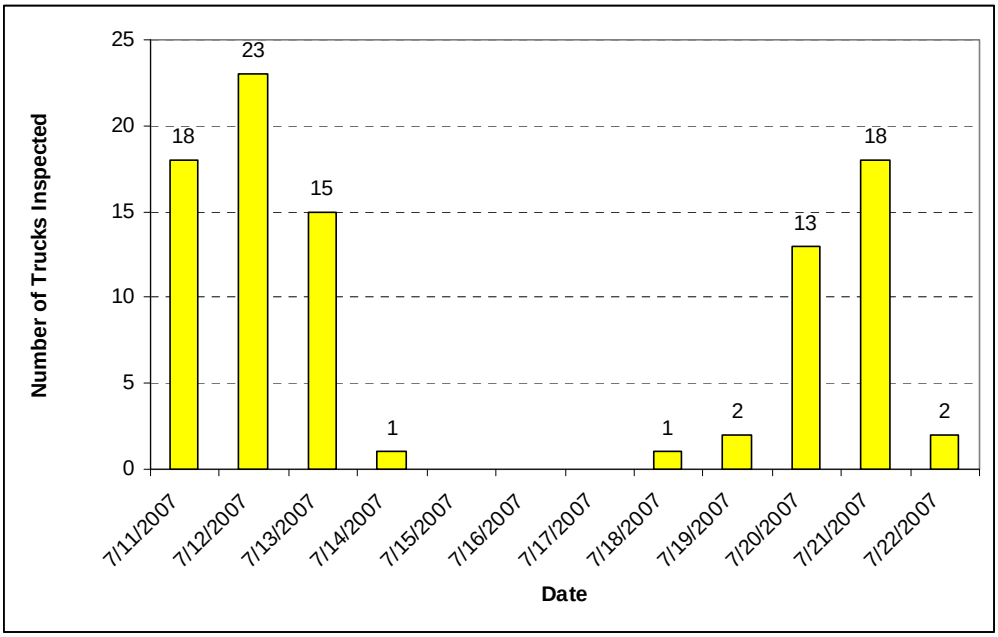

Figure C.4-3. Daily Number of Inspections during Kentucky Field Study

Carrier Demographics

The USDOT number for every truck observed during the field study was cross-referenced with the MCMIS Census File to obtain a few pieces of demographic information. A large percentage of the truck traffic, 95%, was interstate carriers, while the remaining 5% operated within the state of Kentucky. The large percentage of interstate carriers is not surprising for this inspection station given that it lies along I-75, a main corridor for north/south traffic in that part of the country, and is located just 30 miles north of the Tennessee border.

Table C.4-2 shows a breakdown of the trucks' home states. Since license plate information was not captured on all trucks, the home state for each truck is defined to be the base state of the truck's carrier as listed in the MCMIS Census File. Roughly 11% of the truck traffic was based in Kentucky. Another 25% of the trucks had carriers based in three of the states bordering Kentucky (Tennessee, Ohio, and Indiana). A large portion of the truck traffic hails from the Midwest and south with a small percentage based in western states.

Table C.4-2. Distribution of Carrier Base State for Observed Kentucky Field Study Trucks

State	Number	Percent
Kentucky	1,387	10.82
Tennessee	1,301	10.15
Ohio	1,144	8.92
Indiana	773	6.03
Michigan	707	5.51
Arkansas	685	5.34
Wisconsin	593	4.62
Florida	564	4.40
Illinois	531	4.14
Ontario, Canada	477	3.72
Georgia	445	3.47
North Carolina	409	3.19
Pennsylvania	333	2.60
Nebraska	288	2.25
Iowa	283	2.21
Alabama	263	2.05
Arizona	243	1.89
Missouri	235	1.83
Texas	221	1.72
Minnesota	194	1.51
South Carolina	183	1.43
Virginia	175	1.36
New Jersey	107	0.83
All Other States	1,283	10.00
TOTAL	**12,824**	**100.00**

Carrier Electronic Screening

Of the 12,824 observed trucks that traversed the Laurel County inspection station during the times of field study data collection, 639 (or 5%) contained a transponder enrolled in Norpass. Seventy-eight percent of the 639 e-screening participating trucks were allowed to bypass the station while the remaining 22% of e-screening participating trucks were instructed to pull into the station. This observed pull-in percentage is consistent with what would be expected given the Norpass pull-in rates used in Kentucky. Figure C.4-4 illustrates the percentage of trucks that bypassed and pulled into the station each day for the second week of the study. The percentages are fairly consistent across the five days, with a slightly higher pull-in rate on Thursday and Friday.

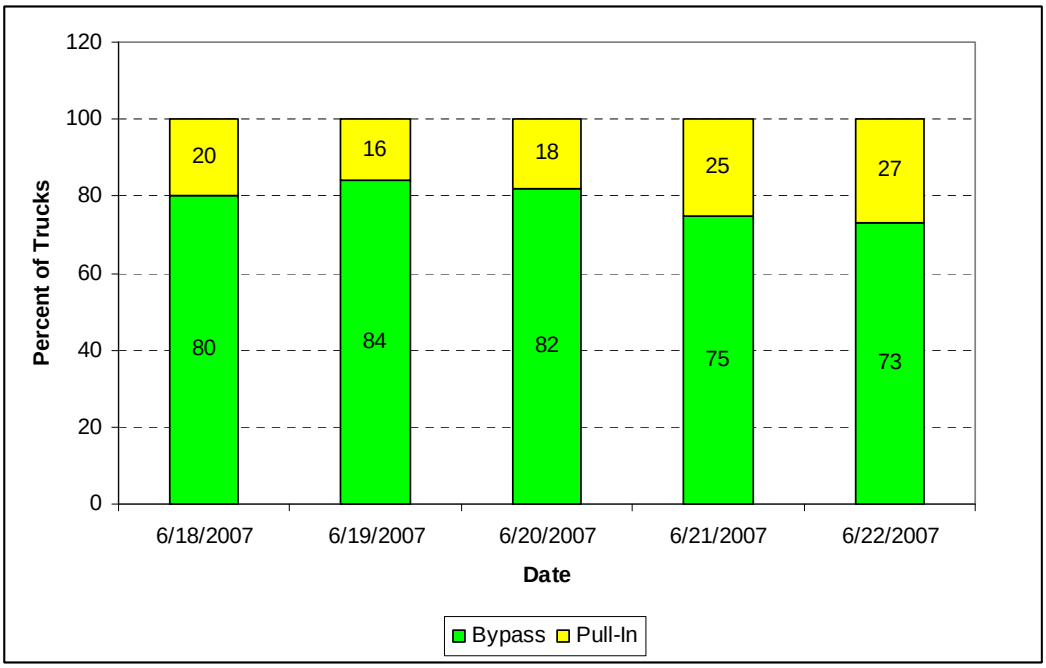

Figure C.4-4. Percentage of E-Screening Participating Kentucky Field Study Truck Traffic that Bypassed and Pulled-In to Inspection Station

Table C.4-3 displays the percentage of trucks that pulled into the station at the direction of Norpass broken down by the reasons they were pulled in. Over half of the trucks were pulled in because of no weight data available from the WIM. Kentucky Transportation Center officials commented that weight data may not be available in cases where a truck is straddling the WIM or there is a significant cargo shift while crossing the WIM. This also could indicate a technical problem with the WIMs. Eighteen percent were selected randomly for pull-in while 13% had problems with their credentials or they were identified as a PRISM carrier. About 11% were brought in for a weight violation.

Table C.4-3. Distribution of Reasons E-Screening Participating Trucks Were Required to Pull-In to Inspection Station during Kentucky Field Study

Reason for Pull-In	Percentage of Trucks
Credentials related or PRISM Carrier	12.6%
No weight data	58.2%
Random Selection	17.9%
Weight Violation	11.4%

Carrier Risk

The carriers' ISS scores were used to assess their safety risk. ISS is a decision aid recommended by FMCSA for commercial vehicle roadside driver/vehicle safety inspections, which guides safety inspectors in selecting vehicles for inspection. The underlying inspection value is based on

data analysis of the motor carrier's safety performance record using information from FMCSA's Motor Carrier Management Information System (MCMIS). It is primarily based on SafeStat with an additional carrier-driver-conviction measure. SafeStat ranks all carriers by their safety performance in areas of crash history, inspection history, driver history, and safety management experience. (UGPTI 2004). The system provides FMCSA with the capability to continuously quantify and track the safety status of motor carriers, especially unsafe carriers. This allows FMCSA enforcement and education programs to effectively allocate resources to carriers that pose a high risk of involvement in crashes. The ISS provides a three-tiered recommendation as shown in Table C.4-4.

Table C.4-4. ISS Values and Recommendations

Recommendation	ISS Inspection Value	Risk Category
Inspect (inspection warranted)	75 - 100	High
Optional (may be worth a look)	50-74	Medium
Pass (inspection not warranted)	1-49	Low

The USDOT numbers for the 12,824 trucks observed at the inspection site were compared with a copy of the SAFER database obtained at the time of the field study to obtain the ISS score for each carrier that could be identified. Trucks were then placed into risk categories based on Table C.4-4. Carriers were placed into an "insufficient data" risk category if there was not enough information to generate an ISS score. Carriers with USDOT numbers that could not be found in SAFER were labeled as unknown. The distribution of safety ratings was also generated for all inspections performed from January 2005 through September 13, 2007 both at the Laurel County inspection site and throughout the state of Kentucky. This was done to determine if the inspections performed at the Kentucky field study sites are representative of inspections performed in the state in general. This will help to determine the degree to which the results from the field study inspection sites can be extrapolated.

The second column of Table C.4-5 shows the percent of Kentucky field study truck traffic that fell into each risk category based on their carrier's ISS score. Also shown in columns 3 through 5 is the risk breakdown of: (1) all trucks inspected during the field study; (2) trucks inspected from 2005 to mid-September, 2007 at the Laurel County stations; and (3) trucks inspected from 2005 to mid-September, 2007 in the entire state, respectively. Since only 93 trucks were inspected during the field study, the use of inspections conducted in this 32.5 month period provided a more robust risk distribution of inspections.

