Evaluation of the National CVISN Deployment Program

Volume 1
Final Report

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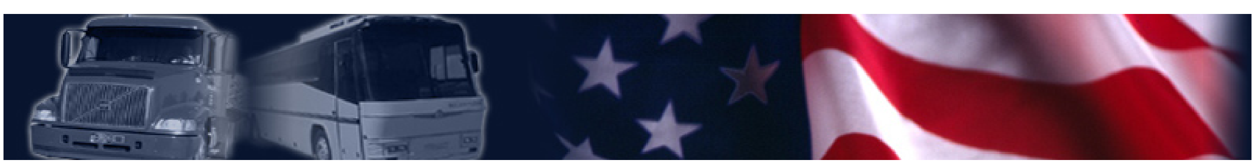

Federal Motor Carrier Safety Administration

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16. Abstract

Commercial Vehicle Information Systems and Networks (CVISN) is a collection of information systems, communications networks, and Intelligent Transportation Systems that support commercial vehicle (large truck) operations. The three main functions of CVISN are electronic credentials administration, safety information exchange, and electronic screening or transponder-based preclearance/bypass programs for roadside weigh/inspection stations. This report presents the results of an independent evaluation of the deployment and operation of CVISN technologies across the U.S. With the main goal of measuring the effects of CVISN on the safety, efficiency, and economics of commercial vehicle operations, four main analyses were performed: motor carrier survey, cost analysis, safety analysis, and benefit-cost analysis. In addition, the current status of CVISN deployment was assessed, and qualitative benefits as reported by transportation and law enforcement officials in states deploying CVISN technologies were summarized. A total of 848 commercial motor carrier companies participated in a national survey. It was found that carriers are generally aware of CVISN technologies, but that, in terms of power units represented in the survey, a much larger proportion take part in electronic credentialing than in electronic screening. Average per-state costs to deploy CVISN for e-credentialing were about $1.35 million; for safety information exchange about $680,000, and for e-screening about $1 million to $2.8 million. If CVISN safety and screening technologies were to be deployed and operated at all weigh stations nationwide, depending on the deployment scenario, approximately 4,000 to 17,000 additional commercial vehicle-involved crashes could be avoided per year, compared to those avoided through current inspection selection practices. This equates to the saving of between 56 and 215 additional lives that otherwise would have been lost in those crashes per year. Economically, a series of nationwide roadside enforcement scenarios provided positive societal benefit-cost ratios ranging from 1.9 to 7.5, and electronic credentialing showed a life-cycle benefit-cost ratio of 2.6. All scenarios were modeled over a 25-year life cycle. Taken together, these results indicate that all aspects of the National CVISN Deployment Program examined in this BCA, when they are deployed, are expected to produce significant net benefits to society and are economically justified.

17. Key Words
Intelligent Transportation Systems, Safety, CVISN, Commercial Truck, Motor Carrier, Inspection, Weigh Station Bypass, Electronic Screening, Law Enforcement, Credentials, Economics, Benefit-Cost Analysis, Survey

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Executive Summary

Commercial Vehicle Information Systems and Networks (CVISN) is a collection of information systems, communications networks, and Intelligent Transportation Systems (ITS) that support commercial vehicle operations (CVO). Through a series of grants, earmark funds, research and development (R&D) funds, and other mechanisms, the Federal Motor Carrier Safety Administration (FMCSA)—in conjunction with the ITS Joint Program Office (JPO), formerly affiliated with the Federal Highway Administration (FHWA) and currently part of the Research and Innovative Technology Administration (RITA)—supports states in the deployment and evaluation of advanced technologies that constitute CVISN programs.

CVISN is explicitly included in §4126 of the highway bill passed by the U.S. Congress in 2005 (SAFETEA-LU):

> ***"The Secretary [of Transportation] shall carry out a commercial vehicle information systems and networks program to—***
> > ***(1) improve the safety and productivity of commercial vehicles and drivers; and***
> > ***(2) reduce costs associated with commercial vehicle operations and Federal and State commercial vehicle regulatory requirements."***

CVISN Functional Areas

As an integral element of the federal government's ITS initiative since the mid-1990s, CVISN services and technologies focus on three functional or capability areas:

- Electronic Credentialing (EC) systems for electronic submission, processing, approval, invoicing, payment, and issuance of commercial vehicle credentials and special permits.

