

Final Report

Economic Analysis and Business Case for Motor Carrier Industry Support of CVISN

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16. Abstract The objective was to evaluate economic justifications for motor carriers to participate in CVISN deployment. CVISN (Commercial Vehicle Information Systems and Networks) includes: interstate credentials administration (registration and permitting), electronic screening (transponder-based weigh station bypass), and safety information exchange. A broader goal was to improve the industry's understanding of the effect that Intelligent Transportation Systems (ITS) can have on the business operations of motor carriers. Thirty-eight telephone interviews were conducted with motor carriers or service bureaus. An economic model was developed based the telephone interviews, and supplemented by a literature review. The economic analysis documented (1) startup and annual recurrent costs for motor carriers; (2) economic benefits; and (3) the returns on investment (ROIs) made by motor carriers who choose to deploy CVISN technologies. The model assumed a 10-year life cycle, with appropriate discount rates. The economic analysis indicates significant, near-immediate financial benefits to carriers from taking part in electronic (web-based) credentials administration, and substantial benefits to carriers from enrolling their trucks in electronic screening programs or partnerships. Over the 10-year ROI time horizon, total net benefits per carrier for participating in electronic credentialing are estimated at \$3.6 million, resulting in an overall ROI of 2,971:1 and a payback period of less than 1 month. Enrolled motor carriers are also experiencing significant returns on their investment in electronic screening technologies, with ROI ratios for all but one of the companies evaluated ranging from 6.1:1 to 15.9:1.			
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Executive Summary

Objectives. The overall objective of the Economic Analysis and Business Case for Motor Carrier Industry Support of CVISN is to identify and evaluate the economic justifications for motor carriers and their industry partners (such as service bureaus or licensing and registration brokers) to participate in CVISN deployment. The broader goal of the task is to improve the industry's understanding of the effect that Intelligent Transportation Systems (ITS), including CVISN technologies, can have on the business operations of motor carrier companies.

CVISN, which stands for Commercial Vehicle Information Systems and Networks, includes three functions: interstate credentials administration, roadside electronic screening, and safety information exchange. The analysis in this business case emphasized two of the CVISN functions: electronic screening and electronic credentialing technology. Because safety information exchange applies mostly to government and law enforcement functions, it is not considered within this motor carrier business case.

The intended audience for this report is motor carrier business analysts and related private-sector stakeholders in the commercial vehicle operations industry who may be deciding whether their companies should invest the time, resources, and attention required to participate in CVISN deployment.¹ This business case was developed through the collection and analysis of detailed interview data on costs, benefits, attitudes, and beliefs as obtained from representatives of the motor carrier industry and allied organizations. Interview data were supported by a review of relevant literature. Whereas much prior work has focused on federal and state government economics and viewpoints or on societal benefits in general, the objective of this task has been to develop a business case from a private-sector, for-profit motor carrier perspective that combines quantifiable benefits with appropriate evidence, context, and economic analysis.

Data Collection. The main source of data for the business case was a series of 38 in-depth telephone interviews with motor carriers or service bureaus, most of whom are participating in one or more aspects of CVISN deployment. A few respondents are not currently participating in all aspects of CVISN. In this way, the actual experiences of CVISN motor carriers—and the factors that affected their companies' decisions to participate—were included. Also, the perceptions of carriers who have yet to adopt CVISN technologies in their operations were included, which yields information on the economic and institutional barriers they perceive to such adoption. Credentialing service bureaus (third-party licensing brokers) were included, because of their close involvement in electronic credentialing for many carriers.

The names of motor carrier companies chosen to be contacted were gleaned from various sources. The primary source for the calls was the federally sponsored Motor Carrier Management Information System (MCMIS) census file, from which were selected 200 carriers that were shown in the MCMIS file to be operating more than 20 power units. In all, 25 motor carriers were selected from each of eight states known to be active in e-credentialing and e-

¹ A briefer, summary version of this motor carrier business case is also being prepared, directed more toward industry executives, planners, and decision-makers (FMCSA 2007).

screening. This list was supplemented by carriers identified on the PrePass[®] and Norpass web sites, and by lists of large motor carriers shown on the Hoover's directory of businesses.

Other calls were placed to carriers and service bureaus using geographically representative lists that 1) were derived from states with active CVISN programs, and 2) reflected carriers that are active on state or national trucking associations' "tax and registration" committees. Out of 272 calls attempted, 38 interviews were completed, for a response rate of approximately 14 percent, which was lower than anticipated. A customized interview guide was used by data collectors as a calling script (Appendix A).

To supplement the telephone interviews, a literature search from a range of state, federal, nonprofit, private industry, and other sources was conducted. The literature search identified existing data on the economics of CVISN technologies from the motor carrier perspective.

Data Analysis. An economic model was developed and populated, with information from the telephone interviews of motor carriers, supplemented by information from the literature review. The purpose of the economic data analysis was to document (1) startup and annual recurrent costs associated with CVISN deployment for motor carriers; (2) the economic benefits of CVISN deployment, as perceived by motor carriers; and (3) the returns on investment (ROIs) made by motor carriers who choose to deploy CVISN technologies. The model is based on a 10-year life cycle, and includes appropriate discount rates. The model focuses on comparing monetized benefits with dollar costs to the motor carrier industry, as opposed to societal benefits and costs. Investments and cost savings to state agencies are not included in this analysis. The model's output includes ROI ratios, net benefits estimates, and payback periods for the industry.

Characteristics of Respondents. All of the 38 responding companies reported working across state lines as interstate carriers or as service bureaus that work with interstate carriers. The numbers of states the carriers operate in ranged from 7 to 50, with most carriers reporting 48 states. The vast majority of carriers were for-hire, as opposed to private (company-dedicated) carriers. Fifteen respondents were primarily truckload carriers, eight were less-than-truckload, and 11 reported carrying both kinds of loads. Most respondents used predominantly dry freight vans, followed in frequency by refrigerated vans and straight trucks. Other trailer types were much more rarely reported. The mean number of power units among the respondent population was 7,451, with a range from 22 to more than 50,000 power units per company. These counts include company-owned, leased, and owner-operator power units. Figure 1 summarizes the characteristics of the motor carriers surveyed for this study.

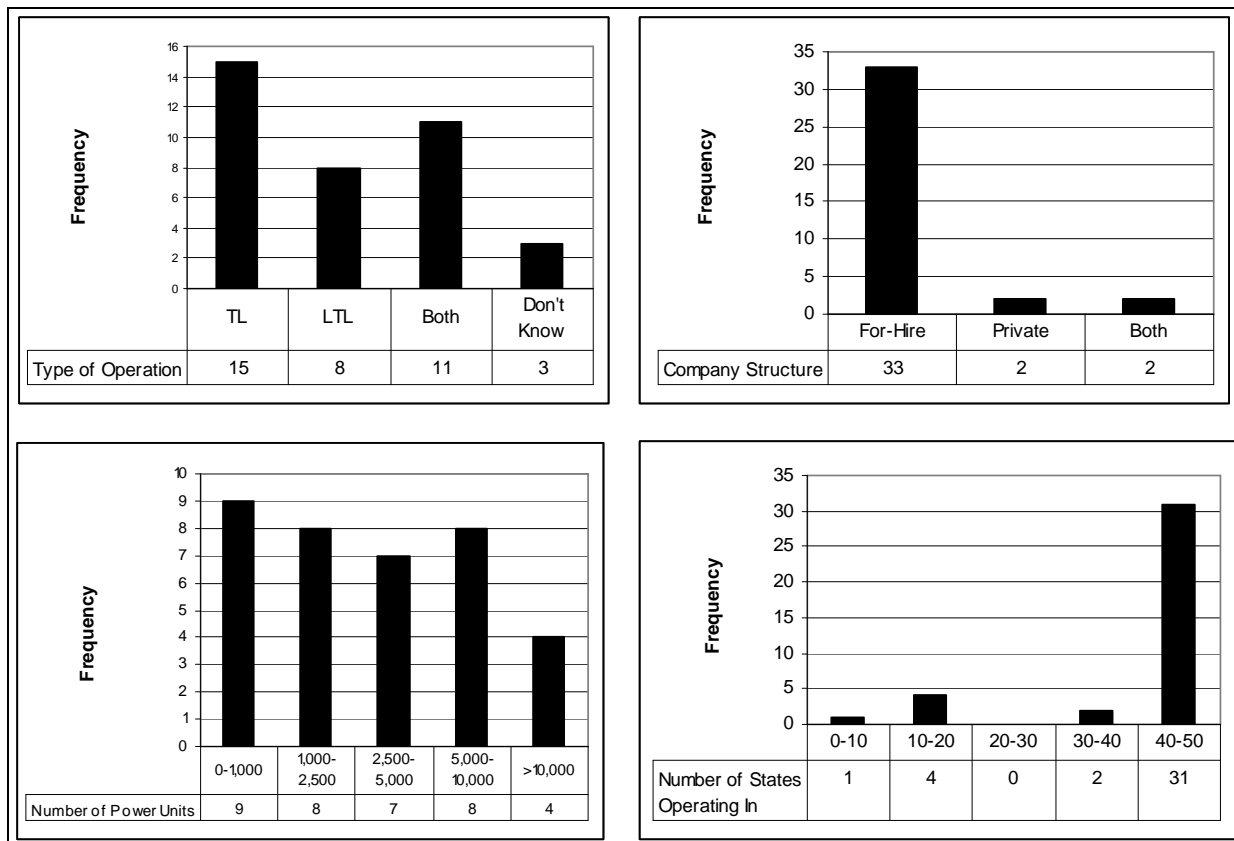


Figure 1. Characteristics of surveyed motor carriers

Results. The motor carriers surveyed for this study indicate that both the startup (\$275 per carrier) and annual recurrent (\$125) costs associated with electronic credentialing are negligible. The most significant benefit of electronic credentialing considered in this study is the time value of increased fleet utilization, or the ability to expedite the process for placing trucks into service. Respondents indicated that electronic credentialing allows them to place new trucks into service an average of 3.5 days sooner than would have otherwise been possible under paper-based systems, at an average savings to motor carriers of \$371 per truck. The cost savings associated with increased fleet utilization are based on the finance charges accruing on vehicles as they await credentials. On average, this benefit translated into \$413,065 in annual cost savings per carrier for the motor carriers interviewed for this study. The second most significant benefit associated with electronic credentialing is the labor savings per transaction, which was estimated at \$4.13 per transaction (10 to 12 minutes per transaction). Respondents also identified benefits associated with reduced materials and postage costs of \$1 per transaction. When the full range of benefits are considered, total net benefits per company interviewed for this study were estimated at \$3.6 million over a 10-year analysis time horizon (average annual net benefits of \$360.5 thousand), resulting in an overall ROI ratio of 2,971:1 and a payback period of less than one month.

The majority of the motor carriers contacted for this study indicated that they had incurred no up-front costs associated with the transponder acquisition, redistribution to drivers, and driver training when entering electronic screening partnerships and programs. On a recurrent basis,

most motor carriers incurred monthly costs ranging from \$7 to \$14 per transponder, based on the number of trucks enrolled in the electronic screening program and the negotiated rate. Time savings per bypass in this study are estimated at 3 to 5 minutes, and average motor carrier operating costs are valued at \$2.16 per minute. Thus, cost savings associated with electronic screening are valued in this study at \$8.68 per bypass. Based on the assumptions outlined in Section 6 of this report, net benefits to motor carriers examined in this study range from \$3.2 to \$219.4 million per company over the 10-year study time horizon. With the exception of one company, all ROI ratios range from 6.1:1 to 15.9:1. Payback periods for all motor carriers contacted for this study were less than one year. The annual net benefit per transponder-equipped truck was estimated at \$1,169.

Conclusions and Implications. The economic analysis of CVISN from a motor carrier perspective indicates significant, near-immediate financial benefits to carriers from taking part in electronic (web-based) credentials administration, and substantial benefits to carriers from enrolling their trucks in electronic screening programs or partnerships. The study targeted large motor carriers in states known to be active in CVISN. Almost all of the responding companies (97 percent) participate in electronic credentials administration, and a strong majority of responding companies (75 percent) use some kind of transponder-based preclearance or e-screening technology in their trucks. The following key findings emerged from the economic and qualitative analysis.

- Motor carriers expressed a high degree of satisfaction with their experiences in using electronic credentialing. The respondents unanimously agreed that electronic credentialing had generated net financial benefits to their company. Most indicated that the acceleration of credentialing and labor time savings were the most significant reasons.
- Startup and annual recurring costs associated with electronic credentialing are minimal. Motor carriers reported in some cases the need to improve hardware, obtain computer technical support, and incur other training-related costs. Total startup costs are estimated at \$275 per carrier, and annual recurring costs are estimated at \$125 per company.
- On the benefit side, motor carriers indicated that on average, electronic credentials accelerated the time required to place new trucks into service by an average of 3 to 4 days, at a savings of \$371 per truck. Increased fleet utilization is the most significant benefit associated with electronic credentialing.
- The second largest benefit associated with electronic credentialing is reduced labor costs. On average, companies save 10 to 12 minutes per transaction resulting in labor cost savings of \$4.13 per transaction. Over the 10-year ROI time horizon, total net benefits per carrier for participating in electronic credentialing are estimated at \$3.6 million, resulting in an overall return on investment of 2,971:1 and a payback period of less than one month.
- For electronic screening or weigh station bypass/precleanance, time savings and labor cost savings were the top two reasons cited for participating. The time savings per bypass was estimated at 3 to 5 minutes based on prior studies.

- The operating cost savings (for the motor carrier company) per bypass was estimated to be \$8.68, which is the product of the estimated time savings per bypass and documented heavy truck operating costs per minute. Total net benefits associated with electronic screening over the 10-year analysis time horizon ranged from \$3.2 million to \$219.4 million per company.
- Enrolled motor carriers are experiencing significant returns on their investment in electronic screening technologies, with ROI ratios for all but one of the companies evaluated ranging from 6.1:1 to 15.9:1.² In all cases, the payback period for e-screening was less than one year. The annual net benefit per transponder-equipped truck was estimated at \$1,169. Electronic screening is perceived as a significant enhancement for driver satisfaction and morale improvement, helping motor carriers recruit and retain drivers.

This business case has provided an outline of the reasons—both pro and con—that carriers use when deciding whether to adopt CVISN technologies for their companies. Survey respondents may have many motives, beyond the reasons given in a brief telephone interview, for the complex business decisions they make. Future market-type research could attempt to tease out the underlying business principles and practices that attract some companies to new technology for safety, administration, and operations, while causing other companies to delay their adoption. Results of this research could be used in planning ITS deployments in both the public and private sectors to match carriers' business needs, and in representing the service offerings through outreach, education, and information exchange intended to appeal to the motor carrier industry. The results may also be useful in refining services offered by states and vendors in plans for Expanded CVISN, the FMCSA's Comprehensive Safety Analysis (CSA) 2010 initiative, vehicle-infrastructure integration (VII), Electronic Freight Management, Wireless Roadside Safety Inspections for Trucks and Buses, and other initiatives.

State transportation, public safety, and law enforcement officials can use the results of this business case to aid in planning the kinds of credentialing and screening programs to make available to motor carriers operating within their states, and to help decide which features or services should be included in future modifications of existing ITS initiatives such as CVISN.

Federal transportation officials and commercial vehicle operations analysts can use the results of this business case when deciding which technologies show the greatest promise of providing tangible benefits to the motor carrier industry, relative to the costs companies incur in deploying and operating such technologies. The industry perspective in turn feeds into a fuller understanding of how ITS can benefit society in general, through increased transportation safety, efficiency, and mobility.

² One motor carrier reported much higher than average costs associated with transponder maintenance (including labor), annual subscription fees, and weigh station bypass fees totaling \$780,000 annually (\$780 per enrolled power unit). The ROI ratio for this carrier was estimated at 1.5 based on reported costs.

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Abbreviations

Abbreviation	Definition
ACS	Affiliated Computer Services
BCA	Benefit-cost analysis
BLS	Bureau of Labor Statistics
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial vehicle operations
DK	Don't know [survey response code]
EC	Electronic credentialing
ES	Electronic screening (preclearance)
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FTE	Full-time equivalent
HAZMAT [HM]	Hazardous material(s)
HELP	Heavy Equipment License Plate
IFTA	International Fuel Tax Agreement
IRP	International Registration Plan
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MCMIS	Motor Carrier Management Information System
MDI	Model Deployment Initiative
NORPASS	North American Preclearance and Safety System
O&M	Operating [operations] and maintenance
OMB	Office of Management and Budget
PPI	Producer Price Index
RE	Roadside enforcement
REF	Refused [survey response code]
ROI	Return on investment
TIC	Technical Information Center
USDOT	U.S. Department of Transportation

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Final Report

Economic Analysis and Business Case for Motor Carrier Industry Support of CVISN

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1. Introduction

1.1 Objectives and Strategy

The overall objective of the Economic Analysis and Business Case for Motor Carrier Industry Support of CVISN is to identify and evaluate the economic justifications for motor carriers and their industry partners (such as service bureaus or licensing and registration brokers) to participate in CVISN deployment. The broader goal of the task is to improve the industry's understanding of the effect that Intelligent Transportation Systems (ITS), including CVISN technologies, can have on the business operations of motor carrier companies. CVISN stands for Commercial Vehicle Information Systems and Networks. The task entailed the collection and analysis of detailed interview data on costs, benefits, attitudes, and beliefs as reported by representatives of the motor carrier industry.

The intended audience for this report is motor carrier business analysts and related private-sector stakeholders in the commercial vehicle operations industry who may be deciding whether their companies should invest the time, resources, and attention required to participate in CVISN deployment. Both for-hire carriers and private or company-dedicated fleets are included in the scope of the motor carrier industry for purposes of this report. A briefer, summary version of this report is also being prepared, directed more toward industry executives, planners, and decision-makers (FMCSA 2007).

1.2 Task Organization and Hypotheses

The task order was organized into three subtasks: (1) Review Information and Collect Existing Data, (2) Establish Contacts with Motor Carriers, and (3) Develop Economic Modeling of Analysis Outcomes. The third subtask addressed three objectives through the construction of a return on investment (ROI) model, intended to test the hypotheses listed below each objective:

Objective 1 – Document startup and annual recurrent costs associated with CVISN deployment for motor carriers under various scenarios.

Hypothesis: In deploying CVISN technologies, motor carriers incur one-time startup costs that are clearly defined and measurable.