About 29% of the Kentucky field study truck traffic is considered high-risk based on ISS while 19% and 42% are considered medium- and low-risk, respectively. The risk distribution of field study truck traffic is fairly consistent with the risk distribution of the inspected performed at the Laurel County site as well as the state overall in the 32.5 month period. Thus, it appears that current inspection practices at the Laurel County station yield about the same percentage of high-risk trucks than if vehicles were selected for inspection randomly. The percentage of high-risk trucks selected for inspection during the field study were higher than the past 32.5 months but this distribution is based on only 93 inspections.

Table C.4-5. Comparing the Risk Distribution of Kentucky Field Study Truck Traffic and Inspections Performed at the Laurel County Inspection Site and the Entire State of Kentucky

ISS Risk Class	Percent of Trucks or Inspections By Risk Class			
	Field Study Truck Traffic (12,824 Trucks)	Inspections		
		Field Study (1)	Laurel County(2)	Kentucky(3)
High	29.3%	46.3%	33.9%	31.8%
Medium	18.8%	20.0%	18.4%	18.4%
Low	41.7%	30.5%	41.7%	36.1%
Insufficient Data	7.8%	3.2%	5.7%	11.9%
Unknown	2.4%	0.0%	0.3%	1.9%
Total	100.0%	100.0%	100.0%	100.0%

(1) Field study percentages based on 93 inspections conducted during two-week field study
(2) Laurel County percentages are based on 17,471 inspections conducted at north and south bound Laurel County stations in 2006
(3) Kentucky percentages are based on 222,452 inspections performed in the state from January 2005 through mid-September 2007

In addition to assessing the safety risk distribution for Kentucky truck traffic versus the inspected vehicle population, risk classification was also used to compare different segments of the Kentucky truck traffic observed during the field study. Table C.4-6 examines the risk distribution (based on ISS scores) of Kentucky field trucks with and without transponders.

Table C.4-6. Comparison of ISS Risk Distribution for E-Screening and Non-E-Screening Kentucky Field Study Truck

ISS Risk Classification	# of KY Field Study Trucks Screened with Transponder	%	# of KY Field Study Trucks Screened without Transponder	%
High	83	13.0	3,677	30.2
Medium	91	14.2	2,315	19.0
Low	459	71.9	4,890	40.1
Insufficient Data	4	0.6	996	8.2
Unknown	2	0.3	307	2.5
Total	639	100.0	12,185	100.0

Of all trucks participating in e-screening, about 72% are classified as low-risk compared to only 40% of non e-screening participating carriers. Thirteen percent of e-screening carriers are in the highest risk class as opposed to over 30% of trucks without transponders. This is not surprising as carriers with better safety records are more likely to enroll in e-screening than carriers with poorer safety records.

Table C.4-7 examines the risk distribution of all e-screening participating carriers who were given a green light to bypass the station as well as those instructed to pull into the station. Based

on the objectives of e-screening, one would expect a larger percentage of high-risk trucks to be pulled in versus allowed to bypass. The data supports this expectation as the set of bypassed trucks have a lower percentage of high-risk trucks (about 11%) compared to the trucks instructed to pull in (about 21%). Again this is not surprising given that the rate in which trucks are pulled into stations is higher for those trucks with higher carrier's vehicle and driver OOS rates. Lower risk trucks are pulled in less frequently.

Table C.4-7. Comparison of ISS Risk Distribution for Trucks Bypassing Station and Trucks Pulling into Station Using Kentucky Screening Criteria

ISS Risk Classification	# of KY Field Study Trucks that Bypassed Station	%	# of KY Field Study Trucks that Pulled In	%
High	53	10.6	30	21.3
Medium	78	15.7	13	9.2
Low	361	72.5	98	69.5[a]
Insufficient Data	4	0.8	0	0.0
Unknown	2	0.4	0	0.0
Total	498	100.0	141	100.0

a. As shown in Table C.4-3 above, 58% of the pulled-in, transponder-equipped trucks received red lights because of a lack of weight (WIM) data.

Inspection Efficiency

The data that were needed to assess the efficiency of the current inspection practices included the following:

- ISS Risk classifications for trucks in the population at the inspection site (based on observed truck traffic during field study);
- ISS Risk classifications for trucks that were inspected (based on approximately 2.5 years of state inspections); and
- OOS rates by ISS risk classification, historically, and during the field observational studies.

As discussed in the previous section, trucks observed at the inspection site were placed into one of five risk categories based on the carrier's ISS score. Using the same methodology, risk classifications based on the ISS score were also obtained for trucks inspected at the Laurel County station from January 2005 through mid-September 2007. In order to obtain OOS rates by risk category, the historical inspection records were used to determine whether each inspection over the 32.5 month timeframe resulted in an OOS order being issued. OOS rates were calculated as the number of OOS orders given per 100 inspections for each risk category.

It should be noted that for trucks inspected in Kentucky from January 2005 through September 2007, the carrier's risk category at the time the inspection took place is based on information contained in a copy of the SAFER database at a single point in time (i.e. at the time of the field study). The carrier's risk rating at the time of the inspection may not be exactly the same as the rating in SAFER during the field study. However, absent any other information, it is reasonable to assume that the carrier's rating did not change significantly.

Table C.4-8 summarizes the inspection efficiency at the Laurel County inspection station in terms of the probability of selecting high-risk trucks. Actual vehicle inspection totals by risk category in the first row are based on more than 17,000 inspections performed at the Laurel County north and southbound stations between January 1, 2005, and September 13, 2007. Since only 95 trucks were inspected during the two-week field study, the use of the historical inspections provided a more robust risk distribution of inspections. Also for this reason, inspections from the southbound Laurel County station were included. The southbound station is located on the other side of the highway and is similar in layout to the northbound station, with the exceptions that the southbound station does not have an ISSES, and the southbound station has both the low-speed bypass lane and the static scale lane on the east (highway) side of the scale house. The truck traffic vehicle totals in the second row are based on the total number of trucks observed traversing the station during the field study. The vehicles selected for inspection as well as those in the truck traffic population were divided into high-, medium-, and low-risk, insufficient data, and unknown risk based on the ISS scores of the carrier and are shown in columns 2 through 5 of Table C.4-8.

For the inspected and truck traffic vehicles, the probability of a truck being high-risk is shown. The probability of a truck being in the high-risk category is calculated as the number of high-risk trucks divided by the total number of trucks. About 29% of the truck traffic at Laurel County was considered high-risk while 34% of the vehicles inspected at the Laurel County station were high-risk. The ratio of the proportion of high-risk vehicles inspected to the proportion in the truck traffic population is 1.16 (33.94% divided by 29.32%). This ratio is statistically significantly greater than 1 (the value expected if there was no difference between random inspections and current practices). Thus, current inspection practices such as inspector judgment, visual observation of vehicles, and use of Norpass for transpondered vehicles yield slightly more high-risk trucks than if inspectors would simply choose trucks randomly.

Table C.4-8. Inspection Selection Efficiency at Laurel County Station

Vehicle Data	Number of Trucks by Risk Classification					Percent of High-Risk Carriers
	High	Med/ Low	Insuff. Data	Unknown	Total	
Inspected(1)	5,929	10,502	987	53	17,471	33.94%
Truck Traffic(2)	3,760	7,755	1,000	309	12,824	29.32%
Inspected vs. Truck Traffic						1.16

1. Vehicle inspection totals based on more than 17,000 inspections performed at the Laurel County northbound and southbound stations between January 1, 2005 and September 13, 2007
2. Truck Traffic totals based on more than 12,800 trucks observed during two-week field study at Laurel County Station

The analysis comparing OOS rates for different inspection selection strategies requires estimates of OOS rates across risk categories. Table C.4-9 shows statewide OOS rates by risk categories, which were calculated using all inspections in Kentucky between January 1, 2005 and September 13, 2007. OOS rates were 7.2 per 100 inspections for low-risk trucks and 17.2 per 100 inspections for high-risk trucks. OOS rates for trucks with insufficient data and for an unknown risk class were higher than those for high-risk trucks. The overall OOS violation rate was 13.6% over the 32.5-month span.

Table C.4-9. Kentucky Statewide OOS Violation Rates by Risk Category for Inspections Performed January 1, 2005 through September 13, 2007

Risk Class (Based on ISS Score)	Number of Inspections	Number of Inspections with an OOS Violation	OOS Rate (No. per 100 Inspections)
High-Risk	70,803	12,183	17.2
Medium-Risk	40,818	5,597	13.7
Low-Risk	80,225	5,763	7.2
Insufficient Data	26,384	5,072	19.2
Unknown	4,222	1,561	37.0
Total	222,452	30,176	13.6

It should be noted here that Kentucky's OOS rates were found to be significantly below the national average. Nationally, 24% of vehicles inspected were put OOS for vehicle violations and 7% of drivers inspected were put OOS for driver violations in 2005 [NAFTA Safety Stats, 2005]. Based on Kentucky inspections performed from January 1, 2005 through September 13, 2007, Kentucky's vehicle and driver OOS rates for 2005 were 9.5% and 4.7%, respectively. Representatives of the Kentucky Transportation Center acknowledged that Kentucky's OOS rates are below the national average and that FMCSA and the Commissioner of KVE have identified this fact as a priority. The Kentucky Transportation Center has been performing a detailed analysis of Kentucky's OOS rates in an attempt to better understand the difference in OOS rates between Kentucky and the rest of the nation. At the time of this evaluation, no results or conclusions from this analysis were available.