- Safety Information Exchange (SIE) technologies to facilitate the collection, distribution, and retrieval of historical and real-time commercial vehicle information at the roadside.

- Electronic Screening (ES) systems, which allow transponder-equipped commercial vehicles that maintain good safety and legal status to bypass some roadside inspection and weigh stations.

CVISN Evaluation Background

In addition to providing funds directly to the states through the CVISN Model Deployment Initiative (MDI) and subsequent core and expanded CVISN deployment grant programs, FMCSA also supports ongoing activities to measure and evaluate the effectiveness of the CVISN deployments, individually and collectively, and to disseminate the results of these evaluations to all stakeholders. These evaluation and outreach activities are intended to aid the U.S. Department of Transportation (USDOT) and participating states in recognizing innovative or successful approaches to CVISN deployment and to present a coherent account of the achievements of CVISN at a national level. Evaluations also help USDOT plan for future deployments and infrastructure investments and more effectively apply resources to programs, technologies, and approaches that are performing well in the field.

Beginning in 1996, USDOT sponsored an MDI of CVISN in several states. This initiative was the subject of an evaluation report, issued in 2002, which concluded that CVISN is a good investment for the United States. CVISN can produce substantial cost savings for states and motor carriers, improve the efficiency and fairness of CVO enforcement, and most importantly, save lives. Since the conclusion of the MDI, CVISN technologies and related capabilities have continued to be increasingly deployed across the country, in a great variety of settings. In light of this ongoing interest and the expanding deployment of CVISN technologies—and as a logical follow-on to the MDI Evaluation—FMCSA initiated a National Evaluation in 2003, which is the subject of this report.

The National Evaluation built upon the findings from the CVISN MDI evaluation by conducting four main analyses:

- Motor Carrier Survey
- Cost Analysis
- Safety Analysis
- Benefit-Cost Analysis.

An analysis of deployment status across participating CVISN states was also conducted, and the qualitative benefits and lessons learned, as reported by the states, were summarized.

National Evaluation Goals

Within the structure of a CVISN National Architecture, states have great latitude in designing and executing their CVISN deployments to match their operational needs. This freedom, accompanied by differing CVO environments and funding situations from state to state, leads to a high degree of creativity and variability in the approaches taken by individual states. One of the key difficulties faced in this National Evaluation, and one of its important contributions, is the attempt to unify and describe the disparate deployments, costs, and benefits of CVISN in terms that are reasonably comparable across states.

Information from the states provides insight into navigating the many issues involved in specifying, procuring, setting up, operating, and maintaining advanced systems for enhancing commercial vehicle (CV) safety, administration, and efficiency. In particular, insights such as those compiled for the first time in this report are intended to help later-adopting states—or states with unique and challenging local situations—save time and effort in the course of their own CVISN deployments. The evaluation is also intended to aid federal and state transportation planners is setting the strategic direction for the ongoing CVISN initiative.

Five overall goals, determined in conjunction with FMCSA planners and state CVISN program managers, guided the evaluation:

1. Measure the effects of CVISN technologies on the safety of trucks and the general traveling public, through improved roadside enforcement and administrative processes

2. Measure and analyze the costs of deploying and operating CVISN technologies in several typical configurations

3. At a national level, compare the costs of deployment versus the benefits realized through improved efficiency, improved safety, and reductions in other costs

4. Enable states to estimate the costs and benefits particular to their CVO setting

5. Document and analyze the attitudes of motor carriers regarding CVISN deployment.

The four main analyses plus the deployment analysis were conducted using a variety of methods, including reviews of available program information and the open literature, reviews of the self-evaluation reports prepared by the states, telephone and in-person interviews, field observational studies, and the application of statistical and economic models. The next sections highlight the results from the deployment analysis, which establishes the scope of CVISN infrastructure available and in operation today. This discussion is followed by a summary of benefits, and the results from each of the four main analyses.