Hypothesis: In operating CVISN technologies over time, motor carriers incur annual labor and operations and maintenance (O&M) costs that are clearly defined and measurable.

Hypothesis: CVISN cost structures vary between segments of the motor carrier industry.

Objective 2 – Document the benefits associated with CVISN deployment.

Hypothesis: Motor carriers are experiencing benefits associated with CVISN deployment that are both defined and measurable.

Hypothesis: CVISN benefit structures vary between segments of the motor carrier industry.

Objective 3 – Document the returns on investment (ROIs) associated with CVISN deployment.

Hypothesis: The ROI, net benefits, and payback periods associated with CVISN deployment are measurable and vary between segments of the motor carrier industry.

2. Purpose and Current Status of CVISN Deployment

The Federal Motor Carrier Safety Administration (FMCSA), an agency of the U.S. Department of Transportation (USDOT), is leading a nationwide program focused on developing and deploying integrated, cost-effective information systems and communications networks. The program, known as CVISN, represents the collection of state, federal, and private-sector information systems and communications networks that support commercial vehicle operations. CVISN deployment, which was formalized in the mid-1990s, provides an overall technical framework for stakeholders to follow for electronically collecting and exchanging motor carrier safety and interstate registration and tax payment information, and for making that information available at the roadside in support of electronic screening and enforcement.

2.1 CVISN Functional Areas

The CVISN program has developed and deployed information systems to support implementation of an initial set of core capabilities in three areas:

- **Interstate credentials administration**—Using web sites to enable motor carriers and service bureaus or brokers to apply for, pay for, and receive International Registration Plan (IRP) and International Fuel Tax Agreement (IFTA) credentials and certain other types of operating permits electronically.
- **Roadside electronic screening**—Using technology to identify trucks electronically at mainline speeds and allow some safe and legal trucks to bypass weigh stations while focusing the state’s enforcement resources on higher risk carriers and vehicles.
- **Safety information exchange**—Electronically collecting and exchanging safety performance and other information among states, federal agencies, motor carriers, and

other stakeholders, and transferring these kinds of data between the roadside and various central databases.

These three capabilities rely mainly on state agencies (governments) to develop and deploy hardware, software, and network systems, and use these technologies in day-to-day operations and enforcement. FMCSA has defined a basic or “core” level of deployment for the three functional areas. As of August 2007, 18 states have completed deployment of CVISN Core Capabilities [formerly known as Level 1 deployment, defined in the Introductory Guide to CVISN (JHU APL 2000)]. Many other states are actively implementing portions of the program. The extent of deployment varies from state to state and from technology to technology. Figure 2 illustrates CVISN program status by state.

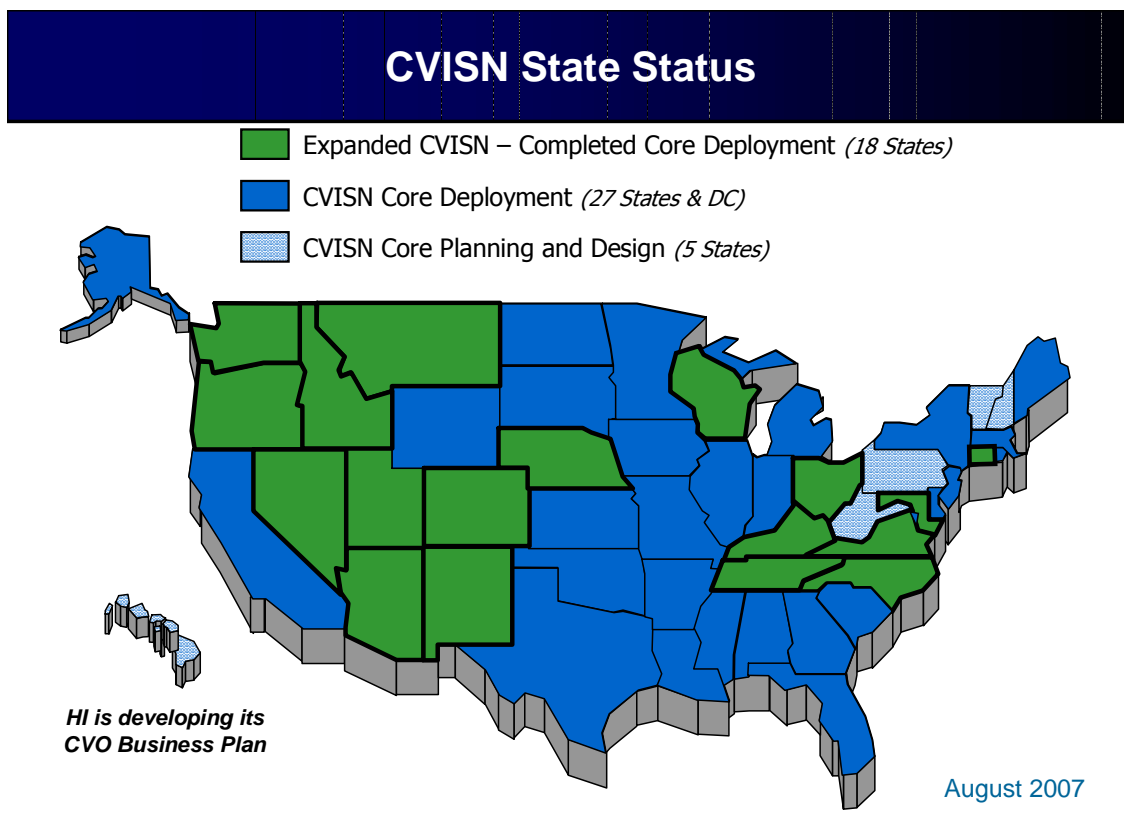


Figure 2. Core CVISN deployment status
(source: Johns Hopkins University Applied Physics Laboratory)

The federal and state agencies pursuing ITS and CVISN deployment are focused on public-sector priorities such as safety, efficiency, mobility, productivity, and reducing the energy consumption and environmental costs of transportation. Many if not all of these goals are also high priorities for trucking companies, which have the additional objective of producing a profitable return on investment for their owners or shareholders. Thus one of the purposes of this business case is to learn how CVISN technologies—both those systems actually installed,

and future CVISN deployments as they are envisioned by the industry—fit into the profit/loss picture for private-sector motor carrier companies.

As with the public-sector functions, the motor carrier technologies relevant to CVISN functions are in various stages of development and use. To take advantage of CVISN technologies, carriers must step forward and subscribe to e-credentialing and e-screening programs. Some carriers are also testing or actively using onboard technologies for routing and planning, satellite-based freight location and tracking, telecommunication, traffic awareness, and automated toll payment. These carrier-focused technologies, some of which are outside the scope of CVISN core deployment, correspond with CVISN goals and may eventually be integrated with state programs to enhance the efficiency and safety of commercial vehicle operations to benefit both the public and private sectors.

The two CVISN technologies or functional areas of greatest importance to motor carrier economics are electronic credentialing and electronic screening or preclearance. As detailed below, these two areas were the focus of the motor carrier industry business case.

Electronic credentialing is the process by which motor carriers and service bureaus (credentials and permits brokers or agents) can apply for, pay for, and receive operating credentials such as IRP cab cards and IFTA quarterly tax returns using a computer interface, such as a state-operated web site. E-credentialing is also being used in some jurisdictions to automate the process of administering special-use permits, for example trip permits, oversize/overweight permits, or other temporary credentials. The process saves time for carriers because much of the information is prepopulated in electronic forms, reducing the need to rekey duplicate information, and reducing the frequency of typographical errors. Many of the systems are available 24 hours a day. One carrier contacted in an earlier FMCSA study reported that e-credentialing had saved the company approximately 1 hour of administrative labor per power unit per year (FMCSA 2004). Also, credentials can be issued within minutes or hours, instead of days, as with the previous or legacy system, which often relied on mail delivery of applications, funds, and official documents. This allows carriers to get newly purchased trucks on the road and into revenue service more quickly, avoiding downtime at the terminal.

A number of states now offer electronic application and issuance of commercial vehicle credentials. Fewer states offer electronic payment options, often because of budgetary, legislative, or institutional issues related to the responsibility for payment of credit card or automated clearinghouse/credit/debit service fees. In some states, e-credentialing is by invitation only, because state systems are oriented to only certain segments of the industry, e.g., carriers with larger numbers of power units, so that carriers can achieve economies of scale when training staff and using the electronic system. Most states report that they are at least moving in the direction of e-credentialing, and are interested in increasing the proportion of carrier accounts that conduct their credentialing transactions electronically.

Electronic screening is the process by which carriers can enroll or register their trucks with a program or partnership, allowing certain trucks to receive a green light signal in the truck cab to bypass a weigh and inspection station without slowing down or stopping in transit. Each enrolled truck is given a battery-powered radio frequency transponder, which is mounted on the

windshield and emits a unique identifying signal. Radio antennas and transmitters at the roadside, some distance upstream of the weigh station, are connected to back-end databases. Traveling at mainline speed, the transponder signal is received and read, the truck is identified, and it is assessed using a governing formula or algorithm that includes safety and credentials history and a periodic pull-in signal even for vehicles that pass the e-screening algorithm. The system then sends a return radio signal to the transponder directing the driver to either keep going on the mainline or pull into the weigh station. Some e-screening systems also correlate high-speed weigh-in-motion technology in the mainline as a screening criterion for weight enforcement. E-screening saves time and money for carriers because their trucks can keep moving; avoid wear and tear on brakes and other mechanical systems caused by stopping and starting at weigh stations; conserve fuel; and operate more safely without having to slow down, speed up, and merge as often in traffic, which should lead to fewer truck-involved crashes.

As with electronic credentialing, most states have some form of electronic screening at one or more sites. Ideally, all trucks would be equipped with enrolled transponders, and all weigh stations would offer e-screening, so that states could reduce the numbers of safe, compliant trucks entering their weigh stations and focus their enforcement resources on only the highest-risk carriers, drivers, and vehicles. Currently, the number of trucks with transponders is just over 500,000 (approximately 412,000 in PrePass and 93,000 in Norpass), which represents only a fraction of the total U.S. commercial vehicle population.³ The states that offer e-screening, either through state-owned systems (e.g., Norpass or Oregon Green Light) or through a private third-party arrangement (e.g., PrePass), are actively seeking to increase the numbers of enrolled trucks.

2.2 Related Research

A related business case with similar objectives was completed in 2006 (FHWA). That report was designed to “qualitatively demonstrate the benefits to motor carriers of an advanced CVISN infrastructure.” State CVISN officials, a series of national and state trucking association executives, as well as a representative from the American Transportation Research Institute (ATRI) were interviewed. The current economic analysis and business case is intended to complement the 2006 FHWA study by providing quantitative information directly from individual motor carrier companies themselves, with detailed economic analysis of the cost and monetized benefit data.

³ According to the American Trucking Associations, there were 26.2 million trucks used for business purposes in the U.S. in 2004, excluding farming and government. There were 6.2 million trucks in Classes 3 through 8, and 2.7 million trucks in Class 8 alone. Source: Standard Trucking and Transportation Statistics (2006), Vol. 12, Issue 2, ATA Economics and Statistics Group, available at <http://www.truckline.com>.

3. Data Sources and Analysis Methods

3.1 Review Information and Collect Existing Data

A literature search was conducted to identify existing data on the impacts (real and perceived) of CVISN deployment on motor carriers. The literature search included a targeted review of documents and databases known to contain CVISN-related information and a more general search engine-based approach using resources associated with highway transportation, advanced technologies, and the motor carrier industry.

The targeted review involved mining CVISN-related documents and databases for information associated with both perceived and measured economic and business benefits of CVISN deployment. Sources of CVISN information included:

- The CVISN Self-Evaluation benefits and lessons-learned reports now being completed and updated by many participating CVISN states
- Published reports posted on the FMCSA and ITS Electronic Document Library web sites
- Published reports on the CVISN web site (maintained by the Johns Hopkins University Applied Physics Laboratory)
- The independent evaluation report on the CVISN Model Deployment Initiative (published in 2002)
- Various state-sponsored and federally sponsored evaluations and case studies of different aspects of CVISN deployment
- Information in the web-based unit costs and benefits tracking databases maintained by the ITS Joint Program Office
- Public information posted by states on their respective transportation and law enforcement web sites
- Data being collected by other organizations on separate task orders, and original research through contacts with selected motor carriers and other stakeholders.

In conjunction with the targeted review, internet-based research was conducted to identify any other existing data that may have been published on the impacts of the CVISN deployment program. This work included keyword searches of technical databases and search engines.

Sources for the generalized literature search were identified through computer-based library resources. Keywords included the following: commercial motor vehicle, CVISN, weigh station, screening, preclearance, PrePass, Norpass, credential, registration, permit, inspection, truck, safety, efficiency, cost savings. These terms were used in various combinations using Boolean AND/OR/NOT logic. The search focused on documents published from 2001 to the present.

Researchers reviewed abstracts of journal articles or reports identified through technical databases and search engines to isolate the most relevant results. Full-text versions of all relevant items were obtained. The bibliographies of any relevant articles identified were reviewed for additional relevant references. All relevant results were documented and compiled in a reference list including bibliographic citation, brief description, and notes on where and how the information could be used in the business case.

3.2 Establish Contacts with Motor Carriers

Because this was a targeted survey—intended to collect information primarily from larger motor carriers who were using CVISN technologies and who were based in active CVISN states—it was not meant to be statistically representative of any particular population of motor carriers. Instead, we set out to collect in-depth economic information from between 20 and 50 motor carriers. A larger-scale, more representative survey was recently completed, under a separate FMCSA/FHWA task order (BA34007), the CVISN National Evaluation. That survey attempted to contact more than 1,800 motor carriers, and yielded more than 800 completed interviews. Results are currently in preparation for publication in late 2008.

The following sections summarize the development of the telephone calling lists and the calling process for the CVISN motor carrier business case. Further details on the telephone interview process and data collection for this study are presented in Appendices A and B.

Calling List Development. Two lists of motor carrier companies to contact were developed. The primary source for the first calling list was the FMCSA Motor Carrier Management Information System (MCMIS) census file, as of September 30, 2006. The MCMIS list was chosen as the most current, complete source of contact information on all motor carriers subject to federal regulation. It was hoped that the MCMIS census file would give the research team a fair cross-section of the motor carrier industry.

To collect sufficient information from carriers who were actually using CVISN technologies, the state CVISN self-evaluation reports were used to identify those states that were highly active in making CVISN available to the carriers based in their states. For example, the percentage of IRP transactions processed electronically and the number of electronic screening sites within a state were taken as reasonable surrogates of a state's activity in deploying CVISN. Carriers from these states were believed to be more likely to be using CVISN technologies:

- Arizona
- Indiana
- Kansas
- Kentucky
- New Mexico
- Oklahoma
- Tennessee
- Virginia.

Twenty-five carriers that were listed in MCMIS as operating more than 20 power units, and coded as being a company in the for-profit motor freight business were selected from each of these eight states. The list of 200 carriers was augmented with approximately 50 carriers from the PrePass and Norpass web site lists of enrolled carriers, and another approximately 40 carriers from a national commercial business directory. The 20-truck minimum company size was chosen for this investigation because it was thought that these larger carriers (a) would be more likely to have staff dedicated to the credentials and safety/screening functions affected by CVISN, (b) would be more likely than the smaller carriers to have staff available to participate in telephone interviews, and (c) would be more likely to have deployed some aspect of CVISN, which represented the main target population for the survey. The vast majority of motor carrier companies operate very few trucks; however, the top 20 percent of U.S. carriers by company size are responsible for approximately 80 of all drivers, trailers, and tonnage in the industry (Murray

2007). The implications of this focus, and opportunities for expanding the coverage of CVISN technologies to smaller motor carriers, are discussed in Section 7.2 below.

The second calling list was developed via a multi-tiered process that collected carrier contact data by sector, geography, and proclivity to be engaged in CVISN. Specifically, a proprietary trade association list of carriers in core CVISN states was developed, augmented by carrier “tax & registration” committee lists from state and national trucking associations. The two lists were compared to prevent callers from contacting the same company.

An interview guide, in the form of a telephone calling script (Appendix A), was drafted, with the goal of balancing the need for collecting useful, detailed economic and business information with the need to keep the interview length and thus the respondent burden as low as possible. Telephone research staff developed the interview guide, in consultation with FMCSA and the ITS Joint Program Office Program Assessment Customer Service Survey Review Team. The targeted length of the interviews was approximately 20 minutes.

Four pilot-test conference calls were pre-scheduled and made between February 23 and March 9, 2007, using a preliminary draft of the interview guide. These pilot calls tended to last approximately 30 to 45 minutes each, including some time for introductions, background, discussion of the survey methods, and refinement of terminology. The data from the motor carriers and service bureaus invited to take part in the pilot calls were included in the economic analysis. Minor modifications to the calling script were made based on the responses to the pilot calls. If a respondent requested it, the interview guide was also e-mailed, faxed, or sent to the company by U.S. Mail. As described elsewhere, some of the contacts began with an e-mail message, instead of a telephone call.

A blanket letter of authorization was prepared and signed by the FMCSA Task Order Manager, and this letter was sent to a few respondents who requested documentation of the purpose and legitimacy of the interview process. Respondents were told that the information collected would be reported anonymously.

Calling Process and Response Rates. Industry contacts using the final interview guide took place between April 2 and June 8, 2007. Table 1 shows the response rates.

Table 1. Calls attempted and interviews completed

	Calls Attempted	Calls Completed (%)
Pilot Calls	4	4 (100%)
Study Calls	268	34 (13%)
TOTAL	272	38 (14%)

Table 2 shows the numbers of initial contacts made by telephone or e-mail/fax, compared with the numbers of surveys completed by both media. As shown in Table 2, approximately 20 percent of initial contacts were made by e-mail, and the bulk of completed surveys were taken by phone.

Table 2. Initial contact methods and survey response methods

	Number of Initial Contacts		Number of Completed Surveys		
	Phone	E-Mail	Phone	Fax	E-Mail
Pilot Calls	4	0	4	0	0
Study Calls	215	53	23	6	5

Response rates were somewhat lower than expected. For the callers using the MCMIS list, it was found that many of the companies on the MCMIS census file had phone numbers that were either out of service or now belonged to a different company or individual, or the company simply did not respond to the initial phone and/or email messages. The low response rate for these calls indicates that the MCMIS census file may not be the ideal source for identifying motor carrier companies to contact to request responses to a lengthy, impromptu telephone survey dealing with potentially sensitive carrier business information.