Table C.4-10 presents the results of the analysis of OOS rates. The expected number of OOS orders was calculated for two scenarios: if trucks were selected randomly for inspection, and if trucks were selected according to current practices. The expected number of OOS orders per 100 inspections under each of these scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. That is, the number of OOS orders per 100 inspections was equal to the proportion of those 100 inspections that would be expected to be in the risk category multiplied by the OOS rate for the risk category. For example, the table illustrates that about 29% of trucks observed during the field study were classified as high-risk compared to roughly 34% of the inspections conducted at the Laurel County station. The state OOS rate for the high-risk category is 17.2. Thus, the expected number of OOS orders per 100 random inspections of high-risk trucks would be 5.04 (29.32*0.172). Using current inspection practices, the expected number of OOS orders per 100 inspections for high-risk trucks is 5.84 (33.94*0.172). Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Table C.4-10. Comparison of Expected Number of OOS Orders Per 100 Inspections for Laurel County Inspection Station Random Selection Versus Current Inspection Practices

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Inspected(2)		Random Selection	Inspected
High	29.32	33.94	17.2	5.04	5.84
Medium	18.76	18.43	13.7	2.57	2.52
Low	41.71	41.68	7.2	3.00	3.00
Insufficient Data	7.80	5.65	19.2	1.50	1.08
Unknown	2.41	0.30	37.0	0.89	0.11
Total Expected OOS Orders per 100 Inspections				**13.00**	**12.55**

(1) Random selection percentages were determined from ISS Scores of more than 12,000 vehicles that were observed at the Laurel County inspection site during the field study.
(2) Actual selection percentages are based on more than 17,000 inspections performed at the Laurel County northbound and southbound stations between January 1, 2005 and September 13, 2007.

Overall, if trucks were selected for inspection at random, one would expect about 13 OOS orders per 100 inspections. Using the current inspection selection procedure, the number of OOS orders per 100 inspections would be expected to drop 0.45 OOS orders per 100 inspections. Although the number of OOS orders for high-risk trucks increases, the slight overall drop in OOS orders is due mainly to the lower percentage of insufficient data carriers that are inspected compared to the percentage of carriers with insufficient data in the truck traffic population. This is a consequence of Kentucky not using ISS scores to select vehicles for inspection but rather focusing on OOS rates as a measure to select high-risk trucks if any historical safety data were used at all. Moreover, the state OOS rate for insufficient data carriers is quite high at 19.2 OOS orders per 100 inspections. Thus, current inspection selection practices do not yield an improvement in the number of OOS orders over selecting trucks randomly.

Table C.4-11 illustrates the impact on the number of OOS orders per 100 inspections where an inspection selection strategy is adopted that incorporates the use of full ES. Under this scenario, all commercial vehicles classified as low- and medium-risk enroll in Norpass, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors then use current practices to select vehicles for inspection from the remaining trucks in the high-risk and insufficient data categories. The second column again shows the risk distribution of trucks that would be expected if trucks were selected randomly for inspection. The third column shows the proportion that would be inspected if all low- and medium-risk trucks were allowed to bypass the site and if the numbers for the remaining risk categories were increased proportionally. For example, the percentage of high-risk trucks expected to be inspected under this strategy would be 74.17% {74.17% = 29.32% / [1-(0.1876+0.4171)]}, while no medium- or low-risk trucks would be inspected. As in the preceding table, the expected number of OOS orders per 100 inspections under each of these two scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Table C.4-11. Comparisons of Expected Number of OOS Orders Per 100 Inspections for Laurel County Inspection
Random Selection Versus Electronic Screening Where Medium- and Low- Risk Carriers Are Allowed to Bypass Station

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Full ES(2)		Random Selection	Full ES
High	29.32	74.17	17.2	5.04	12.76
Medium	18.76	0.00	13.7	2.57	0.00
Low	41.71	0.00	7.2	3.00	0.00
Insufficient Data	7.80	19.73	19.2	1.50	3.79
Unknown	2.41	6.10	37.0	0.89	2.26
Total Expected OOS Orders per 100 Inspections				**13.00**	**18.81**

(1) Random selection percentages were determined from ISS Scores of more than 12,000 vehicles that were observed at the Laurel County inspection site during the field study.
(2) Distribution was derived from random selection percentages and the assumption that ES will eliminate low and medium-risk carriers from the selection process (e.g., for high-risk category 74.17% = 29.32% / (1-(0.1876+0.4171))

Again, if trucks were selected for inspection at random, one would expect about 13 OOS orders per 100 inspections. If ES were implemented to the point that all low- and medium-risk trucks would be allowed to bypass the site, the number of OOS orders per 100 inspections would be expected to rise to about 19. This last scenario represents an increase of OOS orders per 100 inspections of about 45% from the scenario where trucks are randomly selected for inspection from the population of traversing trucks. It also represents an increase of OOS orders per 100 inspections of about 50% compared to current inspection practices.

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Appendix C.5
Ohio Field Study Results

Overall, USDOT numbers were captured for 2,044 commercial vehicles entering the Preble County station during the three-day field study. A total of 100 trucks were inspected during the field study. Figure C.5-1 summarizes the number of trucks observed and inspected each day of the field study. The number of observed trucks increased across the three days. The study was conducted Tuesday through Thursday. According to the Ohio State Highway Patrol, truck volume at the Preble County station is usually lowest on Monday and Tuesday with peak volumes occurring on Wednesday and Thursday. More inspections were conducted on Wednesday and Thursday due to a larger number of inspectors on duty later in the week.

Figure C.5-1 contains only those trucks that were observed by the data collector. Identifying information was not captured on a small subset of vehicles. For example, USDOT numbers for trucks that legally bypassed the station via PrePass were not made available to the evaluation team. Also, identifying information for trucks that bypassed the station due to temporary station closures to prevent trucks queuing on the mainline or trucks that illegally bypassed the station were not captured due the distance from the scale house to the mainline. In addition, it is estimated that the researcher was unable to obtain identifying information on about 5% of the vehicles traveling across the scale, mostly because consecutive trucks were traveling too fast past the scale house window to capture all information. While such unidentified trucks are excluded from this analysis, it is assumed that the safety ratings and other characteristics for the small set of missed trucks are identical to those trucks from which identifying information was captured.

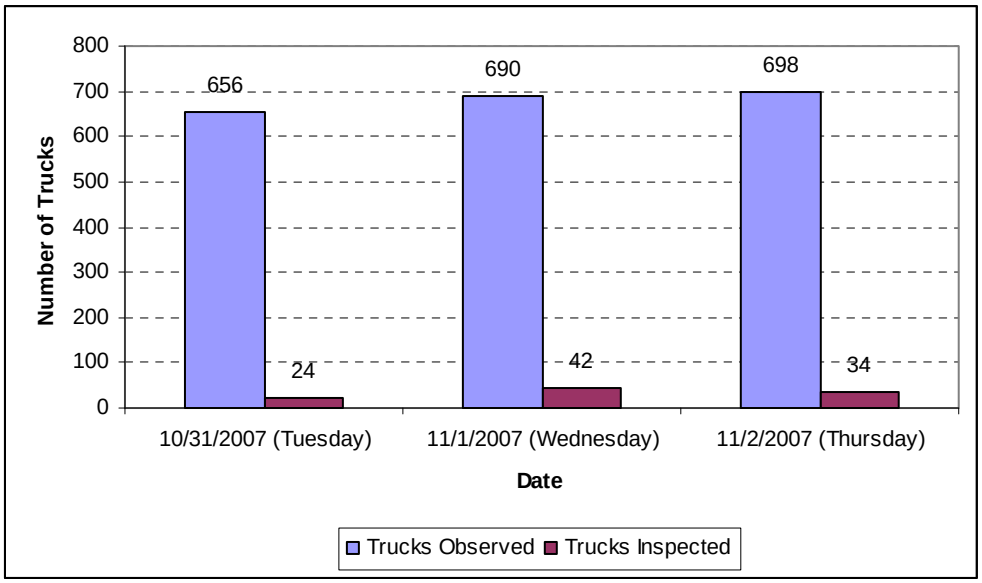

Figure C.5-1. Total Number of Trucks Observed By Data Collector and Inspected During Each Day of Ohio Field Study

Carrier Demographics

All vehicles observed during the Ohio field study were interstate carriers. This is not surprising for this inspection station given that it lies along I-70, less than a mile east of the Indiana/Ohio border.

Table C.5-1 shows a breakdown of the trucks' home state. License plate information captured from each observed vehicle was used to associate a truck with a base state. License plate information was not able to be obtained for 107 of the 2,044 observed trucks due to the speed of the trucks across the scale or the condition of the plates. Over half of the observed trucks were from Ohio, Indiana, or Illinois. Roughly 17% of the truck traffic was based in Ohio. Another 20% of the trucks had carriers based in Indiana while 17% were from Illinois. A large portion of the truck traffic originates from the Midwest with a small percentage based in western and southern states.

Table C.5-1. Distribution of Carrier Base State for Ohio Field Study Trucks

State	Number	Percent
Indiana	381	19.67
Ohio	328	16.93
Illinois	327	16.88
Oklahoma	92	4.75
Wisconsin	87	4.49
Iowa	78	4.03
Missouri	76	3.92
Nebraska	69	3.56
Pennsylvania	63	3.25
All Others	436	22.51
TOTAL	**1,937**	**100.00**

Carrier Risk

The carriers' ISS scores were used to assess their safety risk. ISS is a decision aid recommended by FMCSA for commercial vehicle roadside driver/vehicle safety inspections, which guides safety inspectors in selecting vehicles for inspection. The underlying inspection value is based on data analysis of the motor carrier's safety performance record using information from FMCSA's Motor Carrier Management Information System (MCMIS). It is primarily based on SafeStat with an additional carrier-driver-conviction measure. SafeStat ranks all carriers by their safety performance in areas of crash history, inspection history, driver history, and safety management experience (UGPTI 2004a,b). The system provides FMCSA with the capability to continuously quantify and track the safety status of motor carriers, especially unsafe carriers. This allows FMCSA enforcement and education programs to effectively allocate resources to carriers that pose a high risk of involvement in crashes. The ISS provides a three-tiered recommendation as shown in Table C.5-2.

Table C.5-2. ISS Values and Recommendations

Recommendation	ISS Inspection Value	Risk Category
Inspect (inspection warranted)	75 - 100	High
Optional (may be worth a look)	50-74	Medium
Pass (inspection not warranted)	1-49	Low

The USDOT numbers for the 2,044 trucks observed at the inspection site were compared with a copy of the SAFER database obtained at the time of the field study to obtain the ISS score for each carrier that could be identified. Trucks were then placed into risk categories based on Table C.5-2. Carriers were placed into an "insufficient data" risk category if there was not enough information to generate an ISS score. Carriers with USDOT numbers that could not be found in SAFER were labeled as unknown. The distribution of safety ratings was also generated for all inspections that were performed from January through October 2006 throughout the state of Ohio, including the Preble County station. This was done to determine if the inspections performed at the Preble County site are representative of inspections performed in the state in general. This helped determine the degree to which the results from the single inspection site can be extrapolated.