Deployment Analysis Results

CVISN deployment is often characterized in terms of progress toward a "Core" or baseline level of functions, previously known as "Level 1 Deployment." Figure ES-1 shows the national status of CVISN states in achieving Core Deployment status. As shown in Figure ES-1, 20 states have completed Core Deployment, while 25 other states and the District of Columbia currently are in the process of achieving Core Deployment, as of fall 2008. The five remaining states are in the business planning or core planning and design phase.

This current status, with nearly all of the states actively deploying at least some CVISN technologies, or planning to do so, is confirmed by data from the self-evaluation reports—which numerous state CVISN program managers have been preparing and updating through a web-based online system since 2003—and by participation of many states in the CVISN grant program. In all, 41 states have some detailed deployment data represented in the self-evaluation database. According to FMCSA, as of June 2008, 44 states plus the District of Columbia had received some form of CVISN grant funding from FMCSA under TEA-21 and SAFETEA-LU since the grant program began in 1999. A total of 48 jurisdictions remain eligible to receive federal funding to support their CVISN programs.

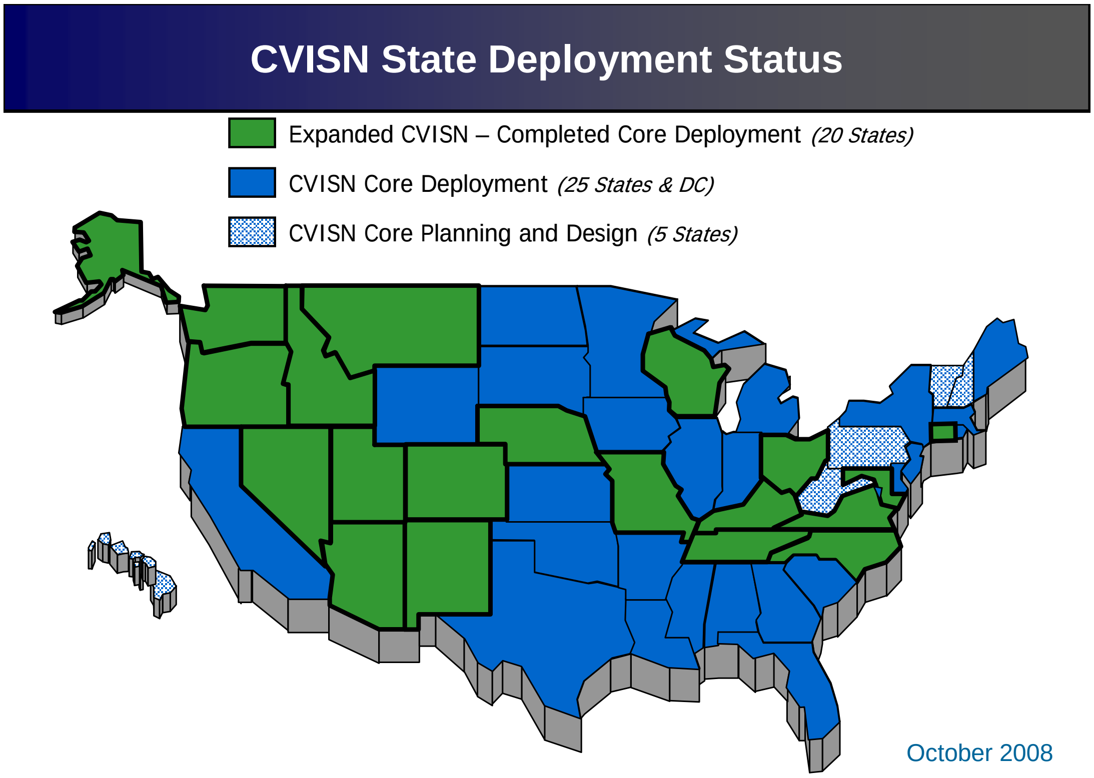

Figure ES-1. Expanded CVISN, Core Deployment, and Planning/Design Status (October 2008)

As an approximate measure of the "market penetration" of CVISN among all states submitting self-evaluation reports, an average of 22% of International Registration Plan (IRP) motor carrier credentialing accounts are currently using CVISN technology (i.e., applying electronically), or will be doing so shortly. Likewise, an average of 22% of International Fuel Tax Agreement (IFTA) carrier accounts are now or soon will be applying electronically.