In contrast, callers using the trade association list had a much higher response rate when calling carriers, possibly due to their ability to better target interested parties, and access to more up-to-date and accurate contact information than available through the MCMIS census file.

Callers had more success in gaining an interview when the purpose of the study was presented simply. Callers found that saying something brief—for example, “We’re working on a study for FMCSA”—made more sense to respondents than going through the entire introductory script (see Appendix A) before asking for the appropriate party.

In the follow-up to the pilot calls, it was agreed that callers could use some latitude or conversational discretion in introducing themselves and the project, while generally keeping the language of the survey itself—especially the wording and flow of the individual questions—intact.

The introduction was often shortened or re-worded, with the insertion of the two CVISN technologies into the introductory paragraph and an explanation of the two technologies only if the respondent was not familiar with them (virtually never). It was emphasized that the caller was interested in the respondent’s experience with credentialing systems, particularly with respect to business impacts (cost savings or increases). In all cases interviewers emphasized that 1) participation was voluntary, 2) responses were confidential, and 3) FMCSA was the investigating organization.

Other questions were delivered verbatim, but the surveyor’s ability to offer probing questions was enhanced as the survey progressed and carriers provided examples of additional costs and benefits they had encountered. In many instances, the range of survey content questions ultimately required the participation and responses from two to three different individuals within each responding company. On average, the *total* time needed to complete the surveys was estimated at approximately 30 to 35 minutes.

Job titles and duties varied widely among the respondent companies, so when the caller did not have a specific contact name, the caller requested to speak with the person in charge of operating permits, safety, and/or weigh station clearance. It was found that “credentialing” is not a widely

used term. Instead, “operating permits” was a more widely recognized term among the carriers contacted in this survey.

Table 3 shows the percent of calls completed, and breaks down the prevailing types of nonresponses faced by the research team.

Table 3. Summary of responses and nonresponses

	Approximate Percent of Calls Attempted
Company responded and call completed	14
Company did not respond to repeated contact attempts	64
Phone number out of service or company closed	12
Company initially agreed to participate, but did not respond to repeated follow-up contacts	7
Company declined and gave a reason	2
Company declined without giving reason	1
TOTAL	100

Among participating companies, the following types of reasons were given:

- Expressed particular interest in the topic
- Offered multiple benefits and disadvantages of the technologies
- Saw survey as an “opportunity for industry’s voice to be heard.”

Among companies that were contacted but declined to participate, the following types of reasons were given:

- Trucks are leased from another company, so the company has nothing to do with licensing, registration, etc., or else owner-operators take care of their own credentials and dispatchers order miscellaneous permits as needed
- Company policy prohibits responding to surveys or questionnaires
- Company does not deal with the issues described in the survey
- Company does not deal with weigh stations, etc., because it just distributes products locally.

As noted above, the response rate was much higher when callers contacted companies by phone, compared to making the initial contact by e-mail. The trade-off was that calling individual companies and making contact with the respondent at a convenient time for an interview proved to be very time consuming. Conducting the telephone interviews took much longer than estimated as well; interviews almost always took 30 minutes, but sometimes stretched to as much as an hour due to the detailed nature of the interview. Via e-mail, research staff were able to distribute many more surveys in less time, but saw a lower rate of response.

Many carriers preferred to be faxed or e-mailed a copy of the survey, which they could then fill out at their convenience rather than complete the survey over the phone. While this deprived researchers and respondents of the ability to ask clarifying questions, the advantages of

contacting a greater number of respondent companies and allowing time for respondents to more thoroughly consider questions requiring cost or number estimates was a favorable trade-off.

Interviews became easier to conduct as time went on and the researchers gained a better understanding of the types of credentialing systems used by carriers. Familiarity with credentialing was extremely useful for developing rapport with respondents. Generally, respondents for the pre-clearance section of the interview were less forthcoming with implementation details, and tended to be more “operationally” focused.

In juxtaposing the complexity of the trucking industry with the detailed, multivariate survey objectives, it quickly became apparent that the survey was targeting different, very disparate audiences. With some exceptions, preclearance issues are divided between safety and technology/maintenance functions. Credentialing application and management functions was considered a “back-room” function—in contrast to dispatching and operations. Consequently, credentialing staff often had little information on trip and operational impacts. Furthermore, carrier size often determined the level of familiarity and cross-cutting of data and information; the larger the carrier, the more likely that credentialing management, financing, and operations were managed as separate functions within the carrier’s business plan. Alternatively, small carrier staff had greater understanding of the full range of issues and impacts, but lacked the internal sophistication to quantify the full range of CVISN costs and benefits.

The pilot calls—made to companies purposefully selected and scheduled in advance—achieved their goal of allowing the research team to refine the survey instrument and the methods of eliciting information. However, the pilot calls did not fully prepare the team for the eventual difficulty in completing surveys when initially contacting motor carriers on the calling lists. None of the four companies on the pilot calls indicated any concerns about the length, intrusiveness, or complexity of the survey. In retrospect, the complexity of the CVISN survey/interview methodology was almost certainly the leading factor in explaining the relatively low response rate as well as posing challenges in rectifying responses within and across interviews.

3.3 Develop Economic Parameters and Model

To establish a framework for systematically examining the benefit and cost elements outlined in the previous section, this study relies on a number of economic parameters and assumptions to determine the relevant return on investment (ROI) ratios, net benefits estimates, and payback periods (Table 4). Based on a preliminary review of CVISN studies, the analysis time horizon was established at 10 years, a period that is based on the expected economic life of CVISN equipment. The discount rate established for compressing streams of benefits and costs into present value terms was established at 7 percent, consistent with the recommendations of the Office of Management and Budget (U.S. OMB 1992). This rate serves as a proxy for the after-tax rate of return to private capital.

Table 4. Economic parameters used to conduct return on investment analysis.

Parameter	Assumption	Basis of Assumption
Discount rate	7%	OMB Circular A-94
Analysis base year	2007	
Annual PPI inflation	2.6%	Average annual change in the Producer Price Index from the Bureau of Labor Statistics (2001-2005)
Annual growth in truck registrations	3.0%	American Trucking Association, U.S. Freight Transportation Forecast to 2008
Analysis time horizon	10 years	

The base year of the analysis is 2007, and all monetary values are presented in constant 2007 dollars unless otherwise noted. The average annual change in the Producer Price Index (PPI) is estimated at 2.6 percent based on growth in the PPI, as estimated by the BLS from 2001 to 2005. Annual growth in the number of heavy trucks operating in the US is estimated at 2.98 percent based on the American Trucking Association's (ATA) US Freight Forecast to 2008.

These parameters are combined with industry data in an economic model to determine ROIs, net benefits estimates, and relevant payback periods. The Microsoft Excel-based economic model designed for this study contains multiple output or results pages and a single input or assumptions page. Designing the model in this manner enabled the analyst to enter inputs and change study parameters, including those related to discount rates and the analysis base year, without the need to examine detailed study data or possess any foreknowledge of the model's design.

For the purposes of estimating the startup and recurrent costs associated with electronic credentialing, mean or median values were not used because the data were highly variable and many respondents either were unsure what costs had been incurred or indicated that the costs were negligible. Since statistical means and medians were of limited usefulness, the research team assigned what it considered to be reasonable values based on its evaluation of the survey responses.

The original intent was to attempt to segment the industry by region, company size, type of operation, and other demographic variables. However, the relatively small sample size and the homogeneity of respondents (e.g., all operating interstate, and mostly across the 48 continental states) meant that segmentation would have left very small numbers of carriers in each group, reducing the representativeness of the results. Further, not all of the responses received could be used to support the economic analysis, thus reducing the overall sample size for many of the questions. Unless otherwise indicated, all analyses in this report consider the respondents as a single group.

4. Prior Studies and Anecdotal Evidence

This section summarizes the limited information that is available on motor carrier costs and benefits from CVISN technology deployment. Further details on the findings of the review of pertinent prior literature summarized below are presented in Appendix C.

While substantial information exists on the impacts of CVISN deployment on states, few studies have documented the impacts of CVISN deployment on motor carriers. Review of journal articles, case studies, press releases, and web sites yielded anecdotal evidence on the impacts of CVISN technologies on motor carriers. Motor carriers benefit from bypass time savings, fuel economy improvement, increased safety through reduction in backups, increase in miles traveled, reduction in administrative costs, reduced operation and maintenance costs by eliminating frequent starts and stops, increased regulatory compliance, and increased levels of efficiency and effectiveness. Only studies published after 2001 providing quantitative information on the costs and benefits of CVISN have been summarized below.

In 2002, as part of a U.S. DOT-sponsored independent evaluation, the technical and institutional feasibility, costs, and benefits of intelligent transportation user services for commercial vehicle operations deploying CVISN were estimated (FHWA 2002). The focus of the study was to estimate costs and benefits to states. In the process of gathering data to support that effort, a national motor carrier survey was conducted to gather qualitative data on costs and benefits of CVISN to motor carriers. A total of 158 responses were received. Across large motor carriers, the reported total in-house staff time involved in credentialing had a mean of between 1 and 2 full-time equivalent (FTE) days per power unit per year, with a median value of between 0.2 and 2 FTE days.

As for the time saved through electronic screening (preclearance or weigh station bypass), survey respondents estimated the mean amount of time involved per inspection to be 19 minutes for size/weight checks and 45 minutes for safety checks.

For the same study, three motor carriers were also interviewed in detail as part of the cost analysis data collection effort; two carriers were participating in the Kentucky deployment and one carrier in the Maryland deployment. Motor carriers were interviewed to gather information on the costs incurred in obtaining IRP credentials before and after CVISN deployment and the impact of CVISN systems on the efficiency and productivity of motor carrier operations. These three companies reported saving an average of between approximately 60 and 80 percent of their administrative costs for credentialing, and between approximately 50 and 60 percent of their labor hours after converting from paper-based to CVISN electronic credentialing.

The design of Washington State's e-credentialing program, its deployment and operation, and some of the benefits realized through the use of intelligent transportation systems were documented in a case study (FMCSA 2004). Benefits identified included time savings through fewer administrative corrections caused by missing or illegible information and accurate tracking of fleet sizes and its associated paperwork. Customer feedback from one company, Gordon Trucking, based in Pacific, Washington, indicates a savings of approximately 1 hour of administrative labor per power unit for administering credentials electronically. Gordon Trucking operated over 1000 power units in 2004 and estimated adding approximately 200 new power units per year. Since joining the program in 2001, the company has reduced cost by going from 2 to 1.5 FTE administrative staff positions dedicated to license processing.

The PrePass electronic screening program has been shown to have a significant impact on the profitability of enrolled motor carriers (Walton, 2002). Benefits of the PrePass system in terms

of time savings, fuel, and operational cost have been captured on a programmatic basis by Affiliated Computer Services (ACS), the system integrator and the operator of the PrePass system (PrePass, 2007). In 2006, 51,124,786 screening bypasses resulted in time savings of 4,260,399 hours, fuel savings of 25,562,393, and operational cost savings of \$255,623,930.

Review of corporate press releases yielded additional anecdotal evidence on the economic benefits of the PrePass electronic screening system:

- Every stop at a weigh station costs carriers about \$5.00 (PRNewswire, 2006a).
- Savings in Illinois from 1999 to June 2006 were estimated at more than \$54.9 million or roughly \$7.8 million annually (PRNewswire, 2006b).
- Savings in Missouri from 2002 to June 2006 were estimated at more than \$32.1 million or roughly \$8 million annually (PRNewswire, 2006c).
- Savings in Wyoming since from 1999 to June 2006 were estimated at more than \$16.7 million or roughly \$2.4 million annually (PRNewswire, 2006d).
- Savings in Nebraska from 1999 to June 2006 were estimated at more than \$8.9 million or roughly 1.3 million annually (PRNewswire, 2006e).
- Savings in California from 1995 to June 2006 were estimated to exceed \$131.5 million or roughly \$12 million annually (PRNewswire, 2006f).

Further details are presented in Appendix C.

5. Quantitative Results

This section presents information on the motor carriers who responded to the business case telephone interviews, followed by the economic results derived from the data collected.

5.1 Characteristics of Population Responding

All of the responding companies reported working across state lines as interstate carriers or as service bureaus that work with interstate carriers. The numbers of states the carriers operate in ranged from 7 to 50, with most carriers reporting 48 states. The vast majority of carriers were for-hire, as opposed to private (company-dedicated) carriers. Fifteen respondents were primarily truckload carriers, eight were less-than-truckload, and 11 reported carrying both kinds of loads. Most respondents used dry freight vans most commonly, followed by refrigerated vans and straight trucks. Other trailer types were reported much less frequently. Carriers in this population reported being responsible for between 22 and 90,000 power units, including company-owned, leased, and owner-operator power units.

Respondents were fairly equally balanced between those who recognized the term “CVISN” (16 respondents, or 44 percent) and those who did not recognize the term (20 respondents, or 56 percent). Among those who had heard of CVISN, there were several positive descriptions. One typical respondent said, “In terms of an information network, it sounds great. It enables technology to gather information to improve performance.” A handful of respondents indicated that CVISN would achieve its greatest benefits if all systems used similar data formats, and that the concept would be positive for the motor carrier industry if it were used to promote consistency across jurisdictions. Figure 3 summarizes the characteristics of the motor carriers surveyed for this study. The figure demonstrates the distribution of motor carriers surveyed for this study is skewed towards large, for-hire carriers operating in more than 40 states.

All but one respondent reported applying for credentials electronically. On the electronic screening side, 24 out of 32 respondents (75 percent) said that some of their companies’ trucks were equipped with screening transponders, while 8 respondents (25 percent) indicated that their company did not use transponders on any of its trucks, or did not know whether or not transponders were being used.

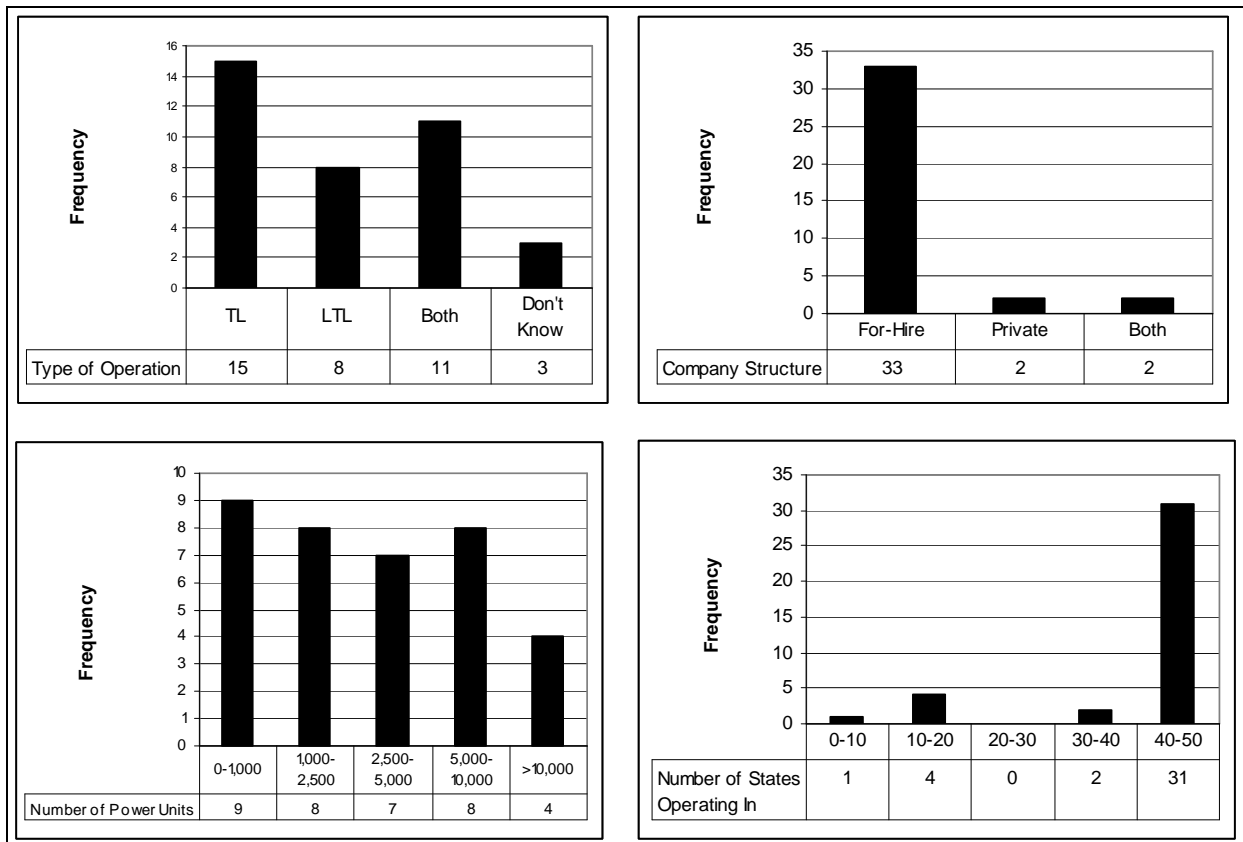


Figure 3. Characteristics of surveyed motor carriers

5.2 Return on Investment Analysis

This section presents the quantitative economic results of the data analysis. The return on investment (ROI) analysis relies on data collected through interviews and analysis of industry

data and literature. This analysis documents the startup and annual recurrent costs associated with CVISN deployment for motor carriers under various scenarios; documents the benefits associated with CVISN deployment; and calculates ROI ratios, net benefits, and payback periods for motor carriers resulting from participation in electronic credentialing and electronic screening programs. Motor carriers interested in constructing their own, customized ROI analysis may do so using the simplified ROI worksheets and accompanying instructions provided in Appendix D. The benefit and cost elements considered within this report are presented in Table 5. The benefits of electronic credentialing are tied to labor, material and postage savings to motor carriers, normalized on a per-transaction basis. The time value of increased fleet utilization is tied to the costs of new trucks waiting to be placed into service. That is, as new trucks sit in the yard or are otherwise unproductive while awaiting the processing of credentials, interest is accruing on the loan taken out by the motor carrier to purchase the truck. This debt carrying cost represents a tangible cost to motor carriers and is quantified in this analysis. The startup and annual costs associated with electronic credentialing technology were assessed for: hardware expenses, computer technical support, company registration, system training, and network connection fees.