Table C.5-3 shows the percent of Ohio field study truck traffic that fell into each risk category based on their carrier's ISS score. Also shown is the risk breakdown of all trucks inspected during the field study as well as trucks inspected through the first 10 months of 2006 both at the station and in the state overall. Since only 100 trucks were inspected during the field study, the use of inspections conducted in 2006 provided a more robust risk distribution of inspections.

About 35% of the Ohio field study truck traffic is considered high-risk based on ISS, while 16% and 39% are considered medium- and low-risk, respectively. The percentage of high-risk trucks observed during the field study was very close to the percent of high-risk trucks inspected in the entire state. However, the percentage of high-risk carriers normally inspected at the Preble County site, 50%, is higher than the state rate. It appears that current inspection practices in 2006 at the Preble County site were more successful than those at other Ohio sites in choosing high-risk trucks for inspection. However other interpretations are possible (e.g. truck traffic at the Preble County site could be different than the rest of the state).

Table C.5-3. Comparing the Risk Distribution of Ohio Field Study Truck Traffic and Inspections Performed at the Preble County Site and the Entire State of Ohio

ISS Risk Class	Percent of Trucks or Inspections By Risk Class			
	Field Study Truck Traffic (2,044 Trucks)	Inspections		
		Field Study[1]	Preble County[2]	Ohio – 2006[3]
High	34.9%	43.0%	50.0%	37.8%
Medium	15.5%	11.0%	16.3%	14.5%
Low	39.1%	38.0%	28.4%	32.5%
Insufficient Data	7.9%	7.0%	5.0%	7.1%
Unknown	2.5%	1.0%	0.4%	8.1%
Total	100.0%	100.0%	100.0%	100.0%

(4) Field study percentages based on 100 inspections conducted during 3-day field study
(5) Preble County percentages are based on 1,130 inspections conducted at Preble County site from January 1 – October 31, 2006
(6) Ohio percentages are based on 76,725 inspections performed in Ohio from January 1 – October 31, 2006

Inspection Efficiency

The data that were needed to assess the efficiency of the current inspection practices included the following:

- ISS Risk classifications for trucks in the population at the inspection site (based on observed truck traffic during field study);
- ISS Risk classifications for trucks that were inspected (based on approximately one year of state inspections); and
- OOS rates by ISS risk classification, historically, and during the field observational studies.

As discussed in the previous section, trucks observed at the inspection site as well as trucks inspected in Ohio for the first ten months of 2006 were placed into one of five risk categories based on the carrier's ISS score. In order to obtain OOS rates by risk category, the historical inspection records were used to determine whether each inspection over the 10-month timeframe resulted in an OOS order being issued. OOS rates were calculated as the number of OOS orders given per 100 inspections for each risk category.

It should be noted that for trucks inspected in Ohio during 2006, the carrier's risk category at the time the inspection took place is based on information contained in a copy of the SAFER database at a single point in time (i.e. at the time of the field study). The carrier's risk rating at the time of the inspection may not be exactly the same as the rating in SAFER during the field study. However, absent any other information, it is reasonable to assume that the carrier's rating did not change significantly.

Table C.5-4 summarizes the inspection efficiency at the Preble County inspection station in terms of the probability of selecting high-risk trucks. Actual vehicle inspection totals by risk category in the first row are based on more than 1,100 inspections performed at the Preble County station between January 1 and October 31, 2006. The truck traffic vehicle totals in the second row are based on the total number of trucks observed traversing the station during the field study. The vehicles selected for inspection as well as those in the truck traffic population were divided into high-, medium-, and low-risk, insufficient data, and unknown risk based on the ISS scores of the carrier and are shown in columns 2 through 5 of Table C.5-4.

For the inspected and truck traffic vehicles, the probability of a truck being high-risk is shown. The probability of a truck being in the high-risk category is calculated as the number of high-risk trucks divided by the total number of trucks. About 35% of the truck traffic at Preble County was considered high-risk while 50% of the vehicles inspected at the Preble County station were high-risk. The ratio of the proportion of high-risk vehicles inspected to the proportion in the truck traffic population is 1.42 (49.56% divided by 34.93%). This ratio is statistically significantly greater than 1 (the value expected if there was no difference between random inspections and current practices). Thus, current inspection practices such as inspector judgment, visual observation of vehicles, and use of PrePass for transpondered vehicles yields about 42% more high-risk trucks than if inspectors would simply choose trucks randomly.

The analysis comparing OOS rates for different inspection selection strategies requires estimates of OOS rates across risk categories. Table C.5-5 shows statewide OOS rates by risk categories, which were calculated using all inspections in Ohio between January 1 and October 31, 2006. OOS rates were 16.0 per 100 inspections for low-risk trucks and 35.2 per 100 inspections for high-risk trucks. OOS rates for trucks with insufficient data and for an unknown risk class were higher than those for high-risk trucks. The overall OOS violation rate was 28.1% over the 10-month span.

Table C.5-4. Inspection Selection Efficiency at Preble County Station

Vehicle Data	Number of Trucks by Risk Classification					Percent of High-Risk Carriers
	High	Med/ Low	Insuff. Data	Unknown	Total	
Inspected(1)	560	511	55	4	1,130	49.56%
Truck Traffic(2)	714	1,116	162	52	2,044	34.93%
Inspected vs. Truck Traffic						1.42

(1) Inspection numbers based on inspections performed at the Preble County site from January 1 to October 31, 2006.

(2) Ohio Truck traffic numbers based on 2,044 trucks observed during the field study, October 31 - November 2, 2006 at the Preble County site.

Table C.5-5. Ohio Statewide OOS Violation Rates by Risk Category for Inspections Performed January 1, 2006 through October 31, 2006

Risk Class (Based on ISS Score)	Number of Inspections	Number of Inspections with an OOS Violation	OOS Rate (No. per 100 Inspections)
High-Risk	28,986	10,205	35.2
Medium-Risk	11,159	3,118	27.9
Low-Risk	24,894	3,971	16.0
Insufficient Data	5,471	2,016	36.8
Unknown	6,215	2,269	36.5
Total	76,725	21,579	28.1

Table C.5-6 presents the results of the analysis of OOS rates. The expected number of OOS orders was calculated for two scenarios: if trucks were selected randomly for inspection, and if trucks were selected according to current practices. The expected number of OOS orders per 100 inspections under each of these scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. That is, the number of OOS orders per 100 inspections was equal to the proportion of those 100 inspections that would be expected to be in the risk category multiplied by the OOS rate for the risk category. For example, the table illustrates that about 35% of trucks observed during the field study were classified as high-risk compared to roughly 50% of the inspections conducted at the Preble County station. The state OOS rate for the high-risk category is 35.2. Thus, the expected number of OOS orders per 100 random inspections of high-risk trucks would be 12.30 (34.93*0.352). Using current inspection practices, the expected number of OOS orders per 100 inspections for high-risk trucks is 17.50 (49.73*0.352). Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Table C.5-6. Comparison of Expected Number of OOS Orders Per 100 Inspections for Preble County Inspection Station – Random Selection Versus Current Inspection Practices

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Inspected(2)		Random Selection	Inspected
High	34.93	49.73	35.2	12.30	17.50
Medium	15.51	16.28	27.9	4.33	4.54
Low	39.09	28.41	16.0	6.25	4.55
Insufficient Data	7.93	4.96	36.8	2.92	1.83
Unknown	2.54	0.35	36.5	0.93	0.13
Total Expected OOS Orders per 100 Inspections				26.73	28.55

(3) Random selection percentages were determined from ISS Scores of more than 2,000 vehicles that were observed at the Preble County inspection site during the field study.

(4) Actual selection percentages are based on more than 1,100 inspections performed at the Preble County station between January 1 and October 31, 2006.

Overall, if trucks were selected for inspection at random, one would expect about 27 OOS orders per 100 inspections. Using the current inspection selection procedure, the number of OOS orders per 100 inspections would be expected to add 1.82 OOS orders per 100 inspections. Thus, current inspection selection practices do yield a marginal improvement in the number of OOS orders over selecting trucks randomly.

Table C.5-7 illustrates the impact on the number of OOS orders per 100 inspections where an inspection selection strategy is adopted that incorporates the use of full ES. Under this scenario, all commercial vehicles classified as low- and medium-risk enroll in PrePass, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors then use current practices to select vehicles for inspection from the remaining trucks in the high-risk and insufficient data categories. The second column again shows the risk distribution of trucks that would be expected if trucks were selected randomly for inspection. The third column shows the proportion that would be inspected if all low- and medium-risk trucks were allowed to bypass the site and if the numbers for the remaining risk categories were increased proportionally. For example, the percentage of high-risk trucks expected to be inspected under this strategy would be 76.93% {76.93% = 34.93% / [1-(0.1551+0.3909)]}, while no medium- or low-risk trucks would be inspected. As in the preceding table, the expected number of OOS orders per 100 inspections under each of these two scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category. Within each inspection selection scenario, the sum of the corresponding numbers over all five risk categories gave the total number of OOS orders expected per 100 inspections.