Out of 25 states reporting their deployment of SIE, about half, or 13 states, reported having 100% of their sites connected to the Commercial Vehicle Information Exchange Window (CVIEW) or equivalent for carrier snapshots. The other states reported having between 4% and 95% of their weigh/inspection sites connected to CVIEW.

In terms of ES, among the 34 states reporting, an average of 54% of their permanent weigh station sites are now or soon will be offering ES or preclearance for transponder-equipped commercial trucks. Seven states offer e-screening at 100% of their scale sites.

Benefits, Challenges, and Lessons Learned as Reported by the States

Among the 20 to 30 participating CVISN states that had completed their Benefits/Lessons Learned self-evaluation reports as of August 2006, the following were the most prevalent responses:

- **Benefits of Electronic Credentialing**
  - Time savings and improvements in efficiency for states
  - More convenience; less time-consuming for motor carriers
  - Improved data quality
  - Reduced labor/workload

- **Benefits of Safety Information Exchange**
  - Improved screening and enforcement
  - Time savings in inspections

- **Benefits of Electronic Screening**
  - Increased bypass efficiency
  - Reduced backups on approach lanes

- **Institutional Issues (Both Pro and Con)**
  - Enhanced data quality
  - Need for data quality improvements in some areas
  - Difficulties in arranging credit card payment for electronic credentials
  - Difficulties presented by evolving, changing technologies
  - Improved relationships among partner state agencies
  - Lack of properly trained staff; lack of technical support
  - Difficulties in integrating multiple disparate technologies or systems
  - Lack of adequate funding.

Below are some highlights from the benefits and lessons learned reports, with examples and quotations chosen to illustrate these general findings. For example, in response to a question about IFTA credentialing, one state representative said:

> *"The automated renewal process has increased the efficiency of state staff and reduced carrier workload. The web based application process has made it easier and less time consuming for a carrier to apply, and it has improved data quality."*

When asked if the deployment of CVISN had freed state employees to perform other duties, several states reported that employees are now able to focus more on functions such as inspections, customer service, data processing and analysis, planning, and training. One respondent noted that:

> *"Electronic credentialing has reduced the [time required for] data entry by at least 80%, and the time for issuing credentials has been reduced from 3 days to 1 hour."*

The computer-based technologies of CVISN have increased both the volume and breadth of data available to states, in central offices and at the roadside. In addition, the transition from previous (legacy) administrative and safety information systems to CVISN systems has brought out problems in data quality and consistency, which likely existed all along, but now are much more visible. When asked about the relationship of CVISN to the persistent issue of data quality, one state responded:

> *"CVISN deployment has highlighted data quality problems and the need to address them. Examples: (1) Loading our CVISN database brought to light problems with inconsistencies between USDOT numbers and state account numbers. These problems were addressed to ensure consistency. (2) Reviewing bridge and highway data for use in automated routing highlighted data discrepancies that are now being resolved, and spurred an effort to set a new policy for timeliness of data updates."*

In response to a question about human resources constraints on CVISN deployment, nearly half of the respondents cited a lack of properly trained staff or adequate technical expertise as a key personnel-related constraint. More than one-third noted that deployment was hindered by the limited ability of staff members to devote time to CVISN. As summarized by one state:

> *"All of the CVISN team members have regular jobs that also required their attention. Because of the lack of a long-term funding commitment for CVISN, we were not allowed to hire additional full-time employees to do the extra work. We also had difficulty finding anyone with the required experience to work on the CVISN technologies."*

Speaking of national ITS standards and the CVISN architecture that is intended to govern and unify interstate information systems and networks, one state provided both pros and cons encountered in maintaining consistency with ITS standards:

> *"Consistency has been valuable in some areas and a problem in others. It has been valuable in areas where there is national leadership and a common view on how to accomplish specific goals. It has been problematic where there is less federal leadership and where states have vastly differing views on how to accomplish specific goals."*

These responses appear to show an overall favorable perspective toward CVISN among participating states, while acknowledging that there have been some technical and institutional hurdles to cross.