The benefits of electronic screening considered in this analysis are entirely tied to operating cost savings to motor carriers, including those related to driver wages and benefits and fuel costs. The types of costs associated with electronic screening considered within this analysis include those related to: membership fees, transponder hardware, other hardware, staff training time, transponder maintenance, monthly transponder fees, and fees paid on a per-bypass basis.

Table 5. Benefit and cost elements

CVISN Functional Area	Benefits	Costs
Electronic Credentialing	<ul style="list-style-type: none"> - Labor savings per transaction - Material and postage savings per transaction - Time value of increased fleet utilization per day 	<ul style="list-style-type: none"> - Startup costs <ul style="list-style-type: none"> • Hardware expenses • Computer technical support • Company registration • System training • Network connection fees - Recurrent costs <ul style="list-style-type: none"> • Hardware maintenance • Computer technical support • System training costs
Electronic Screening	<ul style="list-style-type: none"> - Operating costs savings to motor carriers <ul style="list-style-type: none"> • Driver wages and benefits • Fuel • Equipment rents and purchased transportation 	<ul style="list-style-type: none"> - Startup costs <ul style="list-style-type: none"> • Membership fees • Transponder hardware • Other hardware • Staff training time - Recurrent costs <ul style="list-style-type: none"> • Monthly subscription of bypass fees • Transponder maintenance • Other hardware maintenance • Staff training

Electronic Credentialing

Motor carriers contacted for this study expressed a high degree of satisfaction with their experiences in using electronic credentialing. The respondents unanimously agreed that electronic credentialing had generated net financial benefits to their company and when asked why their company had chosen to move towards electronic credentialing, most indicated that the acceleration of credentialing (26 respondents) and labor time savings (24 respondents) were the most significant reasons. Numerous motor carriers also highlighted the benefits of integrating computing technology into the credentialing process, either through its ability to reduce errors and the number of corrections needed or the ability to store and track information electronically. Table 6 shows the number of times each reason was cited by the responding companies. The reasons total more than 38 because a single company could indicate more than one reason. Based on the results of the electronic credentialing ROI analysis presented later in this section, the results of the survey demonstrate that motor carriers are well aware of the benefits that accrue as a result of electronic credentialing and also understand which benefits are most relevant when making a decision to use the technology.

Motor carriers surveyed in support of this study generally agreed that electronic credentialing was faster, used less paper, was easier, and was more efficient than traditional paper filing systems. One respondent noted that in conversations with other motor carriers, all had generally positive things to say about e-filing, while those that were still using paper were frustrated by the process. Most agreed that accuracy was much improved through electronic credentialing resulting in less time spent responding to questions raised by credentialing agencies.

Table 6. Reasons cited by motor carriers for using electronic credentialing (N=29)

Reason	Number*	Percentage of Respondents
Acceleration of credentialing	26	90%
Labor time savings	24	83%
Reduction in errors and corrections needed	7	24%
Ability to store and track information electronically	3	10%
Savings in postage and materials	1	3%
Total	61	

* Out of 29 carriers responding. Carriers could cite more than one reason.

Most of the surveyed motor carriers indicated that both the startup and annual recurring costs associated with electronic credentialing were minimal. Based on consideration of all the data collected, Table 7 presents an overview of the typical costs incurred by a motor carrier when moving to electronic credentialing. Motor carriers reported in some cases the need to improve hardware (\$50 per motor carrier), obtain computer technical support (1 hour at \$75 per hour), and incur other training-related costs (\$150). Total startup costs used in the benefit-cost analysis (BCA) are estimated at \$275, consistent with the data received through the surveys conducted for this study. Annual recurrent costs are estimated at \$125 per company. It was assumed that all carriers would already own at least one computer equipped with a high-speed internet connection, which the carrier would be using in its ordinary course of conducting business, so the total cost for this equipment and service is not allocated as a startup or operating cost to the

CVISN e-credentialing deployment. This assumption is consistent with industry responses regarding the initial startup costs associated with electronic credentialing.

Table 7. Electronic credentialing costs to motor carriers

Element	Value per Company
Startup costs	
Hardware expenses	\$50
Computer technical support	\$75
Company registration	\$50
System training	\$100
Network connection fees	\$0
Other	\$0
Total startup costs	\$275
Recurring costs (annual)	
Hardware maintenance	\$0
Computer technical support	\$75
System training costs	\$50
Total recurring costs	\$125

The benefits associated with electronic credentialing, the value placed on each benefit element, and the basis of the estimated value are highlighted in Table 8. The most significant benefit is the time value of increased fleet utilization described previously within this section. The financing cost associated with loans obtained on new tractors waiting for credentials was estimated at \$106 per day. Motor carriers surveyed for this study indicated that on average, electronic credentials accelerated the time required to place new trucks into service by an average of 3 to 4 days, at a savings of \$371 per truck ($\$106 * 3.5$). The share of the fleet requiring new credentials was estimated at 15 percent based on data presented in the CVISN Model Deployment Initiative Final Report (FHWA 2002).

Table 8. Assumptions governing electronic credentialing benefits estimates

Element	Value or Factor	Basis
Labor savings per transaction	\$4.13	Product of time savings provided by CVISN business case survey respondents (10 to 12 minutes, calculation uses 11 minutes) and labor rates (plus fringe benefits) for administrative personnel provided by respondents (\$22.50/hour)
Material and postage savings per transaction	\$1	CVISN business case surveys
Time value of increased fleet utilization per day	\$106	The financing costs associated with a 3-year loan on a \$105,000 tractor waiting for credentials at an interest rate of 6.38 percent (Murray 2007)
Share of fleet represented by new trucks requiring credentialing	15%	CVISN Model Deployment Initiative Final Report (FHWA 2002)
Acceleration of trucks being placed into service	3 to 4 days	CVISN business case surveys

Evidence collected from motor carriers suggests that the level of savings associated with increased fleet utilization will differ from company to company. For example, if there are other parallel activities required to place a truck into service (painting, equipment installation, etc.) that can be performed while awaiting credentials, the actual difference in service time between the legacy (paper-based) system and electronic credentialing may be less. Based on contacts made with motor carriers and a credentialing broker in support of this study, additional conclusions regarding the increased fleet utilization estimate include the following:

- Motor carriers generally work diligently to ensure that trucks never sit idle for extended periods of time for any reason, including waiting for credentials
- Cost savings will vary by state based on the number and types of credentials required, and the time required for the state to process credentials and issue plates
- Temporary registrations are available in some states and can be distributed via fax or e-mail for use while the carrier waits for permanent plates to be delivered
- Larger carriers have generally streamlined the process of placing new trucks into service and would not experience long waiting periods; smaller carriers could find it more difficult to expedite the credentialing process and could wait several days for credentials
- One credentialing broker indicated that she could work with dealers to obtain copies of required paperwork with all relevant vehicle information, and obtain and send all permits and plates to the motor carrier before the new owner takes possession of the vehicle.

The second largest benefit associated with electronic credentialing is reduced labor costs. The motor carriers surveyed for this study indicated that on average, companies save 10 to 12 minutes per transaction resulting in labor cost savings of \$4.13 per transaction. Cost savings associated with materials (e.g., paper, envelopes) and postage not used in electronic transactions were estimated to reduce costs by an additional \$1 per transaction.

The economic analysis in this business case calculated the benefit of getting trucks into service more quickly for only the 15 percent of an average company's trucks that are purchased in a given year. However, separate dollar values were calculated on a per-transaction basis to cover all types of credentialing transactions, be they new, renewal, or supplemental transactions. Thus, the benefits marked as "per transaction" in the Table 8 apply to all transactions, whereas the benefits tied to fleet utilization and downtime while waiting for new credentials to arrive apply to only a subset of the company's population of power units in any given year.

To examine the ROI associated with replacing paper-based systems with electronic credentialing, mean values for the elements required to perform the ROI calculation were calculated from the surveyed motor carriers, as presented in Table 9. The majority of the motor carriers surveyed for this study were large interstate companies operating in numerous states across the nation. Thus, the average number of annual IRP credential transactions among survey respondents was very high (1,291), with an additional 394 IFTA transactions and 823 transactions involving other

kinds of permits and credentials. These values were applied to the transaction- and power unit-based benefits calculations outlined in Table 8 and examined within the benefit-cost framework described in Section 3 to calculate an ROI ratio, net benefits estimate, and payback period for this mean value scenario.

Table 9. Mean values for CVISN business case survey respondents

Element	Value
Number of IRP credential transactions	1,291 per year
Number of IFTA credential transactions	394 per year
Number of all other permit and credential transactions	823 per year
Number of power units	7,451

Table 10 presents the ROI analysis results for the mean value scenario. Increased fleet utilization is the most significant benefit associated with electronic credentialing resulting in \$413,065 in savings to the motor carrier in the first year of the analysis time horizon. The transaction-based benefits (labor, materials, and postage) result in approximately \$12,855 in savings in the first year of using electronic credentialing. In the first year of this scenario, benefits equate to \$57 per power unit and \$170 per transaction. Over the 10-year ROI time horizon, total net benefits per carrier are estimated at \$3.6 million (\$360.5 thousand average annual), resulting in an overall return on investment of 2,971:1 and a payback period of less than one month. These results were confirmed in some of the interviews conducted for this study. (See the example company profile on page 21).

Table 10. Results of electronic credentialing ROI analysis, mean value scenario (\$2007)⁴

Year	Benefits				Costs			Net Benefits
	Labor	Materials and Postage	Increased Fleet Utilization	Total	Initial	Recurrent	Total	
2007	\$10,347	\$2,508	\$413,065	\$425,920	\$275	125	\$400	\$425,520
2008	9,958	2,414	397,546	409,918	-	117	117	409,801
2009	9,584	2,323	382,610	394,518	-	109	109	394,408
2010	9,224	2,236	368,236	379,696	-	102	102	379,594
2011	8,877	2,152	354,401	365,430	-	95	95	365,335
2012	8,544	2,071	341,086	351,701	-	89	89	351,612
2013	8,223	1,993	328,271	338,488	-	83	83	338,404
2014	7,914	1,919	315,938	325,771	-	78	78	325,693
2015	7,617	1,846	304,068	313,531	-	73	73	313,459
2016	7,330	1,777	292,644	301,752	-	68	68	301,684
Total	\$87,618	\$21,241	\$3,497,866	\$3,606,725	\$275	\$939	\$1,214	\$3,605,511

⁴ Annual benefit estimates reflect both forecast growth in the number of heavy truck registrations (3 percent annually) and the applied discount rate (7 percent). Annual cost estimates are not tied directly to the number of heavy truck registrations and, therefore, were not forecast to grow in real terms over the 10-year analysis time horizon.

**Company Profile:
Electronic Credentialing**

One fleet manager interviewed for this study indicated that electronic credentialing had allowed his company to reassign 4-1/2 FTE among its administrative staff. The change in staffing translates into total savings to the company of \$217,687 assuming that administrative staff salaries plus fringe benefits total \$22.50 per hour and 2150 hours worked annually. The respondent manages a fleet of 1,400 power units engaged in for-hire transport in 48 states. The fleet manager indicated that his company had spent \$100 initially, investing in new hardware but had not incurred any additional costs since the initial investment. Though he had not heard of CVISN per se, he was well aware of the benefits of electronic credentialing and now obtained 100 percent of the company's credentials on-line. He also noted that with electronic credentialing, his company could place new trucks into operation approximately 4 days sooner than would have been the case using paper-based systems. The value of the increased fleet utilization for this company was calculated at \$88,704 based on the assumptions cited earlier in this section with the exception of the one governing the acceleration of trucks being placed into service. The respondent indicated that electronic credentialing accelerated the credentialing process by four days. When these savings are added to the labor cost reductions, we estimate that electronic credentialing has resulted in over \$306,391 in annual savings to this company, or a per power unit savings of \$218.85. The labor savings reported by this carrier far exceeded those experienced by most other respondents. This result is indicative of the variability in commercial vehicle operations (CVO). The ability to become much more efficient reflects both on the company's ability to streamline the credentialing process through electronic means and the high costs built into its previous manual credentialing process.

Electronic Screening

The motor carriers contacted for this study were generally aware of the benefits associated with electronic screening and those that had chosen to equip their vehicles with transponders were confident that the decision had generated positive economic returns to their company. When asked if their company had recovered startup costs, 90 percent of those surveyed responded positively. Table 11 presents the reasons cited by motor carriers for participating in electronic screening programs. The time (20) and labor cost (13) savings were the top two reasons cited for participating in electronic screening programs, though quicker delivery times (8), reduced wear and tear on vehicles (7), and enhanced safety (6) were also cited. Numerous other benefits associated with electronic screening were cited by respondents, including: improved on-time delivery performance, toll discounts for EZPass, simplified scheduling, enhanced driver morale, increased driver retention rates, and reduced overtime pay. There were a number of respondents, however, that argued for greater uniformity and interoperability in electronic screening programs. One carrier noted that with competing electronic screening programs and toll roads, a single truck can be equipped with five or more transponders. Other carriers noted that sometimes transponders interfere with each other.

Table 11. Reasons cited for participating in electronic screening programs (N=21)

Reason	Number*	Percentage of Respondents
Time savings	20	95%
Labor savings for drivers	13	62%
Quicker deliveries	8	38%
Reduced wear and tear on vehicles	7	33%
Increased safety	6	29%
Total	54	

* Out of 21 carriers responding. Carriers could cite more than one reason.

Of the eight respondents who did not participate in electronic screening (or who did not know whether their company had any transponder-equipped trucks), three listed time and cost savings and labor savings for drivers as factors that would influence them to participate in e-screening in the future. Quicker deliveries, reduced wear and tear on equipment, and safety received fewer votes as positive factors. Startup costs, recurring costs, and driver issues each received only one vote each from among these eight respondents as factors that their company would count as negatives, in deciding against adopting e-screening..

Table 12 demonstrates that of those responding carriers who claimed to be participating in an electronic screening program or partnership, 19 respondents (100 percent) were enrolled in PrePass, while 7 (36.8 percent) were enrolled in Norpass, 10 (52.6 percent) in Oregon Green Light and 6 (31.6 percent) in EZ Pass.

Table 12. Electronic screening programs and partnerships (N=20)

Programs / Partnerships	Number*	Percentage of Respondents
HELP/PrePass	19	95%
Oregon Green Light	10	50%
Norpass	7	35%
EZ Pass	6	30%
Total	42	

* Out of 20 carriers responding. Carriers could cite more than one reason.

The ROI analysis considers a number of startup cost categories, including: membership fees, transponder hardware, other hardware, staff training time, and other costs. The majority (72.2 percent) of the respondents indicated that there were no initial startup fees associated with enrolling in an electronic screening program or partnership. Initial costs identified by some of the motor carriers contacted for this study included transponder hardware costs of \$99 per unit, staff training time of approximately 1 to 2 hours per unit, and a \$2,000 cost to mail transponders to all drivers in the company.

Annual recurrent costs considered within this analysis include: monthly transponder fees, bypass transaction fees, transponder maintenance costs, other hardware maintenance, staff training, and other recurrent costs. Of the 18 motor carriers providing sufficient data to construct ROI ratios, seven (38.9 percent) provided their own estimates of annual recurrent costs. These costs were largely driven by the monthly transponder fees paid to electronic screening programs, though

two respondents included bypass fees of between \$0.65 and \$0.85. For the 11 respondents that were unable to estimate annual recurrent costs, we assumed per-company costs based on the PrePass fee schedule identified in Table 13. Note that there are no initial startup costs associated with PrePass. Costs are variable based on the number of trucks enrolled by the motor carrier, and PrePass + includes EZPass (toll booth bypass).

Table 13. Monthly PrePass rate schedule (\$ per transponder)

Number of Trucks	PrePass	PrePass +
0-25	16	21
26-100	15	20
101-200	14	19
201-300	13	17
301-500	12	16
501-3,000	11	15
3,001-4,000	10	14
>4,000	9	13

A number of assumptions were required to calculate the benefits associated with electronic screening, including the time savings per bypass, annual number of bypasses per enrolled vehicle, number of enrolled vehicles, and heavy truck operating costs (Table 14). The number of enrolled vehicles per company was obtained through the motor carrier interviews. To determine the total number of bypasses, the number of enrolled vehicles for each company was multiplied by an average annual number of bypasses per truck based on PrePass data. The time savings per bypass was estimated at 3 to 5 minutes based on a midpoint of estimates provided by the Oregon Green Light Program, PrePass, and the CVISN Model Deployment Initiative (MDI) Final Report (FHWA 2002). The motor carriers contacted for this study, however, indicated that time savings per bypass could reach as high as 20 minutes. This reported estimate may have included some allowance for the small portion of weigh station stops when a truck is selected for a safety inspection, which can take approximately 30 to 60 minutes.

Table 14. Assumptions governing electronic screening benefits estimates

Element	Value	Basis
Time savings per bypass	3-5 minutes	Midpoint of estimates provided by FHWA (2002) [2.8 minutes], Oregon Green Light Program (http://www.oregon.gov/ODOT/MCT/docs/906.pdf) [3-5 minutes], and PrePass website (http://prepass.com/whatsprepass.htm) [5 minutes]
Annual number of bypasses	135	Based on data provided on PrePass website (http://prepass.com/whatsprepass.htm) regarding annual number of bypasses and number of vehicles enrolled in PrePass
Heavy truck operating cost	\$2.16 per minute	ATA data cited by Oregon Green Light Program (http://www.oregon.gov/ODOT/MCT/docs/906.pdf) and inflated from 2003 to 2007 based on PPI
Operating cost savings per bypass	\$8.68	Product of time savings per bypass and heavy truck operating cost per minute

In examining the benefits of the Oregon Green Light Program, the Oregon DOT cites ATA (2003) data estimating the average motor carrier operating cost per mile at \$2.80, and average speed from point of origin to delivery at 42 miles per hour (Oregon DOT 2006). Based on these assumptions, the average operating cost to motor carriers can be computed at \$1.96 per minute. Adjusting this estimate based on four years' growth in the PPI (from the source year of 2003 to the current base year of 2007) results in an average operating cost assumption of \$2.16 per minute for motor carriers.

The results of the electronic screening ROI analysis for 18 of the surveyed motor carriers providing sufficient data are presented in Table 15. Table 15 matches benefit and cost estimates to company data regarding the number of states in which the motor carrier operates, whether the carrier is a truckload or less-than-truckload carrier, if the motor carrier is private or for-hire, and the number of power units equipped with a transponder. Table 15 is sorted according to the number of power units equipped with transponders.