Table C.5-7. Comparisons of Expected Number of OOS Orders Per 100 Inspections for Preble County Inspection Station – Random Selection Versus Electronic Screening Where Medium- and Low- Risk Carriers Are Allowed to Bypass Station

ISS Risk Category	Percentage of Commercial Vehicles		State OOS Rate	No. OOS Orders per 100 Inspections	
	Random Selection(1)	Full ES(2)		Random Selection	Full ES
High	34.93	76.93	35.2	12.30	27.08
Medium	15.51	0.00	27.9	4.33	0.00
Low	39.09	0.00	16.0	6.25	0.00
Insufficient Data	7.93	17.47	36.8	2.92	6.43
Unknown	2.54	5.59	36.5	0.93	2.04
Total Expected OOS Orders per 100 Inspections				26.73	35.55

(3) Random selection percentages were determined from ISS Scores of more than 2,000 vehicles that were observed at the Preble County inspection site during the field study.
(4) Distribution was derived from random selection percentages and the assumption that ES will eliminate low and medium-risk carriers from the selection process (e.g., for high-risk category 76.93% = 34.93% / (1-(0.1551+0.3909))

Again, if trucks were selected for inspection at random, one would expect about 27 OOS orders per 100 inspections. If ES were implemented to the point that all low- and medium-risk trucks would be allowed to bypass the site, the number of OOS orders per 100 inspections would be expected to rise to about 36. This last scenario represents an increase of OOS orders per 100 inspections of about 33% from the scenario where trucks are randomly selected for inspection from the population of traversing trucks. It also represents an increase of OOS orders per 100 inspections of about 25% compared to current inspection practices.

Appendix C.6
Prior Research on Infrared Brake Screening Technology for CMVs

This appendix comprises a short summary of the USDOT (2000) study conducted to evaluate infrared brake screening technology. The full report is available online at: http://www.itsdocs.fhwa.dot.gov//JPODOCS/REPTS_TE//13339.pdf.

A study was conducted from June 1999 to May 2000 on behalf of FMCSA, in which a mobile infrared camera-based inspection system (IRISystem) was evaluated in four states (USDOT 2000). The IRISystem enables the operator to recognize wheels, tires, and other components that are markedly hotter or colder than normal, which can signify brake defects and other potential safety problems.

In the FMCSA study, 392 commercial motor vehicles were identified by the operator of the IRISystem and were pulled out of the traffic stream. These vehicles were subjected to a Commercial Vehicle Safety Alliance (CVSA) Level 1 inspection. Most of the vehicles selected for inspection had potential defects or problems as observed by the system operator. Some "control group" vehicles with no evident problems observed in the IRISystem screening were also pulled for Level 1 inspection, to reduce the potential for bias on the part of the Level 1 inspector.

Results from the vehicles selected for inspection using the IRISystem in this field study were compared with inspection results as recorded in the SafetyNet system for all inspections from 1997 to 1999 in the four participating states: Georgia, Kentucky, North Carolina, and Tennessee. The percentage of vehicles placed out of service (OOS) after IRISystem screening (59%) was significantly greater than the percentage of vehicles placed OOS using the previous screening methods (27%), or more than twice as effective. Of those vehicles placed OOS after IRISystem screening, nearly 80% were placed OOS for brake violations. Therefore, about 47% of vehicles identified by IRISystem as having a potential problem were placed OOS for brake violations.

The percentage of vehicles with brake violations increased by 2.5 times, from 34% with current screening methods to 84% with IRISystem screening (USDOT 2000, pg. ix).

It was noted that the brake violations reported in this study were not necessarily all OOS violations. That is, a vehicle could have a brake defect recognized as a violation in a CVSA Level 1 inspection, but the defect is not sufficient cause to place the vehicle OOS.

Other relevant findings from this study were:

1. The majority (90%) of the problematic wheels reported by the IRISystem operator were cold brakes (pg. 20).

2. The majority of problems identified during IRISystem screening were located on the trailer wheels on the far side of the CMV with respect to the IRISystem van. This may have been due in part to wheel covers on the near-side wheels, which obstructed the view of the brake components on those wheels, and the better lines of sight from the IRISystem to the far-side back wheels (pg. viii).

3. The presence of brake defects or deficiencies was a good indicator that other repairs were needed on the CMV (pg. viii).

4. Mainline screening of CMVs at speeds greater than 55 mph was attempted with the IRISystem, but it was determined not to be practical in this study (pg. 20).

Appendix C.7
Availability of Inspections in SAFER

In order for SAFER to be a useful tool to assist inspectors in obtaining information on previously performed inspections, it is vital that inspection results from all states be uploaded to SAFER shortly after the inspection is completed. As such, this appendix examines: (1) The number of inspections uploaded to SAFER nationally as well as by state to provide an indication of the extent states are uploading inspection data to SAFER; (2) The time between the inspection and upload of the inspection report to SAFER to assess the timeliness of the uploads; and (3) The percentage of performed inspections that are found in SAFER to determine the completeness of the SAFER Inspection Table. A copy of the SAFER Inspection Table as it appeared on November 6, 2006 was made available from the Volpe Center. In addition, inspection data from 2006 for Colorado, Kentucky, and Ohio were available to evaluate the completeness of the SAFER database.

The SAFER Inspection Table contains data on a rolling 6-month time period. The data utilized for this analysis are from inspections uploaded between May 10, 2006, and November 6, 2006. SAFER inspection data from only the fifty states and the District of Columbia were included in the analysis (i.e., data from American Samoa, Virgin Islands, etc., were excluded).

Figure C.7-1 shows the average number of inspections uploaded to SAFER by day of the week. Across all days, the average number of inspections uploaded daily was 6,503. The average number of inspections was higher on Tuesdays, Wednesdays, and Thursdays with each day seeing over 9,200 inspections uploaded. Fewer inspection uploads are seen on Mondays and Friday with about 7,000 and 6,600 inspections uploaded, respectively. Inspection upload averages are significantly lower on Saturday and Sunday with about 2,100 and 1,600, respectively.

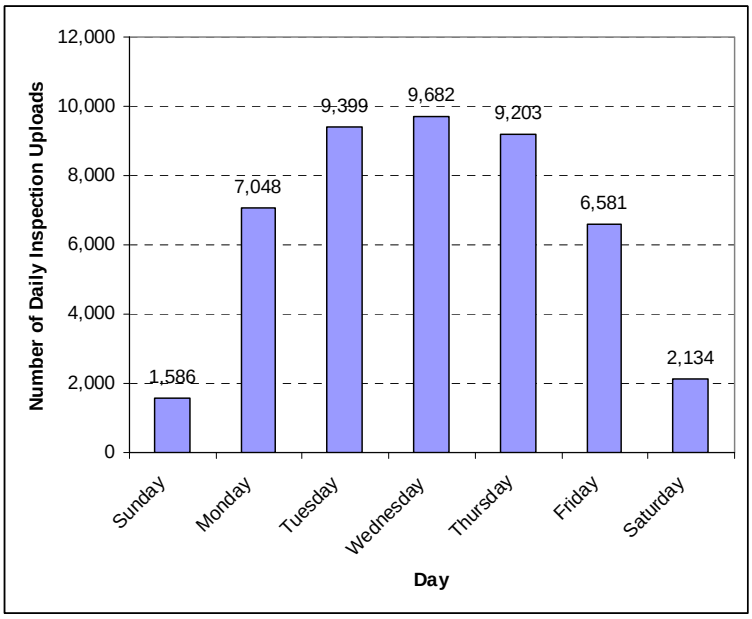

Figure C.7-1. Daily Inspections Uploaded to SAFER Nationally (May 10 – November 10, 2006)

Daily averages of the number of inspections uploaded by each state and the District of Columbia also were calculated. These are presented in Table C.7-1 along with the minimum and maximum number of inspections uploaded on a given day. The SAFER database utilized for this analysis contained inspections for every state except North Dakota, providing evidence that nearly all states are uploading inspection reports to SAFER. Furthermore, thirteen states (Arizona, Colorado, Florida, Indiana, Kansas, Maryland, Michigan, New Jersey, Nevada, New York, Ohio, Tennessee, and Utah) uploaded at least one inspection every day between May 10, 2006 and November 6, 2006. California had the highest average number of inspections uploaded at 1,036. There were over 187,000 California inspections found in the SAFER table in the six-month period.

Table C.7-1. Daily Inspections Uploaded by State

State	Daily Inspections Uploaded		
	Mean	Minimum	Maximum
Alaska	27	0	93
Alabama	90	0	263
Arkansas	51	0	169
Arizona	165	12	483
California	1,036	0	1,980
Colorado	111	8	280
Connecticut	60	0	220
Washington, D.C.	13	0	75
Delaware	18	0	52
Florida	204	10	809
Georgia	239	0	518
Hawaii	11	0	70
Iowa	93	0	347
Idaho	25	0	148
Illinois	156	0	628
Indiana	120	8	386
Kansas	102	2	299
Kentucky	108	0	329
Louisiana	65	0	232
Massachusetts	54	0	288
Maryland	215	1	708
Maine	50	0	218
Michigan	161	2	435
Minnesota	150	0	393
Missouri	128	0	356
Mississippi	97	0	496
Montana	92	0	182
North Carolina	144	0	401
North Dakota	0	0	0
Nebraska	125	0	294
New Hampshire	19	0	68
New Jersey	115	2	314
New Mexico	135	0	348
Nevada	72	4	248
New York	296	4	1,234
Ohio	246	15	789
Oklahoma	31	0	294
Oregon	87	0	267
Pennsylvania	361	0	1,695
Rhode Island	12	0	115
South Carolina	101	0	359
South Dakota	70	0	142
Tennessee	105	1	314
Texas	428	0	1,606
Utah	97	3	388
Virginia	93	0	313
Vermont	33	0	115
Washington	177	0	501
Wisconsin	59	0	207
West Virginia	34	0	253
Wyoming	23	0	135

Timeliness of Inspection Uploads

Using inspection and upload dates provided in the SAFER Inspection Table, the amount of time that it took for data from each completed inspection to be uploaded to SAFER was calculated. These time differences then were averaged nationally and for each state. Figure C.7-2 shows the distribution of time between the completion of the inspection report and the upload of the inspection data to SAFER. For example, about 39% of the inspection reports were uploaded to SAFER within one hour of completion, and 65% were uploaded within 24 hours. Another 3% were uploaded between 24 and 48 hours later, and the remaining 32% were not uploaded for at least two days. The Evaluation of the I-95 Commercial Vehicle Operations Roadside Safety and SAFER Data Mailbox Field Operational Tests conducted in 2002 reported that only 16% of the inspection reports were uploaded within one hour of completion and 56% within 24 hours. (USDOT 2002). Thus, progress has been made in getting inspections into SAFER immediately following the inspection in the last few years. However, 32% of inspections take longer than two days to get into SAFER, the same percentage from the 2002 report.