Motor Carrier Survey Results

A total of 848 commercial motor carrier companies responded to telephone interviews between December 29, 2006, and March 19, 2007. While the carriers participating in this national survey had fairly even levels of awareness of both ES and EC (representing about 64% of power units in the survey), carriers had very different levels of actual participation in the two programs or services. When looking at the proportion of commercial trucks (power units) represented in this survey, only about 15% were taking part in ES, while more than 46% were taking part in EC. This suggests that the out-of-pocket cost to participate (which is negligible for EC and significant for some ES programs) may be one of the differentiators in carriers' decision-making. In this instance, “cost” is considered relatively narrowly, outside the overall life-cycle benefit or ultimate economic return on investment that carriers might realize through participating in either program. Motor carriers’ perceived lack of benefits from electronic screening also is often cited as a barrier to their adoption of CVISN services. For example, in electronic screening, if the average combination vehicle is inspected only rarely, carriers may not see the avoidance of these inspections as a sufficient benefit to participate in ES.

Electronic Credentialing. E-credentialing is used for more than 46% of the power units among the sample surveyed. More than 70% of giant and large motor carriers are aware of e-credentialing, and these carriers are much more likely than smaller carriers to be aware of this service.

As for the reasons for participating, companies tend to take part in e-credentialing because it is convenient, it saves staff time, it enables carriers to get trucks into service more quickly, and it increases the accuracy of data. These kinds of benefits were borne out in a recently completed FMCSA-sponsored Business Case report (FMCSA 2007a,b) and in the benefit-cost analysis in this National Evaluation Report (Section 8.0). Carriers who choose to apply for their credentials electronically reported a reduced frustration level with credentials administration. Among the responding motor carrier companies that do not participate in e-credentialing, privacy and security were the most frequent reasons cited, followed by lack of in-house technology and resources and lack of available staff.

Electronic Screening. There is a positive attitude toward ES among those carriers who participate. Nearly 100% of these carriers report savings in shipping time plus increases in convenience and efficiency. For nonparticipating motor carrier companies, the ES fee appears to be a barrier. The costs of ES are known, but the benefits are vague and although they may be realized in the future, they are less tangible and more difficult for carriers to measure immediately. Plus, as an industry, carrier companies tend to operate on relatively thin margins. As a barrier to participating in ES, privacy concerns ranked relatively low in importance.

To increase levels of carrier participation in ES, the message from states, FMCSA, and the motor carrier industry should focus on return on investment. States that want to increase their numbers of trucks equipped with transponders should concentrate their outreach on the bottom-line savings, and help carrier companies to view the monthly fee in the larger context of the overall savings. As was the case with e-credentialing, the recent FMCSA-sponsored report (FMCSA 2007a,b) and Section 8.0 confirm and describe in greater detail the positive industrial and societal benefit-cost ratios from ES programs.

When looking at which companies are most likely to participate in ES, giant and large motor carrier companies are much more likely to take part in ES than smaller carriers. Medium-sized carriers are especially concerned about the costs of ES (80% of medium carriers versus 59% for all carriers combined).

Cost Analysis Results

Data for the CVISN cost analysis were collected from two major sources:

- Self-evaluation templates completed by approximately 28 states as of April 2006
- Site visits to four states (Montana, New Jersey, New York, South Dakota), intended to collect detailed cost data and contextual information about specific deployments.

Site Visits. Four states were chosen for site visits, based in part on an informal strategy-setting survey in which states were invited to submit ideas for cooperative research. The four states were also chosen in part because of their geographic diversity, compared to the main states that had provided cost data for the 2002 CVISN MDI evaluation (Connecticut, Kentucky, Maryland, and Virginia). Montana was an early proponent of CVISN and has deployed much of its system by working through contractors. New Jersey's program is still under development, but the state had a detailed cost proposal in hand at the time of the cost analysis. New York has an advanced, one-stop EC system, and does all of its roadside inspections at mobile locations. South Dakota has observed cost savings from the deployment of an extensive automated permitting system for commercial carriers. The following section presents the key findings form each state, followed by a national perspective on CVISN costs.