The results of the ROI analysis suggest that motor carriers are experiencing significant returns on their investment in electronic screening technologies, with ROI ratios for all but one of the companies ranging from 6.1:1 to 15.9:1. (See the company profile on page 26 to review a more detailed assessment of one company's experience with electronic screening). In all cases, the payback period was less than one year when an initial investment was made. Total net benefits associated with electronic screening over the 10-year analysis time horizon ranged from \$3.2 million to \$219.4 million per company. The annual net benefit per transponder-equipped truck was estimated at \$1,169.

Two anomalous values appear in the Startup Cost column of Table 15. One carrier representative responded to Question S-6a, on one-time membership fees for electronic screening, by saying that it cost their company \$550 per power unit for screening, including the cost of a toll transponder system for use in the Midwest and Northeast. This same carrier also reported operating 9,000 power units, for a total startup cost of \$4.9 million.

A different carrier reported investing \$900,000 in transponder hardware (Question S-6b) plus 80 hours of labor related to deploying transponders, plus 24 hours of labor related to starting membership in screening program(s), for a total startup cost of \$902,279. No further details on these unusually high reported startup costs were obtained during the calls. The majority of carriers responding to this survey reported incurring no startup costs for electronic screening.

The results of the electronic screening analysis suggests that large operations are able to reduce the per-unit costs associated with recurrent membership fees and transponder maintenance, thus increasing their return on investment. Figure 4 demonstrates that motor carrier operations are achieving positive returns to scale as it relates to investment in electronic screening technology. Note that data from one company with 25,500 power units and an ROI ratio of 10.8 was excluded from Figure 4 due to its impact on the scale of the x-axis and the visual appearance of the figure.

Table 15. Results of electronic screening ROI analysis

For-Hire or Private	Number of States Operated Within	Truckload, Less than-Truckload (LTL)	Units Equipped with Transponders	Annual Benefit	Startup Costs	Annual Recurrent Costs	Total Present Value 10-Year Benefits	Total Present Value 10-Year Costs	ROI Ratio	Payback Period
For-Hire	13	LTL	200	233,949	-	33,600	1,895,652	272,255	7.0	N/A
Both	11	Truckload	212	247,986	-	33,072	2,009,391	267,977	7.5	N/A
For-Hire	48	Truckload	475	\$555,630	-	\$91,200	\$4,502,173	\$738,978	6.1	N/A
For-Hire	48	Truckload	500	585,108	-	72,029	4,741,025	583,637	8.1	N/A
For-Hire	48	Truckload	1,000	1,169,747	657	780,000	9,478,258	6,320,862	1.5	<1 year
For-Hire	39	Not Known	1,103	1,289,646	109,148	145,530	10,449,780	1,288,352	8.1	<1 year
For-Hire	48	Truckload	1,400	1,637,646	-	184,800	13,269,562	1,497,402	8.9	N/A
For-Hire	50	Both	1,452	\$1,698,473	\$1,095	\$192,448	\$13,762,431	\$1,560,468	8.8	<1 year
For-Hire	48	Truckload	2,500	2,924,368	-	330,000	23,695,646	2,673,933	8.9	N/A
For-Hire	48	Truckload	2,900	3,392,267	-	382,800	27,486,949	3,101,762	8.9	N/A
For-Hire	15	Both	3,300	3,860,166	-	396,000	31,278,253	3,208,719	9.7	N/A
For-Hire	48	Truckload	3,395	3,971,292	-	407,400	32,178,687	3,301,091	9.7	N/A
For-Hire	48	LTL	5,589	6,537,425	-	410,000	52,971,616	3,322,159	15.9	N/A
For-Hire	33	LTL	8,550	10,001,338	-	747,700	81,039,109	6,058,483	13.4	N/A
For-Hire	49	LTL	9,000	10,527,725	4,950,000	900,000	85,304,325	12,242,544	7.0	<1 year
For-Hire	48	Truckload	9,100	10,644,699	902,279	1,277,500	86,252,151	11,253,639	7.7	<1 year
For-Hire	50	Truckload	9,800	11,463,522	-	823,200	92,886,932	6,670,247	13.9	N/A
For-Hire	48	Both	25,500	29,828,553	-	2,754,000	241,695,588	22,315,184	10.8	N/A

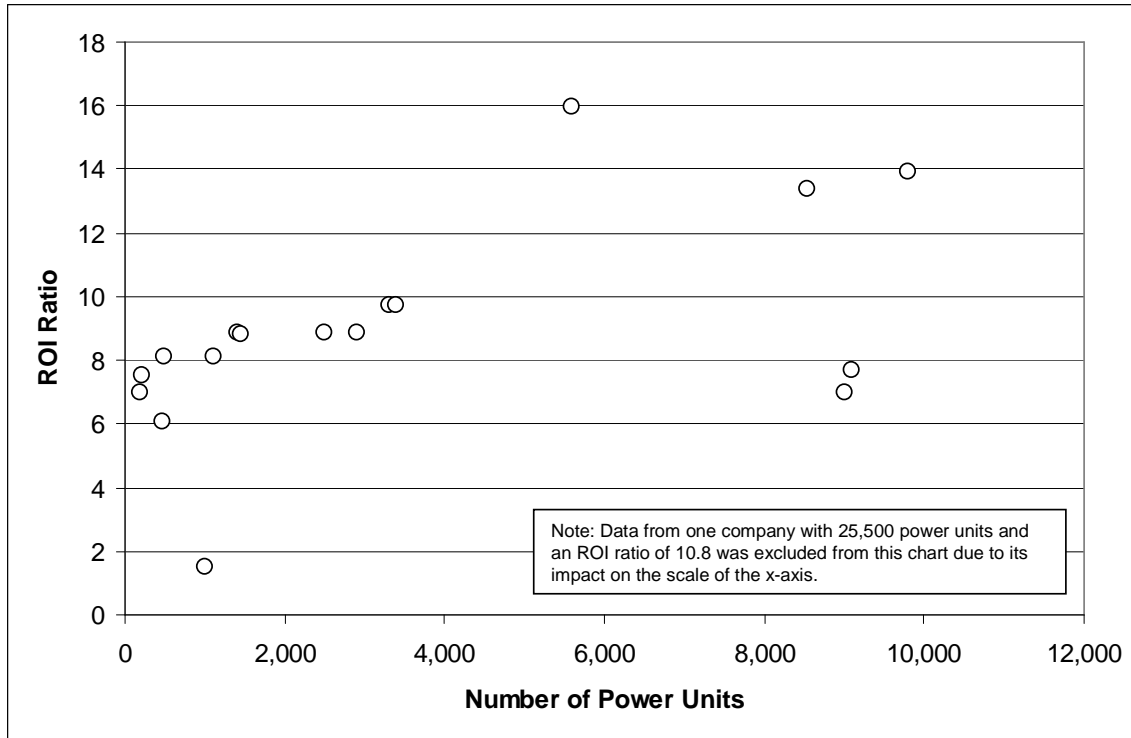


Figure 4. Relationship between the number of power units and ROI ratio

Company Profile: Electronic Screening

One company considered in this study operates 6,575 power units in 48 states, and is a for-hire, less-than-truckload carrier. The company indicated that because it pays its drivers either by the mile (60 percent) or the hour (40 percent), it viewed electronic screening as a means to reduce both labor and fuel costs. Thus, the company had equipped 85 percent of the trucks it operates with transponders, and was enrolled in the PrePass and Oregon Green Light programs. The company's equipment planner, who was interviewed for this study, indicated that the company spent approximately \$410,000 annually on transponder fees but viewed the investment as wise given that trucks were required to wait in lines at weigh stations that according to him could take up to 17 minutes to clear. Based on the assumptions provided previously in this section, we calculate the annual benefits associated with electronic screening to this company at \$6.5 million. The total 10-year electronic screening benefits to the company were estimated at \$53.0 million and when compared with 10-year costs of \$3.3 million generated an ROI ratio of 15.9. No payback period was calculated because no initial investment was claimed to have been made.

6. Qualitative Results

This section presents the more subjective or qualitative findings from the series of telephone interviews on business aspects of CVISN from the motor carriers' point of view. An overview of the demographic features of the respondent population is presented, followed by a discussion with examples of questions asked by callers and verbatim transcripts of the answers given by motor carrier representatives during the telephone/e-mail interviews. The more quantitative, economic analysis results are presented in Section 5.

6.1 Qualitative Responses for Electronic Credentialing

In the area of credentialing, most respondents (33) reported obtaining their own credentials, while only three reported relying on a broker or service bureau. All but one company that reported obtaining its own credentials (32 out of 33, or 97 percent) indicated that they use the internet to obtain some of their credentials, and a large majority (25 out of 34, or 74 percent) were aware of other companies that use an internet-based system. As detailed in Section 6, responding companies overwhelmingly reported that they have easily recovered their startup costs for using computer-based credentialing, by way of dollar savings or staff time savings (Yes=24, No=0, Don't Know=8). Similar proportions (Yes=26, No=0, Don't Know=4) reported that their company typically recovers its ongoing costs for using computer-based credentialing. When carriers have needed to seek technical assistance with electronic credentialing, 16 out of 21 responding companies (76 percent) reported being able to get assistance from the state or system operating vendor in a timely fashion. Qualitatively, the carriers appear to be very pleased with the level of technical support available to them when solving e-credentialing problems.

Besides the straightforward economic benefits described in Section 6, a few motor carriers reported savings in some unconventional areas, following their adoption of electronic credentialing, such as avoiding fines and citations (one company reported saving \$2,000 to \$5,000). Several carriers described significant staff labor savings, including one carrier who said his company went from 5 full-time equivalents (FTEs) to 0.5 FTE when changing from paper-based to electronic credentialing (see related credentialing company profile on page 21).

Some carriers reported no change or savings in operating costs when going from paper-based to electronic credentialing, and a few even reported higher costs, such as one carrier who reported needing to upgrade a computer system to accommodate credentialing transactions.

Below are listed example responses to the question: *What features [of the electronic credential filing process could be improved], and how could they be improved?*

- By being more prevalent (having more states offer more items electronically); more uniformity among states offering it.
- Set standard format for types of processes. If they had one format for IRP, it would be easier to process. Usually each state has a different format.
- Two issues. One, need to tie credentialing (license plate) with title applications. Electronic credentialing should also allow for electronic title application. Two, need to look beyond IRP to full plate registrations for large intrastate vehicle fleets.

- All states should allow permits to be obtained 24 hours a day, 7 days a week. Some states have online permits available during business hours. Also, sites are often down even during business hours.
- Our company does not use credit cards, but some sites require using a credit card. Monthly or weekly invoice would be nice for those who don't use credit cards.
- It should be available in all states.
- Have a broader range of permits available online: Alcohol and HazMat (hazardous materials) permits currently need to be done by hand and notarized.
- More widespread use for credit cards to pay fees.
- All states should have uniform website format. Paper forms had similar layout, saved time spent reading the forms.
- When system goes down on evenings or weekends, have support staff available to fix it.
- All states/permits should have electronic credentialing; some still require manual processing.
- "Other" permits could be more standardized.
- More items available electronically in more states. More uniformity among states in terms of availability of credentials.
- Hard copy credentials: As incentive to obtain new, replace and renew on-line, no hard copy credential (e.g., hazmat, triples permits, mileage/tax permits, etc.) would be issued. Idaho already does this for their Hazardous Materials permit.
- More states could offer it and some states offer it in an easier format than others.

Respondents provided the following comments when asked: ***Are there any other business benefits or disadvantages of electronic credentials administration or permitting that we have not covered, which you want to comment on?***

- If you run into a problem while e-filing that you cannot fix, you need to physically visit the state office for help. It would be nice to be able to call a help line.
- When we added vehicles into the system [using paper-based credentialing], temporary registration may not arrive for 2 to 3 days. Now they can print them immediately. Dramatic improvements are in turn-around time, not internal efficiencies. Some companies don't have the money to work into a system.
- If you have to call the state to have them fix something, and they are not there to answer, it can be time-consuming. We have to call approximately 25 percent of the time; we don't get through about 40 percent of the time.
- The readiness of trucks to immediately go on the road is a benefit to our driver retention efforts.
- Obtaining permits online has made my job much easier. Time saver, increased productivity. IRP system is especially simple.
- Disadvantage: keeping staff informed of passwords (25 different divisions). Electronic permits are still a major benefit to my company.
- Benefit: able to see status of permit during processing.
- Accuracy is much improved. Paper process is a more disjointed process with more opportunity for keying errors.

- Some states require similar information (e.g., Year/Make/License State) to be repeated for each addition, whereas other states have a repeat function. If the states could get together for a “Best Practices” meeting, I think everyone would benefit.

6.2 Qualitative Responses for Electronic Screening

For electronic screening, 24 out of 32 companies responding (75 percent) do use some kind of transponder-based preclearance or automated weigh station bypass technology. Of those, many carriers reported having almost all of their company-owned trucks equipped with a transponder, and slightly fewer of the owner-operated trucks within their company equipped with a transponder for electronic screening.

In all, 17 out of 22 respondents (77 percent) reported that their companies had recovered their startup costs by adopting e-screening. Respondents gave the following comments, when asked: *What kinds of changes in driver productivity has your company seen since joining the preclearance/screening program? (examples: increase or decrease in labor hours per load, or other unit of measure for time savings or productivity changes)*

- Drivers are spending less time stopped; runs are quicker. No guess at how many stops we make per year.
- Time savings; driver retention is most important.
- Driver morale is up.
- Reduced labor and fuel costs.
- Higher efficiency/unit, lower turnover rate—drivers really like transponders, don’t have to carry toll money or fill out reimbursement paperwork.
- Increase in on-time deliveries.
- Savings in transit time, labor savings.
- Decrease in labor hours per load.
- Improve on-time deliveries; less wait time at scales.
- Drivers like it because inspections don’t cut into their hours-of-service allowance.
- Allows drivers to drive more miles so they are happier.
- Less time stopped for clearance.
- Increase in on-time deliveries.
- Drivers are happier.

Similar responses were given to this question: *Has your company seen any other benefits or advantages since joining the preclearance/screening program? (Please specify)*

- Our drivers consider this a benefit that is not always available at other carriers. (Driver retention factor.)
- States give discounts on tolls for using EZPass transponders.
- Hours of service; fuel savings.
- Time savings.
- Decreased turnover.
- Increased retention.

- Driver satisfaction.
- When carrier is audited, easier to figure out discrepancies due to more accurate records. Enables them to have their own internal database for verifying things like hours of service.
- Driver complaints about waiting in lines for scales.
- Some drivers apparently ask whether company has systems, so possibly recruitment benefits.
- Driver satisfaction.
- Drivers seem to really like it.

By contrast, the following responses were given to this question about perceived problems: ***Has your company seen any problems or disadvantages since joining the preclearance/screening program? (Please specify)***

- Some drivers have become lax in their hours-of-service compliance due to relying on the pre-clearance at scales.⁵
- There are no good tracking methods for lost or stolen transponders.
- High turnover rate at company running transponder service. Activation issues have been taken care of.
- No problems, as long as transponders are functioning.
- Drivers take transponders out of trucks and put them into others, which causes problems.
- Program requires some additional administrative work to keep PrePass up to date (which transponder is in which truck).
- Account requires linkage to credit card. Often drivers need to use their own personal credit cards, which can cause problems.

Respondents offered the following comments in response to this question: ***Are there any other business benefits or disadvantages of electronic screening/ preclearance that we have not covered, which you want to comment on?***

- Sometimes transponders interfere with each other. Some drivers cover transponders with foil to prevent interference. FMCSA should declare that all facilities that accept transponders must accept the same one. Need more uniformity and interoperability.
- E-Screening might prompt DOT to leave carriers alone for longer periods of time. It could be a good system for seasoned drivers, but not for new ones.
- Some transponders don't work in certain states; need one nationwide transponder.
- Expensive program in terms of overall cost. Return for dollars invested isn't quantifiable. Necessary for driver retention.
- Overall it enhances business operations.

⁵ In addition to this comment, one other respondent expressed safety concerns regarding e-screening, indicating that within some companies, transponders were viewed negatively as a way for a few unscrupulous drivers to more readily avoid detection of logbook and related hours-of-service violations. This respondent's company allowed its affiliated owner-operators to use transponders, but did not equip its own fleet of trucks with transponders. The respondent was especially concerned that the company's younger, less experienced drivers would use the transponder to skirt the hours-of-service regulations. Only two respondents out of the 38 companies interviewed raised this concern.

- Helps gather data and information that can be used to check on operations of equipment.
- It's a good recruiting tool to mention that you have PrePass in trucks.

Overall, these responses show the kinds of concerns and reservations that would be expected with the deployment of any advanced information technologies for CVO. Overall, however, the subjective reactions of the motor carrier companies contacted for this business case were positive toward CVISN electronic credentialing and electronic screening, with respect to the effects of these two technologies on the companies' business operations.

7. Conclusions and Implications

The economic analysis of CVISN from a motor carrier perspective indicates significant, near-immediate financial benefits to carriers from taking part in electronic (web-based) credentials administration, and substantial benefits to carriers from enrolling their trucks in electronic screening programs or partnerships. The study targeted large motor carriers in states known to be active in CVISN. Almost all of the responding companies (97 percent) participate in electronic credentials administration, and a strong majority of responding companies (75 percent) use some kind of transponder-based preclearance or e-screening technology in their trucks.

7.1 Summary of Findings

The following key findings emerged from the economic and qualitative analysis. All conclusions reflect the information collected from a selection of motor carriers who participated in telephone interviews for this business case.

Electronic Credentialing

- Motor carriers expressed a high degree of satisfaction with their experiences in using electronic credentialing. The respondents unanimously agreed that electronic credentialing had generated net financial benefits to their company and when asked why their company had chosen to move toward electronic credentialing, most indicated that the acceleration of credentialing (26 out of 38 respondents) and labor time savings (24 out of 38 respondents) were the most significant reasons.
- Carriers also highlighted the benefits of integrating computing technology into the credentialing process, either through its ability to reduce errors and the number of corrections needed or the ability to store and track information electronically.
- Startup and annual recurring costs associated with electronic credentialing are minimal. Motor carriers reported in some cases the need to improve hardware (\$50 per motor carrier), obtain computer technical support (1 hour at \$75 per hour), and incur other training-related costs (\$150). Total startup costs are estimated at \$275 per carrier, and annual recurring costs are estimated at \$125 per company.