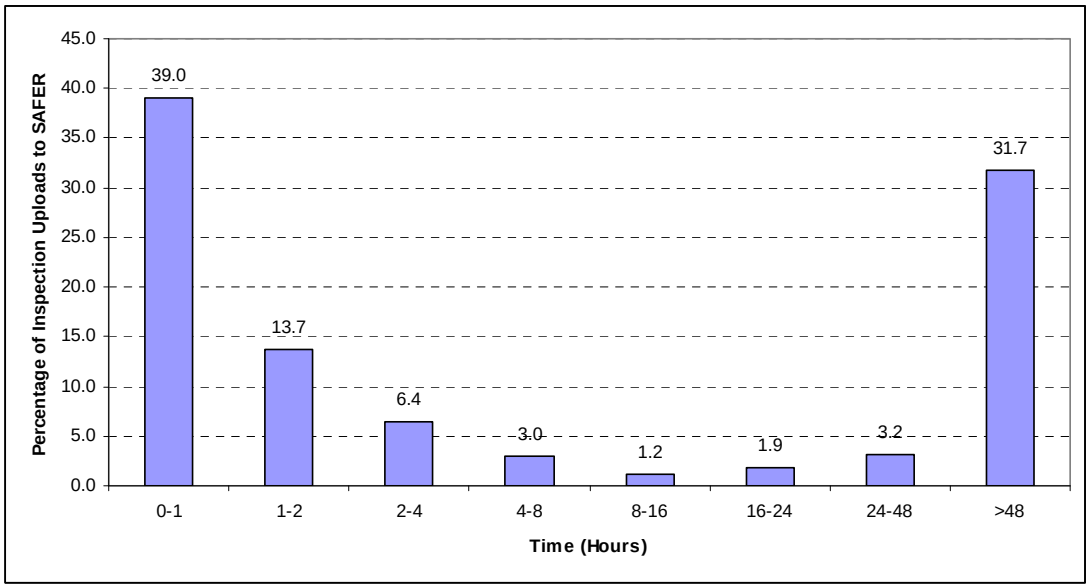

Figure C.7-2. Distribution of Time Between Inspection and Upload of Inspection Report

Table C.7-2 shows the median number of hours between the inspection and the upload of the inspection information for each state as well as the District of Columbia. The first and third quartiles are presented as well. There were a few inspections in each state that took an inordinate amount of time to be uploaded for some unknown reason. Because the mean is heavily influenced by these outlying observations, the median time difference was used as it presents a better picture of how quickly data are typically being uploaded to SAFER. The time between the inspection and upload of information varies greatly by state. Eighteen states have a median time difference of less than one hour, while an additional 22 states have a median time difference of less than five hours. California (136 hours), Wisconsin (141), Kentucky (146 hours), Texas (163 hours), and Oklahoma (872 hours) had the largest differences.

Table C.7-2. Hourly Difference Between Inspection and SAFER Upload of Information by State

State	Hourly Difference Between Inspection and SAFER Upload of Information		
	25th Percentile	Median	75th Percentile
Alaska	0.5	0.9	2.0
Alabama	1.0	4.7	51.4
Arkansas	7.4	22.8	57.2
Arizona	0.7	1.3	4.7
California	44.5	136.2	212.1
Colorado	0.5	0.7	1.2
Connecticut	0.5	0.8	1.6
Washington, D.C.	1.7	4.0	21.0
Delaware	0.4	0.6	1.0
Florida	0.4	0.7	1.2
Georgia	0.5	0.7	1.1
Hawaii	0.7	1.4	4.4
Iowa	43.4	83.4	112.4
Idaho	0.7	2.1	171.2
Illinois	0.8	4.5	1,490.8
Indiana	0.6	1.0	1.7
Kansas	0.5	0.8	2.5
Kentucky	65.9	146.2	335.6
Louisiana	21.7	49.2	155.8
Massachusetts	1.0	2.4	21.0
Maryland	0.4	0.6	1.4
Maine	0.6	1.1	3.3
Michigan	0.8	1.2	2.1
Minnesota	0.6	1.2	2.5
Missouri	23.9	72.5	142.1
Mississippi	0.4	0.8	1.9
Montana	0.5	0.9	2.1
North Carolina	0.5	0.9	2.6
North Dakota*	NA	NA	NA
Nebraska	0.3	0.6	1.8
New Hampshire	0.6	1.3	171.5
New Jersey	0.6	1.0	2.3
New Mexico	0.5	1.0	11.2
Nevada	0.5	1.3	75.8
New York	0.5	0.8	1.3
Ohio	0.7	1.1	1.8
Oklahoma	572.7	871.5	1,304.0
Oregon	0.5	1.1	157.4
Pennsylvania	0.3	0.9	2.0
Rhode Island	0.6	1.0	1.7
South Carolina	0.5	0.8	1.5
South Dakota	1.0	4.7	13.2
Tennessee	0.5	2.0	523.8
Texas	111.9	162.5	216.1
Utah	0.4	0.8	1.7
Virginia	0.4	0.7	1.3
Vermont	0.6	1.1	16.7
Washington	0.7	1.6	121.5
Wisconsin	95.0	141.0	190.0
West Virginia	0.4	0.8	5.9
Wyoming	0.7	121.6	241.0

* There were no inspections from North Dakota in the SAFER Inspection Table

Completeness of SAFER Inspection Table

It is important that roadside enforcement personnel have access to all historical inspection information on a given carrier, truck, and driver when choosing which trucks to inspect or when conducting an inspection. Thus, it is crucial that all inspection reports find their way into SAFER to be available to inspectors at the roadside. Data files containing inspection report information from the 6-month time period covered by the SAFER database were available from three states: Colorado, Kentucky, and Ohio. Utilizing these data, the percentage of inspections from each of the state's files that appear in the SAFER Inspection Table was calculated. Table C.7-3 shows the results of this analysis.

Table C.7-3. Inspections in State Inspection Databases and SAFER Database (For Inspections Conducted May 10 – November 10, 2006)

State	Number of Inspections in State Database	Number of Matching Inspections in SAFER Database	Percentage of Matching Inspections in SAFER Database
Colorado	28,112	20,118	71.6
Kentucky	38,339	19,533	50.1
Ohio	44,104	43,207	98.0

Ohio had the best coverage with about 98% of inspections conducted in the state found in the SAFER inspection table. About 72% of Colorado inspections were found in SAFER while only half of Kentucky's inspections were found in SAFER. Thus, it appears that the completeness of the SAFER Inspection Table varies by state. The exact reason for this variability among these three states is not known. However, in order to determine if the unmatched inspections might have resulted from them occurring late in the six-month time period covered by the SAFER database, the inspection dates were examined for these cases. These inspections occurred fairly uniformly over the six months, thus ruling out the idea that an upload time lag caused them not to be included in SAFER. Also, the unmatched inspections occurred across many locations within each state (i.e., the unmatched inspections were not caused by a failure to upload inspections from one or two locations).

Appendix C.8
Potential for Using Credentialing Data in Roadside Enforcement

This appendix covers one additional data source that could potentially be used to help inspectors in their roadside enforcement decisions. Included here is a brief assessment of the usefulness of a carrier's credentialing status relative to their safety information in identifying high-risk trucks. Most of the focus on data related to vehicles and carriers presented in this report has been related to safety. Some credentialing information is available in federal and state databases. The goal with regards to credentialing was to determine if there exists a strong link between a carrier's credentialing status and their safety risk. Data from a separate FMCSA/FHWA task order, "Kentucky Commercial Vehicle Safety Applications Evaluation" (BA34018, FMCSA 2008a,b) was used to assess this goal.

Kentucky roadside enforcement personnel use the Kentucky Clearinghouse, a state database containing carrier-based safety, credentialing, and licensing information that is housed at the Kentucky Transportation Cabinet in Frankfort, in their roadside practices. Most information in the Clearinghouse comes from internal Kentucky data sources supplemented with information obtained through federal safety systems such as SAFER or SafetyNet. Some information in the Clearinghouse is updated in real time while others are updated hourly or daily from their respective sources. It is believed that Kentucky's ISSES, when fully integrated with these data sources, will allow inspectors real-time, instant access to credentialing data.

Although some credentialing data is present in the Kentucky Clearinghouse database, it is limited in terms of the number of carriers that have information as well as the number of credentials where information is available. This is a direct result of the Clearinghouse not being fully linked to any federal data source such as SAFER. Because of these limitations, credentialing data were left out of the scenarios presented in Section 6 and instead are presented separately in this appendix. Table C.8-1 lists the most common credentials needed to operate in Kentucky for which information is available in the Clearinghouse.

Table C.8-1. Credentialing Information in the Kentucky Clearinghouse

Credential	Explanation
International Fuel Tax Agreement (IFTA)	Fuel tax agreement for carriers engaged in interstate operations
International Registration Plan (IRP)	Registration for carriers engaged in interstate operations
Weight Distance Tax (WDT)	Mileage tax for carriers operating within Kentucky
Kentucky Intrastate Tax (KIT)	Fuel tax for intrastate carriers
Extended Weight [Coal] Decal (EWD)	Permit for companies hauling coal on state maintained highways
Kentucky Highway Use License (KYU)	Used to report mileage tax

One example of the limiting Clearinghouse credentialing data is that while IFTA information is available for all Kentucky based carriers where IFTA is applicable, information from other states is scarce. Kentucky does interface with the IFTA Clearinghouse to capture IFTA revocation data from carriers in other states; however the IFTA information from other states needs to include the USDOT number in order to be processed by Kentucky because the Kentucky Clearinghouse is a carrier based system. Since a large amount of information from other states is not processed

in the IFTA Clearinghouse by USDOT number, the Kentucky Clearinghouse gets limited IFTA information from other states. Over 31% of all carriers with available IFTA information in the Kentucky Clearinghouse are based in Kentucky.

Also, IRP information is strictly limited to Kentucky based carriers in the Kentucky Clearinghouse. According to representatives of the Kentucky Transportation Center, the IRP Clearinghouse is currently geared more towards proper recording of registration fund transfers and does not have a strong real-time revocation system. Thus, the Kentucky Clearinghouse does not have IRP information for non-Kentucky carriers.