Montana has been very progressive with respect to CVISN development, initiating its program in 1991 in response to a legislative mandate to automate its credentialing system. Montana selected a vendor to develop the EC system and by 1999 had automated its oversize/overweight permitting process. Today, the automated program can be used to obtain trip, term, custom combine, and oversize/overweight permits, and to pay gross vehicle weight fees. Montana has developed an extensive ES program at little cost to the state through its partnership with Help, Inc. Montana has deployed CVISN SIE equipment across its system and at all of its weigh stations, which number between 20 and 30. Today, virtually all of its inspections are completed by state officers and inspectors using laptop computers equipped with Aspen. The costs associated with Montana's credentialing and permitting systems are not highlighted in this document because the system was developed in cooperation with a private vendor and the cost data are considered by Montana to be proprietary. Montana's costs were, however, included in national aggregate and average data reporting.

New Jersey represents a program that is still under development but has designs for expansion in the coming years. New Jersey's EC program for IRP was launched in 2002. It focused only on IRP renewals and has not been used for issuing new or supplemental IRP credentials. In 2003, the state processed 9,700 IRP renewal transactions for 44,000 vehicles. The cost of the New Jersey project, excluding state employee labor, was expected to total roughly $279,000. Project costs were expected to include a vendor contract, personal computers, and printer and scanner equipment. A projected increase of 12 to 17% in electronic credentials filing could save the state between $130,866 and $171,665 in labor costs annually.

New York has developed an extensive EC program that has issued more than 400,000 credentials in three years. In the fiscal years 2004 through 2006, the number of electronic credentials issued through New York's One-Stop-Credentialing and Registration (OSCAR) program has grown significantly from 8,984 to 268,973. New York incurred roughly $1.6 million in one-time start-up costs associated with development of its EC system and incurs $497,938 in annual recurring costs. During the site visit, however, these estimates were questioned by a representative of the New York Department of Taxation, who noted that labor costs may have been underestimated. This person estimated the one-time start-up costs in the $2 to $3 million range.

The focus of the **South Dakota** CVISN program has been the development of an extensive automated permitting program called the South Dakota Automated Permit System (SDAPS). SDAPS enables motor carriers to apply for 26 different permits on-line, thus expediting the permit application process for motor carriers and state issuing agencies. SDAPS can also be used to request a transponder to support ES. South Dakota spent approximately $720,278 in one-time start-up costs associated with SDAPS deployment and incurs approximately $518,660 in annual recurrent program costs associated with e-credentialing.

ES in South Dakota has been established at one site: the Jefferson Port of Entry. The cost of this project has totaled roughly $6.9 million and included costs associated with:

- State employee labor and other costs for ES development and activities associated with design and construction
- Contracted construction of buildings, pavement, scales, signs, wiring, as well as other construction activities, labor and software
- Sorter lane weigh-in-motion (WIM) scales.

To date, South Dakota has incurred roughly $2.1 million in labor, software and hardware costs associated with deployment of numerous SIE packages, including the VINA (Vehicle Identification Number Analysis lookup) software program, the South Dakota Accident Reporting System, CVIEW, and Performance and Registration Information Systems Management (PRISM). Today, 100% of the state's officers and inspectors involved in commercial vehicle operations and enforcement use laptop computers with Aspen. South Dakota reported that due to the efficiency savings associated with deploying CVISN SIE components, over the past 5 years the number of inspections the state could perform annually has increased by 25 to 30% to 26,564 in 2004 without expanding the number of enforcement staff.

National Aggregate Data. In the following discussions of national cost averages for one-time CVISN system deployment and annual operations, all costs are expressed in constant 2006 U.S. dollars, adjusted as needed from the year when each state reported its costs.