- On the benefit side, motor carriers indicated that on average, electronic credentials accelerated the time required to place new trucks into service by an average of 3 to 4 days, at a savings of \$371 per truck. This savings is based on the finance charges accruing on vehicles as they await credentials. Increased fleet utilization is the most significant benefit associated with electronic credentialing resulting in \$413,065 in savings to the average motor carrier in the first year of the analysis time horizon.
- The second largest benefit associated with electronic credentialing is reduced labor costs. On average, companies save 10 to 12 minutes per transaction resulting in labor cost savings of \$4.13 per transaction. Cost savings associated with materials (e.g., paper, envelopes) and postage not used in electronic transactions were estimated to reduce costs by an additional \$1 per transaction. The transaction-based benefits (labor, materials, and postage) result in approximately \$12,855 in savings in the first year of using electronic credentialing.
- Over the 10-year ROI time horizon, total net benefits per carrier are estimated at \$3.6 million, resulting in an overall return on investment of 2,971:1 and a payback period of less than one month.
- A theme that emerged from the notes and comments based on the telephone interviews was that carriers desire increased uniformity in credentialing processes across jurisdictions.
- While carriers were generally satisfied with the level of technical support they receive when solving problems in electronic credentialing, some carriers expressed a desire for 24 hour/day availability of credentialing systems and support personnel.
- Some carriers cited the improved turnaround time provided by electronic credentialing as a factor in increased office efficiency and improved driver satisfaction and retention.

Electronic Screening

- Time savings and labor cost savings were the top two reasons cited for participating in electronic screening programs.
- Quicker delivery times, reduced wear and tear on vehicles, and enhanced safety were also cited.
- A number of respondents advocated for greater uniformity and interoperability in electronic screening programs. One carrier noted that with competing electronic screening programs and toll roads, a single truck can be equipped with five or more transponders. Other carriers noted that sometimes transponders interfere with each other.
- The time savings per bypass was estimated at 3 to 5 minutes based on prior studies. The motor carriers contacted for this study, however, indicated that time savings per bypass could reach as high as 20 minutes.

- The operating cost savings (for the motor carrier company) per bypass was estimated to be \$8.68, which is the product of the estimated time savings per bypass and documented heavy truck operating costs per minute. Total net benefits associated with electronic screening over the 10-year analysis time horizon ranged from \$3.2 million to \$219.4 million per company.
- Enrolled motor carriers are experiencing significant returns on their investment in electronic screening technologies, with ROI ratios for all but one of the companies evaluated ranging from 6.1:1 to 15.9:1. In all cases, the payback period for e-screening was less than one year.
- The annual net benefit per transponder-equipped truck was estimated at \$1,169.
- Electronic screening is perceived as a significant enhancement for driver satisfaction and morale improvement, helping motor carriers recruit and retain drivers. This in turn reduces the cost of driver training. Screening is also perceived to be beneficial because drivers that bypass scales have less nonproductive downtime that counts against their hours-of-service allowances.
- Some carriers expressed interest in a simpler, universal, “nationwide” transponder.

General Conclusions

- The economic benefits of CVISN as reported by the carriers in dollar terms match consistently with the most important benefits as perceived by the carriers. That is, the carrier representatives responding to this survey appear to have an accurate understanding of the business benefits associated with CVISN deployment.
- The industry analysis indicates that, while only about half of responding motor carrier companies recognize the abbreviation “CVISN” per se, there is within the industry an awareness of and a positive business attitude toward the underlying technologies that constitute CVISN.

7.2 Implications for Future Research

By design, CVISN technologies have historically tended to be adopted first by larger trucking companies, which are in a better position to realize economies of scale from the deployment of computer-based information technologies and intelligent transportation systems focused on interstate operation. Future research could explore the ways in which CVISN technologies could be adapted to better meet the business needs of smaller motor carrier fleets and owner-operators. These smaller companies might, for example, conduct credentialing transactions only once per year for fewer than 20 power units, so it may be more difficult for them to justify the time required to convert from paper-based to electronic credentialing methods.

This business case has provided an outline of the reasons—both pro and con—that carriers use when deciding whether to adopt CVISN technologies for their companies. Survey respondents may have many motives, beyond the reasons given in a brief telephone interview, for the complex business decisions they make. Future market-type research could attempt to tease out the underlying business principles and practices that attract some companies to new technology for safety, administration, and operations, while causing other companies to delay their adoption. Results of this research could be used in planning ITS deployments in both the public and private sectors to match carriers' business needs, and in representing the service offerings through outreach, education, and information exchange intended to appeal to the motor carrier industry. The results may also be useful in refining services offered by states and vendors in plans for Expanded CVISN, the FMCSA's Comprehensive Safety Analysis (CSA) 2010 initiative, vehicle-infrastructure integration (VII), Electronic Freight Management, Wireless Roadside Safety Inspections for Trucks and Buses, and other initiatives.

CVISN technologies may eventually be further integrated and coordinated with other services and necessary on-board equipment, such as electronic cargo seals, hazmat tracking systems, homeland security and customs enforcement systems, and emission monitors. Significant benefits may be found in capitalizing on the synergies of state and federal programs, coupled with private-sector telematics and mobile resource management.

State transportation, public safety, and law enforcement officials can use the results of this business case to aid in planning the kinds of credentialing and screening programs to make available to motor carriers operating within their states, and to help decide which features or services should be included in future modifications of existing ITS initiatives such as CVISN.

Federal transportation officials and commercial vehicle operations analysts can use the results of this business case when deciding which technologies show the greatest promise of providing tangible benefits to the motor carrier industry, relative to the costs companies incur in deploying and operating such technologies. The industry perspective in turn feeds into a fuller understanding of how ITS can benefit society in general, through increased transportation safety, efficiency, and mobility.

An area of future research worth consideration is the attitude of the motor carrier industry toward economic payback for technology investments. The results of this analysis suggest that the payback period for moving to electronic credentialing is very short—less than 1 month. The payback period for initial investments in electronic screening is also quite short at less than 1 year, though much of the expense is tied to recurrent monthly fees paid to electronic screening partnerships and programs. These results indicate that these technologies are extremely cost beneficial to motor carriers.

Motor carriers, however, may have different expectations relating to payback periods when making decisions to invest in technologies. Thus, it would be extremely useful to gauge these expectations through motor carrier surveys designed to construct payback period curves, where the cumulative share of the motor carrier industry would be charted on the x-axis against payback period expectations on the y-axis. The point of this exercise would be determine what share of the industry would adopt a new technology given a 3-month, 6-month, 1-year, or 2-year

payback period, etc. Results in other industries suggest that most consumers generally require payback periods of no more than 1 to 2 years to make the investment. If payback is delayed until the third year, there are few consumers who would be likely to invest in the technology. When considering private-sector investments in CVISN, it would be instructive to understand the industry's expectations in order to place the findings of the business case in some context.

Other business factors affecting adoption of CVISN technologies may also come into play, including the need for education and outreach to the industry, so that more carriers know about the technologies (and the benefits) available to them in the states where they operate. Many motor carriers work on very narrow profit margins, and some may tend to focus on the cost side of the technology deployment equation. Some motor carriers may not recognize the value of the future benefits of technology to their particular operation, for example, the time that can be saved through electronic credentialing and screening, and the monetary value of this time savings.

In terms of research methodology, future work in the area of economics of ITS should focus on improved methods of surveying and obtaining real-world business information from a random, representative sample of motor carrier companies. Judging from the low rate of response (approximately 14 percent), the industry representatives contacted for this study appeared to be reluctant to take part in an unannounced, ad hoc telephone survey, despite repeated callback attempts and voice mail/e-mail messages left with carriers, in an attempt to increase the response rate.

Gaining buy-in among the industry in advance of survey initiation—with reassurance, for example, that information sharing will not harm any one company's competitive position—might help analysts collect meaningful data from a larger population of motor carriers and might lead to more representative and significant conclusions.

8. References

Brand, D., T.E. Parody, J.E. Orban, and V.J. Brown (2002). Benefit-Cost Analysis of the Commercial Vehicle Information Systems and Networks Program. Transportation Research Record: Journal of the Transportation Research Board, No. 1800, TRB, National Research Council, Washington, D.C., pp. 35-43.

FHWA (March 2002). Evaluation of the Commercial Vehicle Information Systems and Networks (CVISN) Model Deployment Initiative. Volume 1. Prepared by Battelle for the U.S. Department of Transportation, ITS Joint Program Office. Contract No. DTFH61-96-C-00077, Task Order No. 7703. Available at http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13677.html.

FHWA (March 2006). A Business Case for CVISN. Report prepared by Cambridge Systematics for Federal Highway Administration, U.S. Department of Transportation, Washington, DC. Report No. 7091.621.

FHWA (February 23, 2007). Task Order Plan for Economic Analysis and Business Case for Motor Carrier Industry Support of CVISN (Commercial Vehicle Information Systems and Networks). Prepared by Battelle for U.S. Department of Transportation, Federal Highway Administration, Federal Motor Carrier Safety Administration, Contract No. DTFH61-02-C-00134, Task Order BA34022.

FMCSA (September 2004). CVISN Electronic Credentialing for Commercial Vehicles in Washington State: A Case Study, V. J. Brown and J. E. Orban, Battelle report to U.S. Department of Transportation, FHWA and FMCSA, EDL # 13980, Contract DTFH61-02-C-00134, Task Order BA34004, available at http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/13980_files/washington.pdf.

FMCSA (September 2007). CVISN Business Case Summary Report. Prepared by Battelle for U.S. Department of Transportation, Federal Highway Administration, Federal Motor Carrier Safety Administration, Contract No. DTFH61-02-C-00134, Task Order BA34022.

JHU APL (February 2000). Introductory Guide to CVISN, prepared by K. Richeson, Johns Hopkins University Applied Physics Laboratory for the U.S. Department of Transportation FMCSA and ITS JPO, POR-99-7186, Preliminary Version P.2, available at: http://cvisn.fmcsa.dot.gov/downdocs/cvisndocs/guides/intro_p2/pdf_all1/intro_p2full.pdf.

Murray, Dan. American Transportation Research Institute, e-mail communication with P. Balducci and V. Brown, Battelle, July-September 2007.

Oregon Department of Transportation, Motor Carrier News, Salem, OR. September 2006. <http://www.oregon.gov/ODOT/MCT/docs/906.pdf>

PrePass. 2007. What is PrePass? Available at <http://www.prepass.com/whatsprepass.htm>.

PRNewswire. 2006a. Run With the Big Dogs!!! Cooperative BestPass/PrePass Offering Levels Playing Field for Small Fleets and Owner Operators. Available at http://www.cvo.com/press_releases/2006/082506.htm.

PRNewswire. 2006b. Illinois Honored for Intelligent Transportation System Leadership PrePass[®] Saves IL Businesses \$54.9 million. Available at <http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/06-26-2006/0004387288&EDATE=>.

PRNewswire. 2006c. Missouri Honored for Intelligent Transportation System Leadership PrePass[®] Saves Missouri Businesses \$32.1 million.

PRNewswire. 2006d. WY Honored for Intelligent Transportation System Leadership PrePass[®] Saves WY Businesses in Excess of \$16.7 million. Available at http://www.itsa.org/industry_member_news_content/c219_d407/News/Industry_amp_Member_News.html.

PRNewswire. 2006e. Nebraska Honored for Intelligent Transportation System Leadership PrePass[®] Saves NE Businesses in Excess of \$8.9 million.

PRNewswire. 2006f. California Honored for Intelligent Transportation System Leadership PrePass[®] Saves CA Businesses in Excess of \$139.5 million Since Deployment. Available at [http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/06-19-2006/0004383050&EDATE=.](http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/06-19-2006/0004383050&EDATE=)

U.S. OMB (October 1992). Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Circular A-94, revised, U.S. Office of Management and Budget. Washington, D.C.

Walton, M.C. (2002). Delivering Cutting Edge ITS: Truckers and States Enjoy the Many Benefits of PrePass. Transportation Management and Engineering. Volume 7, No.4.

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Appendix A. Interview Guide

CVISN Motor Carrier Business Case Contract DTFH61-02-C-00134, Task Order BA34022

March 15, 2007

I-1	Name of Interviewer	
I-2	Date of First Contact	
I-3	Dates of Second & Subsequent Contacts	
I-4	Status of Messages/Callback	
I-5	Date of Interview	
I-6	Time of Interview	
I-7	Respondent Company	
I-8	Location of Respondent Company (number, street, city, state, ZIP)	
I-9	Name of Respondent(s) for Credentialing	
I-10	Job Title of Respondent(s) for Credentialing	
I-11	Phone Number(s) of Respondent(s) for Credentialing	
I-12	Name of Respondent(s) for Screening	
I-13	Job Title of Respondent(s) for Screening	
I-14	Phone Number(s) of Respondent(s) for Screening	
I-15	Interviewer Notes or Comments	

Hello, my name is _____ with _____ and we are working on a study for the Federal Motor Carrier Safety Administration. We're trying to understand how two technologies supported by FMCSA affect the trucking industry. FMCSA has asked us to conduct telephone interviews with several trucking companies to better understand how these technologies are being used by motor carriers and how they may improve motor carrier safety and efficiency. All of the information we collect will be kept confidential.

The first technology system is electronically filing online credentials such as IRP, IFTA and other permits. We are also analyzing preclearance or screening programs that use transponder tags installed in trucks to allow them to bypass weigh stations. *[We'd like to talk with you, whether or not your company uses either of these technologies.]*

I'd like to talk with someone at your company who handles IRP and IFTA credentialing and permits and with someone who handles weigh station inspections and preclearance or screening. We have two surveys that should take about 15 minutes each. Are you the appropriate person to speak with?

[If no, ask if the respondent can connect you, or if you may have the other person's contact information for later callback. If respondent asks, we can e-mail, US mail, or fax the survey to the company if preferred.]

Since the technologies are somewhat new to the trucking industry, FMCSA wants to better understand how they benefit motor carriers. We are interested in any business impacts that the technologies might produce for motor carriers, and how satisfied they are with them. We'll use the insights to produce a report on the economics of these two technologies for motor carriers.

Again, any information you provide will be kept confidential, and will be only be integrated with dozens of other carrier responses within the final report. We can send you a copy of the final report if you'd like.

[To Interviewer: If not otherwise marked, go from one question to the very next question. Be on the lookout for and flag any memorable quotes as you go, so you can ask for permission to quote the respondent at the end.

CODING KEY: Y=YES; N=NO; DK=DON'T KNOW; REF=REFUSED OR DECLINED TO ANSWER, HAD NO COMMENT]

[COMPANY DEMOGRAPHIC CHARACTERISTICS]

[Note to interviewer: In some cases, not all demographic questions may be answerable by just one respondent. Make sure to revisit any unanswered questions in this section with the second respondent interviewed at a given company, as appropriate.]

D-1. Is your company INTERSTATE or INTRASTATE? DK REF

If INTERSTATE, go to D-2. Otherwise, go to D-3.

D-2. In about how many states is your company licensed to operate? _____ DK REF

D-3. Is your company primarily a FOR-HIRE, PRIVATE FLEET, or BOTH? DK REF

D-4. Are your operations primarily TRUCKLOAD or LESS-THAN-TRUCKLOAD? DK REF BOTH

D-5. What are your two most common trailers used? (mark a "1" next to most common; "2" next to second most common)

- a. Dry freight van
- b. Refrigerated van
- c. Tank (liquid, gas, or dry bulk)
- d. Flatbed or specialized truck
- e. Straight truck (single-unit)
- f. Other trailer type (please specify) _____
- g. DK
- h. REF

D-6. Approximately how many commercial truck tractors (or power units) is your company responsible for, including company-owned, leased, and owner-operator power units? (number) _____ DK REF

D-7. The technologies we are analyzing are part of a state and FMCSA program known as “CVISN,” which stands for “Commercial Vehicle Information Systems and Networks.” Are you familiar with the term “CVISN”? YES NO DK REF

If **Y**, then go to **D-8**. Otherwise go to **C-1**.

D-8. How would you describe the CVISN program, what have you heard about it (e.g., from other companies), and do you have any opinions about it? _____

[CREDENTIALING]

C-1. For the majority of credentials (*examples: IRP, IFTA, state registration, and special permits*) that your company obtains, does your company OBTAIN ITS OWN credentials, or use a BROKER OR SERVICE BUREAU? DK REF

If “broker/service bureau” then go to **C-25**. Otherwise, go to **C-2**.

C-2. In some states, trucking companies can use the internet to obtain operating credentials electronically, instead of using mail, motor vehicle bureaus, or going in-person to a government office. Has your company ever used the internet for electronic credentialing? YES NO DK REF

C-3. Are you aware of any other motor carriers that use this kind of system? YES NO DK REF

If the respondent has used electronic credentialing go to **C-4**. Otherwise, go to **C-20**.

[QUESTIONS FOR COMPANIES THAT NOW USE ELECTRONIC CREDENTIALING TO GET THEIR OWN CREDENTIALS]

C-4. Approximately *how many* **electronic** transactions does your company complete in a typical year, for each of the following kinds of credentials or permits? A *transaction* is defined as the process of obtaining new registrations, renewals, or supplemental credentials for one or more tractors (power units).

- a. Number of IRP Credential Transactions _____
- b. Number of IFTA Credential Transactions _____
- c. Number of All Other Permit and Credential Transactions _____
- d. DK
- e. REF

C-5. In reference to IRP credentials, IFTA credentials, and other kinds of permits, approximately *what percentage* of each kind were processed (*applied for, paid for, received, printed*) **electronically** at your company in the past year? This includes all of your company’s activities required to get each kind of credential or permit (*for example, new, renewal, supplemental, quarterly, single-trip, etc.*).

- a. % IRP electronically _____
- b. % IFTA electronically _____
- c. % All Others electronically _____
- d. DK
- e. REF

C-6. In preparing for electronic/internet credentialing, please estimate all of the “**startup**” costs your company incurred in terms of DOLLARS and/or LABOR HOURS (staff time).

		Dollars	Labor Hours	DK	REF
a.	Hardware expenses (computer/modem/printer)				
b.	Computer technical support				
c.	Company registration				
d.	System training				
e.	Network connection fees				
f.	Other? Please Specify				

C-7. Do you believe your company has recovered its **startup costs** for using computer-based credentialing, in terms of dollar savings or staff time savings? YES NO DK REF

C-8. Please estimate all of the **ongoing costs** your company incurs associated with electronic/internet credentialing, in terms of DOLLARS and/or LABOR HOURS (staff time) PER YEAR.