All carriers traveling in Kentucky are subject to the weight distance tax (WDT) as well as the Kentucky Highway Use License displayed via the Kentucky Use number (KYU) on trucks that operate in the state. Since information for these taxes is housed in a Kentucky state database, the Kentucky Clearinghouse contains WDT and KYU status on a larger number of carriers (both based within and outside of Kentucky). The Extended Weight Decal (EWD) Permit is not used as much as some other credentials and, as such, not a lot of carriers in the Clearinghouse have EWD information. The Kentucky Intrastate Tax is for intrastate carriers only and is obtained from another Kentucky database.

One objective of the safety analysis was to determine if having access to a carrier's credentialing status would provide new information beyond safety information, such as ISS scores and OOS rates, to an inspector to help them select high-risk trucks for inspection. Unfortunately, due to the limits in the amount of data available in the Kentucky Clearinghouse, a complete analysis could not be conducted. However, a few simple analyses were performed to show the relationship between a carrier's risk rating as defined by their ISS score and their credentialing status using IFTA and WDT as examples.

Table C.8-2 illustrates the results using a carrier's IFTA status. For each carrier in the Kentucky Clearinghouse where information on IFTA was available, information was captured to determine if the carrier was in good standing with regard to IFTA. In addition, the USDOT number for each of these carriers was cross referenced with SAFER to obtain the carrier's ISS score. The ISS score was used to assign the carrier to one of five risk categories: high-risk, medium-risk, low-risk, insufficient data, or unknown. The carrier risk ratings are the same as discussed in Section 5.2. Carriers having insufficient or unknown data were excluded from this analysis. Of the 2,258 carriers in good IFTA standing, 25% were considered high-risk as compared to 32% of the 1,510 carriers not in good standing that were high-risk. The percentage of medium-risk carriers not in good IFTA standing was also higher (32%) than those carriers in good standing (26%).

Table C.8-2. Comparison of IFTA Credentialing Status with ISS Risk Category

	Credentials in Good Standing		Credentials NOT in Good Standing	
Risk Level	**Number of Carriers**	**Percent**	**Number of Carriers**	**Percent**
High	632	25%	1,510	32%
Medium	664	26%	1,546	33%
Low	1,262	49%	1,612	35%
Total	2,558	100%	4,668	100%

Table C.8-3 shows similar results when carrier risk rating is compared to WDT status. Thirty-eight percent of carriers not in good WDT standing were considered high-risk versus 24% of carriers in good WDT standing. The percentage of medium-risk carriers with not in good WDT standing was slightly higher (31%) than those carriers in good standing (29%).

Table C.8-3. Comparison of Weight/Distance Tax Credentialing Status with ISS Risk Category

	Credentials in Good Standing		Credentials NOT in Good Standing	
Risk Level	**Number of Carriers**	**Percent**	**Number of Carriers**	**Percent**
High	50,481	24%	3,844	38%
Medium	61,137	29%	3,222	31%
Low	98,458	47%	3,166	31%
Total	210,076	100%	10,232	100%

Both Tables C.8-2 and C.8-3 illustrate that there appears to be a loose correlation with a carrier's credentialing status and their safety risk rating. However, due to the data limitations in the Kentucky Clearinghouse, a more thorough and complete analysis is needed to fully understand and assess the relationship between a carrier's safety and credentialing information. This more complete analysis might explore using the credentialing data available in SAFER where a more complete picture of a carrier's credentialing status is available. The resources available for this evaluation did not permit this more thorough analysis.

It should also be noted that Kentucky is currently in the process of implementing their CVIEW. Testing was being finalized in October and November of 2007. This CVIEW, unlike the Kentucky Clearinghouse, will be directly linked to federal and state databases such as SAFER, License and Insurance (L&I), and MCMIS. As such, inspectors at the roadside in Kentucky as well as other states adopting a CVIEW will have access to timelier and larger quantities of data, including credentialing, for use in roadside enforcement.

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Appendix C.9
Safety Benefits Using Mainline Screening based on Indexed ISS Score

This appendix covers an additional analysis that builds upon the safety benefits presented in Section 6 of the main report. In Section 6.2, six CVISN deployment and roadside enforcement scenarios for selecting vehicles for inspection with the goal being to select trucks that will yield the most OOS orders were presented. Scenarios RE-3, RE-4, and RE-5 involve using ES at all major inspection sites to screen vehicles based on high values of some safety index. In these scenarios, a threshold value of the index is established such that all trucks with safety indices exceeding the corresponding thresholds will be brought into the inspection station for inspection while all others will be allowed to bypass inspection sites. The threshold rates are chosen such that only trucks with the highest safety indices are candidates for inspection. The threshold values can vary depending on both the truck traffic and the rate at which inspections can be performed at the site. The safety indices used in scenario RE-3 are the carrier's vehicle and driver OOS rates where the carrier's brake violation rate and driver OOS rate are used in scenario RE-4. RE-5 uses a combination of infrared technology and driver OOS rates to select vehicles.

The analysis in this appendix examines the safety benefits achieved if the ISS score is used as the safety index to select vehicles for inspection in a manner similar to scenario RE-3 where the OOS rate was used. This analysis was performed to explore a fuller range of inspection selection options. Moreover, the ISS score is recommended by FMCSA and used by some states. Note that the ISS score was used in scenario RE-2 to select trucks for inspection along with mainline screening. However, RE-2 did not allow for different threshold values of the ISS score. The analysis in this appendix involving RE-6, defined below, provides a more thorough treatment of the ISS score as a safety index.

RE-6: Electronic Screening based on high ISS scores. State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from SAFER. In this scenario, each truck is screened based on the ISS score of the carrier. A threshold ISS score is established for both vehicle and driver OOS violations such that all trucks with ISS scores exceeding the corresponding thresholds will be brought into the inspection station for inspection while all others will be allowed to bypass inspection sites. The threshold rates are chosen such that only trucks with the highest ISS scores are candidates for inspection. The threshold values can vary depending on both the truck traffic and the rate at which inspections can be performed at the site. As part of RE-6, three specific threshold values are considered.

Table C.9-1 shows the three levels of threshold values for the ISS score safety index. One year's worth of state inspections from Colorado (2006), New York (2005), and Ohio (2006) together were used to determine the specific threshold values for the index. The high threshold value is 98. This means that roughly 5% of the truck traffic based on data from these states has an ISS score at or above 98. The high threshold level would be used to pull in only the top 5% of vehicles in situations where a smaller number of inspectors were on duty. If more inspectors are available, a lower threshold can be used to pull more trucks into the station. The medium and low threshold values for the ISS score safety index are 96 and 88, respectively.

Table C.9-1. ISS Score Threshold Values Calculated from State Inspections in Colorado (2006), New York (2005), and Ohio (2006)

Percent Selected for Inspection	ISS Threshold
5%	98
10%	96
25%	88

To use Equation (5) from Section 6.2 to estimate the number of crashes that would be prevented, a probit regression model was used to estimate the probability of an OOS violation among vehicles at or above each value of the index threshold. This probability represents the term P(V|I) in Equation (5), namely the probability of finding an OOS violation given the truck was inspected with an index value above the threshold. By plugging in the three threshold rates into the equation and solving for *p*, the probability of a violation given an inspection can be calculated for each level of the safety index. These probabilities are provided in Table C.9-2 alongside the threshold values.

Table C.9-2. ISS Score Threshold Values Along with Corresponding Probabilities of an OOS Violation Calculated from State Inspections in Colorado (2006), New York (2005), and Ohio (2006)

Percent Selected for Inspection	Vehicle OOS Violations		Driver OOS Violations	
	ISS Threshold	P(V|Inspection)	ISS Threshold	P(V|Inspection)
5%	98	28.8%	98	13.1%
10%	96	28.2%	96	12.5%
25%	88	26.0%	88	10.5%

From Equation (5), the number of crashes that are avoided due to vehicle OOS orders when the highest 5% of trucks in terms of ISS score are brought into the station for inspection is equal to

$$\frac{1{,}949{,}375 * (0.288) * 15{,}000 * (1.89 / 1{,}000{,}000)}{0.28} * \frac{0..2862 - 0.28}{(1 - 0.28)} = 489$$

Similarly, 13% of the 2,669,679 driver inspections would result in an OOS order leading to

$$\frac{2{,}669{,}679 * (0.131) * 10{,}000 * (1.89 / 1{,}000{,}000)}{0.05} * \frac{0.1220 - 0.05}{(1 - 0.05)} = 10{,}019$$

crashes avoided.

Applying the 51% adjustment factor used under the other scenarios in Section 6, the estimated number of crashes avoided is 489 + 0.51*10,019 = 5,599. The corresponding numbers of injuries and fatalities avoided are 1,450 and 67, respectively.

The calculation for the number of crashes avoided using the medium (top 10%) and low (top 25%) threshold values is similar and not shown. Rather, the number of crashes, injuries and fatalities avoided under all three threshold levels is presented in Table C.9-3.