		Dollars	Labor Hours	DK	REF
a.	Hardware maintenance				
b.	Computer technical support/upgrades				
c.	Training (e.g., new staff)				
d.	Network access/service fees				
e.	Other? Please specify				

C-9. Do you believe your company typically recovers its **ongoing costs** for using computer-based credentialing, in terms of dollar savings or staff time savings? YES NO DK REF

C-10. What were the two or three main reasons that your company decided to start using electronic credentialing?

- a. Labor time savings
- b. Acceleration of credentialing (getting trucks on the road faster)
- c. Reductions in errors and corrections needed
- d. Savings in postage/materials
- e. Ability to track and store information electronically
- f. Other? _____
- g. DK
- h. REF

C-11. For what percentage of your electronic filings do you need to seek technical assistance? _____ percent DK REF

C-12. Have you been able to get technical assistance in a timely fashion? YES NO DK REF

C-13. How would you characterize the quality of the technical assistance you were given? _____

DK REF

C-14. Do you also have experience using manual paper-based credentialing? YES NO DK REF

C-15. How much **staff time** would you estimate your company typically spends on getting credentials for your trucks, using **electronic** filing (and if known, via the old **paper methods**), in terms of MINUTES or HOURS of staff labor PER POWER UNIT or PER TRANSACTION?

Staff Time Needed (MINUTES or HOURS)
(specify *per power unit* or *per transaction*)

		For electronic filing	If known, for paper filing	Savings	DK	REF
a.	IRP Transactions					
b.	IFTA Transactions					
c.	Other credentials and permit transactions					

C-16. What is the typical truck **turn-around time** at your company when using **electronic** credentialing (time from the first steps in filling out credentialing paperwork to completion/truck on the road), compared to the old **paper methods** (if known), in terms of HOURS or DAYS PER TRANSACTION?

Truck Turn-Around Time (HOURS or DAYS)
(*per transaction*)

		For electronic filing	If known, for paper filing	Savings	DK	REF
a.	IRP Transactions					
b.	IFTA Transactions					
c.	Other credentials and permit transactions					

C-17. Have any **other kinds of operating costs** not already discussed either **increased** or **decreased** for your company as a result of using computer-based credentialing? If possible, please estimate the total cost savings or increase associated with the following cost elements, on a per-transaction basis.

Cost Type	Change in Per Transaction Cost (\$)		No Change
	Lower Costs	Higher Costs	
a. Material (envelopes and other materials)			
b. Mailing Expenses (i.e., postage)			
c. Other			
d. Other			
e. Other			
f. Other			
g. DK			
h. REF			

C-18. Are there any features of the electronic credential filing process that could be improved?
 YES NO DK REF

If Y, go to **C-19**. If no, go to **C-28** (Closing questions for the credentialing section).

C-19. What features, and how could they be improved? _____

DK REF

Go to **C-28** (Closing questions for the credentialing section).

[QUESTIONS FOR COMPANIES THAT GET THEIR OWN CREDENTIALS, BUT DO NOT NOW USE ELECTRONIC CREDENTIALING]

C-20. How much time would you estimate it took your company's staff to process all of its credentials in the past year? [*examples: IRP, IFTA, state registration, and special permits*]
 _____ (*specify units of measure, e.g., annual full-time equivalents; total labor hours per year; or hours per power unit owned*) DK REF

C-21. Are there any features of your current process (ELECTRONIC MANUAL) for obtaining commercial vehicle credentials that could be improved? YES NO DK REF

If Y, go to C-22. Otherwise, go to C-23.

C-22. What features, and how could they be improved? _____

DK REF

C-23. Has your company ever considered using a computer to get credentials?
 YES NO DK REF

C-24. What were the main factors that your company used [*or would use*], **pro** or **con**, in deciding whether to start **filing electronic** credentials? (*check up to 3 of the most important factors: wait for spontaneous answers; if none, offer the list below as ideas*)

	Factor	Pro	Con
a.	Labor time savings		
b.	Acceleration of credentialing		
c.	Reductions in errors and corrections needed		
d.	Ability to track and store information electronically		
e.	Savings in postage/materials		
f.	Startup costs		
g.	Cost to use the system once installed		
h.	Need for staff training to learn the system		
i.	Availability of staff to use the system		
j.	Confidentiality of company records		
k.	Kinds of credentials that can be obtained electronically		
l.	Electronic funds transfer issues		
m.	Level of technical support from the state		
n.	System suited to my scale of business		
o.	Availability of system outside normal business hours		
p.	Experiences of other trucking companies who have used the system		
q.	Other factor(s). Please specify		
r.	DK or REF		

Go to C-28 (Closing questions for the credentialing section).

[QUESTIONS FOR COMPANIES THAT USE A SERVICE BUREAU OR CREDENTIALING BROKER]

C-25. Does the service bureau that handles your company's credentialing file your credentials electronically? YES NO DK REF

If Y, go to **C-26**. Otherwise, go to **C-28** (Closing questions for the credentialing section).

C-26. How does the service bureau's credential processing time compare to the time required for your company to process its own credentials?

SHORTER WITH SERVICE BUREAU or SHORTER WHEN PROCESSING IN-HOUSE
DK REF

C-27. How does the cost of using a bureau compare to your company processing its own credentials?

LOWER COST WITH SERVICE BUREAU or LOWER COST WHEN PROCESSING IN-HOUSE
DK REF

[CLOSING QUESTIONS FOR ALL RESPONDENTS AT THE END OF THE CREDENTIALING SECTION]

C-28. What have you heard from other motor carrier companies about the benefits or disadvantages of electronic credentialing? _____

DK REF

C-29. Are there any other business benefits or disadvantages of electronic credentials administration or permitting that we have not covered, which you want to comment on?

DK REF

C-30. Do you have any questions about credentialing for me, [*before we move on to the preclearance/screening questions?*] _____

DK REF

Go to **G-1** (General Closing Remarks) unless the same respondent will be answering the electronic preclearance/prescreening section (**S-1**).

[ELECTRONIC PRECLEARANCE/PRESCREENING; MAY BE A DIFFERENT RESPONDENT THAN CREDENTIALING SECTION]

S-1. How much operating time would you estimate that **one** of your company's trucks typically loses while waiting to be weighed or inspected? (*minutes per truck per stop; can be a range*) _____ DK REF

S-2. About how many Level I (standard—driver, vehicle, and load) inspections (federal, state, local) does **each** of your company's trucks get in an average year? (*number of inspections/truck/year*) _____ DK REF

****See attachment for definitions of inspection levels if needed.*****

S-3. Do any of the trucks your company is responsible for use preclearance services where transponder tags are installed in the cab to communicate with roadside systems that allow the truck to bypass some weigh and inspection stations? (*red light/green light in the truck cab*) YES NO DK REF

If Y, go to **S-4**. Otherwise, go to **S-16**.

S-4. If so, about how many (*or what percentage*) of your company's trucks have a preclearance transponder installed?

For company-owned/leased units _____ DK REF

For owner-operator units _____ DK REF

(*specify whether count or percent; data analyst refer to D-6 for total numbers of trucks operated by respondent's company*)

[QUESTIONS FOR COMPANIES NOW IN ELECTRONIC SCREENING]

S-5. Which screening program(s) or partnership(s) does your company belong to? (*check as many as apply*)

- a. HELP/PrePass
- b. Norpass
- c. Oregon Green Light
- d. Other (please specify) _____
- e. DK
- f. REF

S-6. Can you estimate the approximate total **startup costs** in terms of DOLLARS and/or LABOR HOURS (staff time) that your company expended to join the screening program or partnership?

	Dollars	Labor Hours	DK	REF
a. Membership fees				
b. Transponder hardware				
c. Other hardware				
d. Staff training time				
e. Other? Please specify				

S-7. Do you believe your company has recovered its startup cost for joining the screening program or partnership, in terms of either operating cost or staff labor cost savings?
 YES NO DK REF

S-8. What were the two or three main reasons your company decided to start using electronic screening?

- a. Time savings
- b. Labor savings for drivers
- c. Quicker deliveries
- d. Reduced wear and tear from stop/start
- e. Increased safety from fewer stops, starts, and merges
- f. Other? _____
- g. DK
- h. REF

S-9. Please estimate your company's **ongoing costs** per year to stay in the preclearance/screening program, in terms of DOLLARS or LABOR HOURS (staff time) PER YEAR.

	Dollars	Labor Hours	DK	REF
a. Annual subscription fees and/or bypass/transaction fees				
b. Transponder maintenance				
c. Other hardware maintenance				
d. Staff training				
E, Other? Please specify				

S-10. Does your company pay its commercial drivers mainly by the mile, by the hour, or by some other method?

- a. By the mile
- b. By the hour
- c. Other payment method (please specify) _____
- d. DK
- e. REF

***** *These next three questions ask you to compare your business operations now with your operations before you began the preclearance/screening program. The questions assume that other aspects of your operation stayed basically the same during that change.*

S-11. What kinds of changes in driver productivity has your company seen since joining the preclearance/screening program? (*examples: increase or decrease in labor hours per load, or other unit of measure for time savings or productivity changes*) _____

DK REF

S-12. What kinds of changes in scheduled delivery times can you credit to the preclearance/screening program? (*examples: average increase or decrease in hours or days per load delivered*) _____

DK REF

S-13. What kinds of changes in operating and maintenance costs (*examples: non-labor costs, such as fuel consumption, brake repair*) has your company seen that can be attributed to the preclearance/screening program? (*examples: dollars per year for whole company or dollars per power unit per year*) _____

DK REF

S-14. Has your company seen any other benefits or advantages since joining the preclearance/screening program? (*Please specify*) _____

DK REF

S-15. Has your company seen any problems or disadvantages since joining the preclearance/screening program? (*Please specify*) _____

DK REF

Go to S-19 (Closing questions for screening section).

[QUESTIONS FOR COMPANIES NOT NOW ENROLLED IN SCREENING]

S-16. Has your company ever considered joining a transponder-based preclearance/screening program? YES NO DK REF

S-17. What were the main factors that your company used *[or would use]*, **pro** or **con**, in deciding whether to **join a screening program**? *(check up to three of the most important factors: wait for respondent to supply spontaneous answers; if none, offer the list below as ideas)*

	Factor	Pro	Con
a.	Time and cost savings		
b.	Labor savings for drivers		
c.	Quicker deliveries		
d.	Reduced wear and tear from stop/start		
e.	Safety factors		
f.	Startup cost of joining the program or partnership		
g.	Recurring (monthly) or transaction costs of participating		
h.	Data privacy concerns		
i.	Driver issues (Please specify)		
j.	Regulatory concerns (Please specify)		
k.	Other factors (Please specify)		
l.	DK or REF		

S-18. Please list the top three changes that a preclearance/screening program would need to make, to increase the likelihood of your company participating in a preclearance/screening program in the future *(check up to three of the most important factors: wait for respondent to supply spontaneous answers; if none, offer list below as ideas)*

	Factor	Spontaneous	Prompted
a.	Coverage in all states where my company operates		
b.	Universal transponder that works in all states		
c.	Universal transponder that works for preclearance and tolls		
d.	No charges for bypasses/monthly charges		
e.	Increase in data privacy or security		
f.	Other change (Please specify)		
g.	DK or REF		

Go to S-19 (Closing questions for screening section).

[CLOSING QUESTIONS FOR SCREENING SECTION]

S-19. What have you heard from other motor carrier companies about the benefits or disadvantages of electronic screening/preclearance? _____

DK REF

S-20. Are there any other business benefits or disadvantages of electronic screening/preclearance that we have not covered, which you want to comment on? _____

DK REF

S-21. Do you have any questions for me, on any of the topics we have talked about?
_____ DK REF

Go to G-1 (General Closing Remarks).

[GENERAL CLOSING REMARKS]

G-1. Thank you for taking the time to participate in this study. We hope to use the information you have provided us with to enhance the ability of advanced technologies to serve the needs of the trucking industry.

Would you like us to send you a copy of the completed report? YES NO DK REF
(If Y, confirm respondent's address as recorded at Question I-8 above.)

[Next part is only if applicable]

G-2. As I said earlier, all answers will remain confidential. FMCSA has asked us to be on the lookout for good anonymous quotes to use in describing and evaluating new technologies. Do you mind if we use quotes from your answers? Quotes will not identify you or your company.
YES NO DK REF

[Interviewer: Find & flag memorable quotes in the survey responses; verify that the quote is correct and indicate by the quotation whether we have the respondent's permission to quote anonymously.]

[Only if Respondent asks:]

G-3. For more information, you can call [insert research contractor name]; or Jeff Secrist at FMCSA, 202-385-2367.

INSPECTION LEVELS DEFINED [FOR REFERENCE ONLY, IF NEEDED]

The North American Standard Truck Inspection procedures have identified six levels of inspections.

LEVEL I - North American Standard Inspection - An inspection that includes examination of driver's license, medical examiner's certificate and waiver, if applicable, alcohol and drugs, driver's record of duty status as required, hours of service, seat belt, vehicle inspection report, brake system, coupling devices, exhaust system, frame, fuel system, turn signals, brake lamps, tail lamps, head lamps, lamps on projecting loads, safe loading, steering mechanism, suspension, tires, van and open-top trailer bodies, wheels and rims, windshield wipers, emergency exits on buses and HM requirements, as applicable.

LEVEL II - Walk-Around Driver/Vehicle Inspection - An examination that includes each of the items specified under the North American Standard Inspection. As a minimum, Level II inspections must include examination of: driver's license, medical examinees certificate and waiver, if applicable, alcohol and drugs, driver's record of duty status as required, hours of service, seat belt, vehicle inspection report, brake system, coupling devices, exhaust system, frame, fuel system, turn signals, brake lamps, tail lamps, head lamps, lamps on projecting loads, safe loading, steering mechanism, suspension, tires, van and open-top trailer bodies, wheels and rims, windshield wipers, emergency exits on buses, and HM requirements, as applicable. It is contemplated that the walk-around driver/vehicle inspection will include only those items which can be inspected without physically getting under the vehicle.

LEVEL III - Driver-Only Inspection - A roadside examination of the driver's license, medical certification and waiver, if applicable, driver's record of duty status as required, hours of service, seat belt, vehicle inspection report, and HM requirements, as applicable.

LEVEL IV - Special Inspections - Inspections under this heading typically include a one-time examination of a particular item. These examinations are normally made in support of a study or to verify or refute a suspected trend.

LEVEL V - Vehicle-Only Inspection - An inspection that includes each of the vehicle inspection items specified under the North American Standard Inspection (Level I), without a driver present, conducted at any location.

Roadside Inspections - A roadside inspection occurs when a Motor Carrier Safety Assistance Program (MCSAP) inspector conducts an examination on individual commercial motor vehicles and drivers to determine if they are in compliance with the Federal Motor Carrier Safety Regulations (FMCSRs) and/or Hazardous Materials Regulations (HMRs.) Serious violations result in the issuance of driver or vehicle out-of-service (OOS) orders. These violations must be corrected before the affected driver or vehicle can return to service. Traffic enforcement violations may also be recorded in conjunction with a roadside inspection.

Source: <http://ai.volpe.dot.gov/ProgramMeasures/RI/NR/NIL/Report.asp?RF=D>

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Appendix B. Calling List Development and Interview Methods

Two separate lists of motor carrier companies to contact were developed. The primary source for the first calling list was the FMCSA Motor Carrier Management Information System (MCMIS) census file, as of September 30, 2006. The MCMIS list was chosen as the most current, complete source of contact information on all motor carriers subject to federal regulation. It was hoped that the MCMIS census file would give the research team a fair cross-section of the motor carrier industry.

In an attempt to increase the representation of CVISN-participating motor carriers in the calling pool, the CVISN self-evaluation reports completed by numerous CVISN states (supported on a separate USDOT task order, BA34009) were consulted to identify a set of states that have highly active CVISN program offerings. The motor carrier companies pulled from the MCMIS files had these states as their mailing address.⁶

Table B-1 shows the process that was used to select eight focus states. Some chosen states appeared in only two of the three columns in the table, while other states appearing in all three columns were not chosen. The final set of eight states were chosen in part to provide a manageable sized group, with some level of geographic diversity. For example, Colorado carriers were not included in the final calling list, in part because those from nearby Arizona, New Mexico, and Oklahoma were.

Various records were excluded from the full MCMIS census, to allow the interviews to focus on companies in the for-profit motor freight business and to make the calling process more efficient. The following four MCMIS carrier classifications

- A – Authorized for Hire
- B – Exempt for Hire
- C – Private (property)
- G – US Mail

were the only records included in the selection. This screen excluded companies that primarily transport passengers, trucks owned by government agencies, and trucks whose classification is “Other.” Also, only companies having a telephone number on file in MCMIS were included.

⁶ The state given in the MCMIS mailing address was used, rather than the carrier’s physical location state. For some carriers, the two states are different. Mailing address was taken to be the more likely headquarters or the state where a motor carrier company conducts the bulk of its regulatory and registration/licensing/credentialing transactions.

Table B-1. Selection process for calling motor carriers located in highly active CVISN states. (Carriers from the eight shaded states were chosen from MCMIS census file.)

State is Highly Active in:		
IRP Electronic Credentialing	IFTA Electronic Credentialing	CVISN Electronic Screening
Colorado	Maryland	California
Indiana	North Dakota	Oregon
Kansas	Michigan	Illinois
Arizona	Arkansas	Missouri
Nebraska	Kansas	Florida
Tennessee	Wisconsin	Colorado
Kentucky	Virginia	Kentucky
Maine	Tennessee	Virginia
New Mexico	Arizona	Georgia
Washington	New York	Indiana
Virginia	Colorado	Tennessee
Wisconsin	Alabama	Utah
Oklahoma	Idaho	Arkansas
Alabama	Florida	Arizona
Illinois	New Mexico	Washington
New Jersey	Kentucky	Oklahoma
New York	Nebraska	West Virginia
	Montana	Kansas
	Ohio	New Mexico
	South Dakota	Montana
	Texas	

Source: State CVISN Self-Evaluation Reports, as of early 2007.