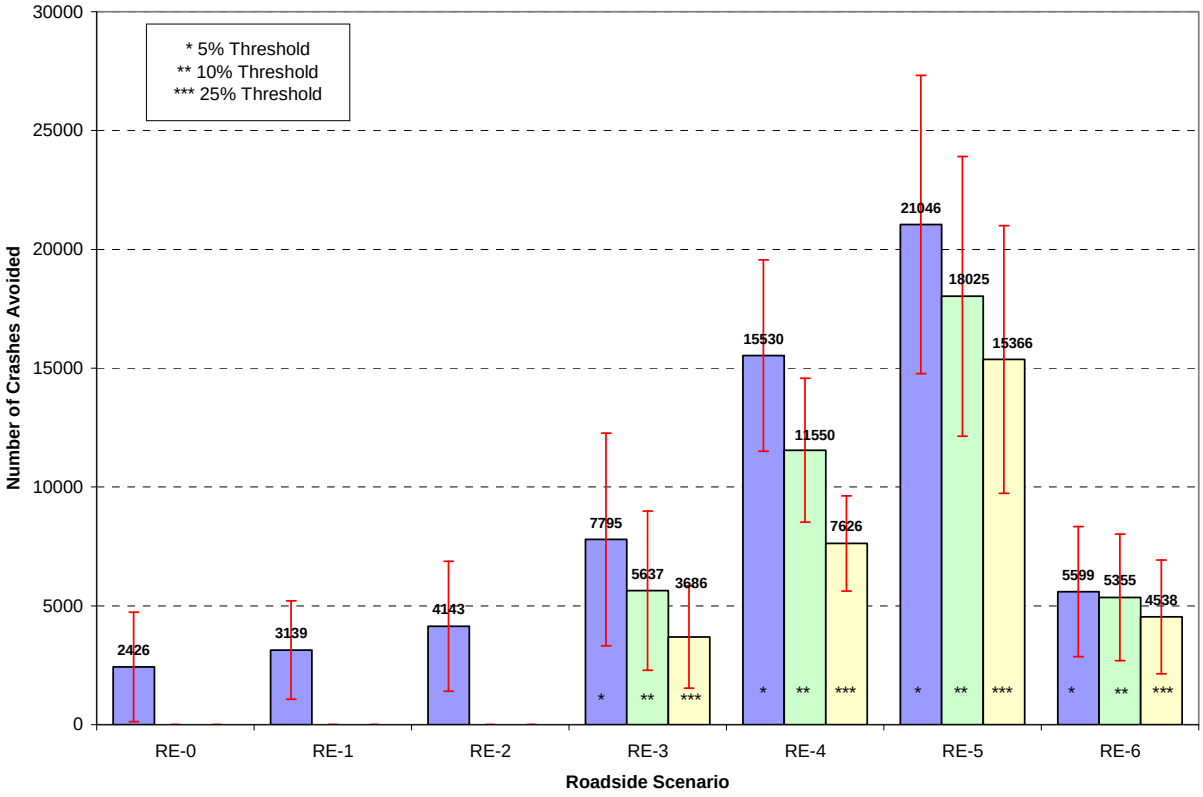
Table C.9-3. Number of Crashes, Injuries, and Fatalities Avoided Under Scenario RE-6

Percent Selected for Inspection	Number of Safety Events		
	Crashes	Injuries	Fatalities
5%	5,599	1,450	67
10%	5,355	1,387	64
25%	4,538	1,175	54

As expected, the results indicate that the higher the threshold value for the safety index, the more crashes, injuries and fatalities can be avoided as a result of inspecting trucks with higher ISS scores. This is slightly misleading because this is mainly a function of calculating the number of safety events avoided based on a fixed number of inspections. The value in choosing a lower threshold (e.g. top 10% or top 25%) is that it makes more trucks available for inspection when inspection resources are high at a given station. For example, suppose an inspection site sees 600 trucks per day traverse the station during normal inspection hours. If the highest threshold value is used, only about 30 trucks would be made available for inspection. If there are 5-7 inspectors on duty on a particular day, it may be advantageous to use a lower threshold level in an effort to inspect more than 30 trucks. In this case more inspections would be performed than would under the scenario where only the top 5% of trucks were inspected due to lower inspection resources. The figures in Table C.9-3 show the safety benefits achieved based on the number of commercial vehicle inspections performed nationally in 2005 (1,949,375 vehicle inspections and 2,669,679 driver inspections). Obviously if more inspections are performed under a lower threshold level, the total number of safety benefits would rise.

The high threshold level represents an increase of 2,460 crashes avoided compared to the baseline scenario (RE-1). Also, 637 more injuries and 29 more fatalities will be avoided under this scenario. To examine how the benefits for RE-6 compare to the other scenarios defined in Section 6, Figure C.9-1 summarizes the crashes avoided for all roadside enforcement scenarios, including RE-6. The mean number of crashes avoided as well as the 95 percent confidence interval for each scenario is provided. RE-3 is most comparable with RE-6 since they both reflect the same inspection selection criteria with the exception that RE-3 uses carrier vehicle and driver OOS rates to screen vehicles while RE-6 uses ISS scores. Slightly more crashes are avoided at the 5 and 10% thresholds using a carrier's vehicle and driver OOS rates as opposed to the carrier ISS score. At the 25% threshold level, however, the benefit associated with RE-6 is higher than RE-3. The differences in crash avoidance estimates between scenarios are due mainly to the differences in the probability of finding a violation given a vehicle has been inspected (Table C-18 in Section 6 for OOS rates and Table C.9-2 for ISS scores). For the highest 5 and 10% of vehicles in terms of a carrier's vehicle and driver OOS rate, the probability of finding a violation is higher than the for the top 5 or 10% of vehicles screened with an ISS

score. The opposite is true when looking at the top 25% of vehicles screened with either safety index.



* 5% threshold ** 10% threshold *** 25% threshold

Figure C.9-1. Estimated National Annual Safety Benefits of CVISN under Selected Deployment Scenarios and Assumptions (Mean Number of Crashes Avoided and 95 Percent Confidence Interval)

Another observation is that there is not much difference in crash benefits across threshold levels for RE-6 as there is with RE-3. This is because the probabilities of a violation given an inspection provided in Table C.9-2 do not differ very much across threshold levels. This implies, that there may not be a large benefit to screening vehicles using the same 5, 10, and 25% threshold levels used with OOS rates. Future study is warranted that examines the effectiveness of ISS at predicting vehicle, driver or specifically brake OOS conditions in vehicles at the inspection site and, if necessary, to recommend modifications to the ISS calculation to better account for brake and driver violations.

Appendix C.10
Alternative Crash Avoidance Model

The crash avoidance model presented in section 6.1 provides a good foundation for estimating the safety benefits that can be realized under various CVISN deployment and roadside enforcement scenarios. The simplest form of the model (Equation 1 from Section 6.1) is presented again below.

$$\#\ Crashes\ Avoided = \#\ inspections * P(V \mid I) * [P(C \mid V) - P(C \mid \overline{V})] \qquad \text{(Eq. C.10-1)}$$

As written, Equation C.10-1 contains an implicit assumption that, conditioned on the presence or absence of a violation, the likelihood of a crash does not depend on whether the truck was selected for inspection. This equation was used for the benefits estimation because it greatly simplifies the calculations and it makes use of available data. This appendix presents an alternative, more complete model, provides some justification for making the simplifying assumption, and suggests potential sources of data for further investigation.

The correct crash avoidance model appropriately conditions the crash probabilities on the event that the truck would have been selected for inspection—in addition to whether or not the truck had violations. If trucks are selected for inspection at random, Equation C.10-2 is equivalent to Equation C.10-1; otherwise it must be accounted for in the model.

In simplest terms, the number of crashes that could be avoided using this revised approach can be written as

$$\#\ Crashes\ Avoided = \#\ inspections * P(V \mid I) * [P(C \mid VI) - P(C \mid \overline{V}I)] \qquad \text{(Eq. C.10-2)}$$

where

- $P(V|I)$ is the probability that a truck has an OOS violation given that it was inspected
- $P(C|VI)$ is the probability of a crash given that a vehicle satisfies the inspection criteria and it has an OOS violation
- $P(C \mid \overline{V}I)$ is the probability of a crash given that a vehicle satisfies the inspection criteria and it does not have an OOS violation

Using Bayes Theorem, we rewrite $P(C|VI)$ and $P(C \mid \overline{V}I)$ as

$$P(C \mid VI) = \frac{P(VI \mid C) * P(C)}{P(VI)} \qquad \text{(Eq. C.10-3)}$$

$$P(C \mid \overline{V}I) = \frac{P(\overline{V}I \mid C) * P(C)}{P(\overline{V}I)} \qquad \text{(Eq. C.10-4)}$$

where

- *P(VI|C)* is the probability that a vehicle has an OOS violation and satisfies the inspection criteria given it is in a crash
- *P(VI)* is the probability that a vehicle has an OOS condition and satisfies the inspection criteria
- $P(\overline{V}I \mid C)$ is the probability that a vehicle does not have an OOS violation and satisfies the inspection criteria given it is in a crash
- $P(\overline{V}I)$ is the probability that a vehicle does not have an OOS condition and it satisfies the inspection criteria
- *P(C)* is the probability of a crash.

Substituting the new expressions for *P(C|VI)* and $P(C \mid \overline{V}I)$ presented in Equations C.10-3 and C.10-4 into Equation C.10-2 and performing some algebraic manipulation yields the following model for crashes avoided:

$$\#\,Crashes\ Avoided = \#\,Inspections * P(V \mid I) * P(C) * [\frac{P(VI \mid C)}{P(VI)} - \frac{P(\overline{V}I \mid C)}{P(\overline{V}I)}] \qquad \text{(Eq. C10-5)}$$

This model is more theoretically correct than Equation C.10-1 because it incorporates the probability of a truck being selected for inspection into the crash probability calculation. However, portions of the model are difficult to estimate precisely because of limitations in the LTCCS database. Specifically, P(VI|C) and $P(\overline{V}I \mid C)$ cannot be estimated for scenarios RE-4 through RE-6 because detailed information on brake violation rates as well as ISS scores was either nonexistent or very limited in the version of the LTCCS database used for this analysis. Even for scenario RE-3 where information on vehicle and driver OOS rates exists, the number of crashes that satisfy the specific condition of having a violation and meeting the inspection criteria are very small. For example, the LTCCS contains 963 crashes involving over 1,200 large trucks, of which 969 trucks had a full post-crash Level I inspection. When attempting to calculate the probability of a crash-involved truck meeting the inspection criteria and having an OOS violation, the number of trucks at that level of detail is too small to get reliable probability estimates.

As a result, a larger sample of crashed trucks that have post-crash inspection information is needed to estimate the probabilities necessary to calculate reliable crash avoidance estimates using this model. The LTCCS database does not have a large enough sample to handle the fine level of detail inherent in the crash probability calculations in Equation C.10-5. Further study in this area is warranted using other data sources that would provide a larger sample of truck crash data. One possibility includes the MCMIS database, where trucks with post-crash inspections over a multi-year period could be utilized. Other potential resources include other FMCSA-sponsored studies into truck crashes such as an ongoing study by the Volpe Center that examines the relationship between OOS violations and truck crashes in terms of the frequency of crashes and their severity. At the time of this report, results from that study were not yet available.