The list of 200 MCMIS carriers (25 carriers each from the eight selected states) was supplemented by carriers from two other sources: (1) The sets of carriers subscribing to the HELP/PrePass and Norpass e-screening programs. This represented approximately 50 carriers, based on the programs' respective public web sites as reviewed in early 2007. (2) The largest motor carriers, i.e., those with more than \$200 million in sales, listed in the Hoover's online business information directory, representing approximately 40 carriers. This combined list was matched and merged visually with two other lists:

- The second set of carriers identified through proprietary trade association sources (approximately 80 carriers)
- The set of approximately 1,800 motor carriers from the MCMIS census file already identified to be contacted in the larger motor carrier survey being conducted concurrently as part of the National CVISN Deployment Program Evaluation (USDOT Task Order BA34007).

Any duplicate records were removed. The final version of this first calling list included 240 motor carrier companies.

The second calling list of approximately 90 motor carriers was developed via a multi-tiered process that collected carrier contact data by sector, geography, and proclivity to be engaged in

CVISN. Specifically, common lists of core CVISN states were used, augmented by carrier “tax & registration” committee lists from state and national trucking associations. These T&R committees focus on operational, financial, and policy issues, with an emphasis on operating credentials. The surveys were e-mailed to each carrier member, with follow-up calls or e-mails. In some cases, interviews were conducted on the first call; otherwise interviews were scheduled at a future date/time. To increase response rates, several state trucking associations faxed out advance notices, urging carriers to be responsive to the survey/interview process.

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Appendix C. Detailed Results from Review of Prior Literature

According to the motor carrier companies contacted as part of the CVISN Model Deployment Initiative (FHWA 2002), companies spend a good deal of staff time in managing and administering their credentials and permitting programs. Adjusting for fleet size, total staff time expended per unit per year varied as shown in Table C-1.

Table C-1. Total in-house staff time expended on credentials administration per year per powered unit (FTE days)

	Mean value (\pm 95% confidence limits)	Median value
11 to 50 power units	1.6 \pm 0.4	2.0
Over 50 power units	1.0 \pm 1.2	0.2

Source: FHWA (2002)

Pre-CVISN and post-CVISN costs and savings from electronic credentialing from three companies contacted for the 2002 study (two in Kentucky and one in Maryland) are identified in Table C-2.

Table C-2. Motor carrier credentialing costs and savings

	Carrier 1		Carrier 2		Carrier 3	
	Cost (\$)	Time (hrs)	Cost (\$)	Time (hrs)	Cost (\$)	Time (hrs)
Pre-CVISN						
New Credential	2334	11	312	6.5	5525	49.3
Credential Renewals	346	17	360	24	344	88.5
Post-CVISN						
New Credential	480	2.2	130	1.4	765	24.5
Credential Renewals	167	7.2	201	11.2	NA	NA
Percent Savings						
New Credential	79%	67%	82%	78%	86%	50%
Credential Renewals	52%	80%	44%	53%	NA	NA
Average Savings	75%	59%	60%	58%	86%	50%

Source: FHWA (2002)

Based on this information, it was estimated that motor carriers participating in pilot tests of electronic credentialing reported saving between 60 and 75 percent of their costs for credentialing, with minimal start-up costs. Start-up costs are limited to a personal computer and most motor carriers use personal computers with internet access on their premises. Communication charges are an additional cost for carriers who did not have internet or email service prior to electronic credentialing. No separate or additional operation and maintenance charges are expected because operating and maintenance costs of equipment and software are covered by service warranties that come with equipment purchase. Motor carriers also reported a time savings of approximately 60% as carriers can print their own credentials without waiting for the mail or traveling to state agency offices. Savings are expected to be higher for new credentials than for renewals because of the additional data entry that accompanies new applications processed via paper based systems.

Results from the FHWA (2002) study were further documented in a peer-reviewed journal article (Brand et al., 2002) to identify whether project benefits to society greatly exceeded project costs. Three road enforcement (RE) scenarios were examined: scenario RE 1 did not include screening, scenario RE 2 included electronic screening with no change in compliance, and scenario RE 3 included screening with improved compliance. Two electronic credentialing (EC) scenarios were modeled: scenario EC 1 involved end-to-end IRP credentialing for those states with in-house credentialing (without Vehicle Information System for Tax Apportionment [VISTA]) systems and EC 2 involved end-to-end IRP credentialing with VISTA. Benefits were estimated with one-time start-up costs in 2000 and to extend through 2025. Net present value of the benefits and costs to carriers and states are reported in 1999 dollars.

Scenario RE 2 and scenario RE 3 identified nationwide benefits to motor carriers in transit-time savings (including O&M and air/noise pollution) of \$4,817,000,000. Scenarios RE 2 and RE 3 identified increased operating cost to carriers of \$2,131,900,000. Increase in OOS costs to carriers was identified as \$19,891,000 for scenario RE 1, \$139,400,000 for scenario RE 2, and \$104,500,000 for scenario RE 3.

Total operating cost savings to carriers for scenario EC 1 was \$56,700,000, for scenario EC 2 was \$18,600,000. Inventory cost savings to carriers for scenario EC1 was \$243,100,000, for scenario EC 2 was \$79,900,000.

The PrePass program for electronic screening is reported to have resulted in fuel cost savings, increase in legal miles traveled, and increased incomes for drivers (Walton, 2002). Walt Keeney, the owner of Food Express, which operates a fleet of 120 power units in the western U.S., has indicated that the time saved from preclearance can add significant miles of legal driving time to each truck per day, which greatly increases productivity.

PrePass benefits have been captured on a programmatic basis by Affiliated Computer Services (ACS), the system integrator and the operator of the PrePass system (PrePass, 2007). Table C-3 illustrates the historical levels of estimated screening activity and cost savings for motor carriers participating in electronic screening.

Review of corporate press releases yielded additional anecdotal evidence on the economic benefits of the PrePass electronic screening System:

- According to Dick Landis, President and CEO of HELP, Inc, which offers the PrePass service, weigh stations cost carriers about \$5.00 for every unnecessary stop (PRNewswire, 2006a).
- Operational in Illinois since 1999, PrePass equipped trucks have complied electronically on the mainline – traveling at normal highway speeds instead of idling in truck inspection facility queues more than 11 million times. In Illinois alone, this has resulted in 915,000 hours of driver time saved; approximately 5.5 million gallons of fuel consumption eliminated; and operational savings for motor carriers and the Illinois shippers they serve of more than \$54.9 million (PRNewswire, 2006b).

Table C-3. Time, fuel, and operational cost savings for motor carriers from PrePass system

Calendar Year	Jurisdiction Benefits	Carrier Benefits		
	Successful Electronic Screening Bypasses	Time Savings Based on 5 min/pull in (Hours)	Fuel Savings Based on 1/2 gal/stop (Gallons)*	Operational Cost Based on \$5/stop (\$ Savings)
2001	14,322,663	1,193,555	7,161,332	\$71,613,315
2002	20,542,294	1,711,858	10,271,147	\$102,711,470
2003	26,639,069	2,219,922	13,319,535	\$133,195,345
2004	35,711,954	2,975,996	17,855,977	\$178,559,770
2005	45,120,415	3,760,035	22,560,208	\$225,602,075
2006	51,124,786	4,260,399	25,562,393	\$255,623,930
Total Since Inception	211,047,599	17,587,300	105,523,800	1,055,237,995
*Iowa State University Center for Transportation Research and Education study found that approximately 0.55 gallons of fuel was being used per stop				

Source: PrePass web site (2007).

- Operational in Kansas City since 2002, PrePass equipped trucks have complied electronically on the mainline – traveling at normal highway speeds instead of idling in truck inspection facility queues more than 6.4 million times. In Missouri alone, this has resulted in 535,000 hours of driver time saved; approximately 3.2 million gallons of fuel consumption eliminated; and operational savings for motor carriers and the Missouri shippers they serve of more than \$32.1 million (PRNewswire, 2006c).
- Operational in Wyoming since 1999, PrePass equipped trucks have complied electronically on the mainline – traveling at normal highway speeds instead of idling in truck inspection facility queues more than 3.3 million times. In Wyoming alone, this has resulted in 279,000 hours of driver time saved; approximately 1.6 million gallons of fuel consumption eliminated; and operational savings for motor carriers and the Wyoming shippers they serve of more than \$16.7 million (PRNewswire, 2006d).
- Operational in Nebraska since 1999, PrePass equipped trucks have complied electronically on the mainline – traveling at normal highway speeds instead of idling in truck inspection facility queues more than 1.8 million times. In Wyoming alone, this has resulted in 147,900 hours of driver time saved; approximately 887,000 gallons of fuel consumption eliminated; and operational savings for motor carriers and the Nebraska shippers they serve of more than \$8.9 million (PRNewswire, 2006e).

- Benefits of PrePass since its inception in California include 2 million hours of driver time saved; approximately 13 million gallons of fuel consumption eliminated; and operational savings for motor carriers they serve, exceeding \$131.5 million (PRNewswire, 2006f).

Appendix D. Return on Investment Worksheets and Instructions

The worksheets below were designed to enable users to examine the return on investment (ROI) associated with using electronic credentialing and electronic screening technologies. Default values are shown on each worksheet based on assumptions outlined in Section 5 of this report.

There are also places where users can enter data. These cells are shaded and are in the “User Input” column. If a user inputs data into these cells, the default values should be ignored. These worksheets are designed to enable the user to update the assumptions underlying the ROI calculations, and to personalize them to ensure that the calculations are directly applicable to his or her company.

The instructions for completing the worksheets refer to lines and boxes in each worksheet. Please note that the columns in the second page (“Benefit Cost Calculations”) of each worksheet are numbered 6 through 14 in the electronic credentialing worksheet and 5 through 10 in the electronic screening worksheet. Letters are assigned to each row in the “Benefit Cost Calculations” tables. When referring to Box 6a, one must go to Column 6, Row (a). All other references are more direct, referring to lines in the preceding tables.

Section 5 of this report defines and discusses the terms used in these instructions and the accompanying worksheets. Note that the annual dollar values in the main report for years 2 through 10 were discounted, but for simplicity, the corresponding dollar values in the accompanying worksheets are not discounted.

Electronic Credentialing Worksheet Step-by-Step Instructions

- Step 1. Either accept the default values or enter new values in Lines 1a through 1c. The discount rate shown in Line 1a is a placeholder only. For simplicity, it is not used in this calculation.
- Step 2. Enter the annual number of IRP, IFTA, and other credentials completed electronically (either the amount currently completed or amount you wish to consider in the calculations) on Lines 2a through 2c. Add Line 2a-2c values and enter result on Line 2d.
- Step 3. Either accept default values or enter startup cost estimates by element on Lines 3a-3f. Add Line 3a-3f values and enter result on Line 3g.
- Step 4. Either accept default values or enter annual recurrent cost estimates by element on Lines 3h-3k. Add Line 3h-3k values and enter result on Line 3l.
- Step 5. Either accept default values or enter new values on Lines 4a-4e, and 4g. You must enter a value for the number of power units operated by your company on Line 4f.
- Step 6. Enter analysis base year from Line 1b in Box 6a. Copy down column adding one year each time – e.g., Box 6b = Box 6a + 1, Box 6c = Box 6b + 1, etc.

- Step 7. Multiply Line 4a and 2d values and enter in Box 7a. Multiply Box 7a value by (1 + Line 1c value) and enter in Box 7b. Continue the operation down the column, thus accounting for growth in the number of vehicles credentialed.
- Step 8. Multiply Line 4b and 2d values and enter in Box 8a. Calculate values for Boxes 8b-8j as outlined in Step 7.
- Step 9. Multiply Line 4c, 4d, 4e, 4f, and 4g ($4c * 4d * 4e * 4f * 4g$) values and enter result in Box 9a. Calculate values for Boxes 9b-9j as outlined in Step 7.
- Step 10. Add Lines 7a-9a and enter result in Box 10a, add lines 7a-9b and enter result in Box 10b, etc. Continue through Box 10k.
- Step 11. Take value from Line 3g and enter it in Box 11a.
- Step 12. Take value from Line 3l and enter it in Box 12a. Calculate values for Boxes 12b-12j as outlined in Step 7.
- Step 13. Add values in Boxes 11a and 12a and enter value in Box 13a. Add values in Boxes 11b and 12 b and enter value in Box 13b. Continue through Box 13j.
- Step 14. Subtract Box 13a from Box 10a and enter result in Box 14a. Continue through Box 14j.
- Step 15. Add Boxes 14a through 14j and enter value in Box 14k.
- Step 16. Take Box 14k value and enter it on Line 5a. This value is not affected by the application of a discount rate.
- Step 17. Divide value on Line 5a by 10 and enter the value on Line 5b. This value is not affected by the application of a discount rate.

The Electronic Credentialing ROI calculation is now complete.

Electronic Screening Worksheet Step by Step Instructions

- Step 1. Either accept the default values or enter new values in Lines 1a through 1c. The discount rate shown in Line 1a is a placeholder only. For simplicity, it is not used in this calculation.
- Step 2. Enter startup cost estimates by element on Lines 2a-2e. Add Line 2a-2e values and enter result on Line 2f.

- Step 3. Enter annual recurrent cost estimates by element on Lines 2g-2l. Add Line 2g-2l values and enter result on Line 2m. Note that in the vast majority of the cases, the most significant cost element is tied to monthly transponder fees. The monthly fees for the PrePass system are highlighted in Section 5 of this report. To calculate the annual cost of these fees, multiply the number of power units equipped with transponders by the monthly fee, and then multiply that amount by 12 in order to convert the monthly fees to an annual amount.
- Step 4. Either accept the default values or enter new values on Lines 3b, 3c, and 3e. There are no default assumptions regarding toll booth bypass systems. You must enter a value for Line 3a in order to complete the ROI analysis. To model the effects of toll booth bypasses, in addition to weigh station bypasses, enter the appropriate values on Lines 3d, 3f, and 3g.
- Step 5. Enter the analysis base year from Line 1b in Box 5a. Copy down column adding one year each time – e.g., Box 5b = Box 5a + 1, Box 5c = Box 5b + 1, etc.
- Step 6. Multiply Lines 3a, 3b, 3c, and 3e ($3a * 3b * 3c * 3e$) and add that amount to the product of Lines 3b, 3d, 3f, and 3g ($3b * 3d * 3f * 3g$). Enter that value in Box 6a. Multiply Box 6a value by (1 + Line 1c value) and enter in Box 6b. Continue the operation down the column, thus accounting for growth in the number of vehicles enrolled in transponder programs.
- Step 7. Take value from Line 2f and enter it in Box 7a.
- Step 8. Take value from Line 2m and enter it in Box 8a. Calculate values for Boxes 8b-8j as outlined in Step 7.
- Step 9. Add values in Boxes 7a and 8a and enter value in Box 9a. Add values in Boxes 7b and 8b and enter value in Box 9b. Continue through Box 9j.
- Step 10. Subtract Box 9a from Box 6a and enter result in Box 10a. Continue through Box 10j.
- Step 11. Add Boxes 10a through 10j and enter value in Box 10k.
- Step 12. Take Box 10k value and enter it on Line 4a. This value is not affected by the application of a discount rate.
- Step 13. Divide value on Line 4a by 10 and enter the value on Line 4b. This value is not affected by the application of a discount rate.

The Electronic Screening ROI calculation is now complete.

Electronic Credentialing ROI Worksheet

	Default	User Input
Economic Assumptions		
1a. Discount rate	7%	
1b. Analysis base year	2007	
1c. Annual growth in truck registrations	3%	

Electronic Credentialing Information		
2a. Annual number of IRP credential transactions		
2b. Annual number of IFTA credential transactions		
2c. Annual number of other permit and credential transactions		
2d. Total number of credential transactions		

Electronic Credentialing Costs to Motor Carriers		
Startup costs		
3a. Hardware expenses	\$50	
3b. Computer technical support	\$75	
3c. Company registration	\$50	
3d. System training	\$100	
3e. Network connection fees	\$0	
3f. Other startup costs	\$0	
3g. Total startup costs	\$275	
Recurrent costs (annual)		
3h. Hardware maintenance	\$0	
3i. Computer technical support	\$75	
3j. System training costs	\$50	
3k. Other costs	\$0	
3l. Total recurring costs	\$125	

	Default	User Input
Assumptions Governing Benefits Estimates		
4a. Labor savings per transaction	\$4.13	
4b. Material and postage costs per transaction	\$1.00	
4c. Acceleration of trucks being placed into service in days	3.5	
4d. Share of fleet comprised of new trucks	15%	
4e. Value of increased fleet utilization per day	\$105.60	
4f. Total number of power units		
4g. Share of new power units obtaining credentials electronically	100%	

Results	
5a. Total 10-year net benefits	
5b. Average annual net benefits	

Benefit Cost Calculations (Electronic Credentialing)								
Year	Benefits				Costs			Annual Net Benefits
	Labor	Materials and Postage	Increased Fleet Utilization	Total	Initial	Recurrent	Total	
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(a)								
(b)								
(c)								
(d)								
(e)								
(f)								
(g)								
(h)								
(i)								
(j)								
(k)	Total							

Electronic Screening ROI Worksheet

	Default	User Input
Assumptions		
1a. Discount rate	7%	
1b. Analysis base year	2007	
1c. Annual growth in truck registrations	3%	

Electronic Screening Costs to Motor Carriers		
Startup costs		
2a. Membership fees		
2b. Transponder hardware costs		
2c. Other hardware costs		
2d. Staff training costs		
2e. Other startup costs		
2f. Total startup costs		
Recurrent costs (annual)		
2g. Annual transponder fees		
2h. Bypass fees		
2i. Transponder maintenance costs		
2j. Other hardware maintenance costs		
2k. Staff training		
2l. Other recurrent costs		
2m. Total recurring costs		

	Default	User Input
Assumptions Governing Benefits Estimates		
3a. Number of power units equipped with transponders		
3b. Heavy truck operating cost per minute	\$2.17	
3c. Annual number of weigh station bypasses per truck	135	
3d. Annual number of toll booth bypasses per truck		
3e. Time saved per weigh station bypass (min)	4	
3f. Time saved per toll booth bypass (min)		
3g. Number of power units with transponders that enable toll booth bypass		

Results	
4a. Total 10-year net benefits	
4b. Average annual net benefits	

Benefit Cost Calculations (Electronic Screening)

	Year	Total Benefits	Costs			Annual Net Benefits
			Initial	Recurrent	Total	
	(5)	(6)	(7)	(8)	(9)	(10)
(a)						
(b)						
(c)						
(d)						
(e)						
(f)						
(g)						
(h)						
(i)						
(j)						
(k)	Total					