The cost of EC to the states is the cost to provide systems that enable motor carriers to apply for, pay for, and receive various operating credentials using transportation data management information systems, such as central IRP and IFTA credentials systems. The initial descriptive statistical analysis shows that the average per-state start-up cost of EC is about $1.35 million. However, this start-up cost ranges widely between a high of nearly $8.5 million in one state to a low of $28,037 in another. In terms of total annual cost to operate and maintain EC systems for

IRP and IFTA credentials, states reported an average cost per state of about $250,000 per year, with the range extending from a low of $22,645 to a high of $1,091,968 per year.

SIE start-up costs include the costs of purchasing hardware for information exchange such as computer network servers, personal computers (including laptops and desktops), printers, wireless modems, routers, T1 lines, and network equipment, as well as material used for outreach, publicity, training, and supporting the deployment of CVISN SIE technologies. On average, the states paid roughly $680,000 in SIE start-up costs. However, this average hides a large variation in first costs ranging from a high of almost $2.7 million to a low of about $31,000. On average, the annual SIE system costs each state roughly $74,000 to operate.

ES start-up costs include network servers, desktop personal computers, laptops, WIM scales, in-vehicle transponders purchased by the states for distribution, in-vehicle transponders purchased by the states for resale (cost recovery or other basis) to motor carriers enrolling vehicles in ES, automatic vehicle identification (AVI) equipment and systems, telecommunication equipment between upstream sites and weigh stations, electronic signs for weigh stations and loop detectors for weigh stations. ES start-up costs also include the cost of existing system upgrades, as well as those costs related to one-time start-up fees paid for ES to third-party vendors. On average, the states invested between $1 million and $2.8 million in ES as one-time start-up costs. Depending on the business model or the ES program or partnership chosen by a given state (predominantly the decision between the divergent Heavy Equipment License Plate, or HELP/PrePass and Norpass business models), some states have very low start-up costs for screening. The average state spent almost $160,000 annually to operate and maintain an ES system. However, the range is significant, from a high of $902,258 annually to a low of $11,071.

Safety Analysis Results

The purpose of the CVISN National Evaluation safety analysis was to measure the effects of CVISN technologies on the safety of trucks and the general traveling public, through improved roadside enforcement and administrative processes. Data to address the evaluation objectives were collected through three methods: (1) examination of existing data sources such as the CVISN self-evaluation database and the CVISN state deployment matrix; (2) phone interviews with various state CVISN officials; and (3) field studies conducted at CV inspection sites in Colorado, New York, Ohio, and Kentucky.

The analytical approach of the safety study was to combine observations of the actual, current inspection selection practices of CV enforcement officers and safety inspectors in the field with current and historical data on inspection results, out-of-service rates, and safety [e.g., carrier Inspection Selection System (ISS) scores, and large truck crash causation factors]. These data sources were used to develop a pre-CVISN or baseline picture of the safety benefits of truck inspections. Then several CVISN scenarios were developed, employing available and advanced or in-development CVISN technologies in varying combinations for pushing more information (and potentially more current and more accurate information) to the roadside, at the point of the inspection selection decision.

The basic concept of CVISN SIE is to provide safety information on individual motor carriers and trucks to the inspector as a truck approaches the inspection site. This will allow an inspector to focus his or her attention on a smaller segment of the stream of trucks traversing a weigh/inspection station (compared to current selection methods), namely those carriers, vehicles, and drivers most likely to be at the very highest risk for a crash. Statistical modeling was employed, building on the available historical safety, crash, and inspection data plus the field observational data from the four sites chosen in this National Evaluation, to estimate the nationwide safety benefits of deploying CVISN technologies in several configurations. Historical data sources include inspection reports from states, carrier safety ratings from SAFER (Safety and Fitness Electronic Records), and crash reports from the FMCSA-sponsored Large Truck Crash Causation Study (LTCCS). Safety benefits were expressed in terms of annual nationwide reductions in commercial-vehicle-related crashes, injuries, and fatalities.

In 2005, 5,212 people were killed and approximately 114,000 were injured in crashes involving approximately 441,000 large commercial motor vehicles (CMVs). Ultimately, safety benefits will be realized only to the extent that targeted inspections and improved compliance translate into reductions in numbers of crashes. The premise of targeted inspections is that, for the same number of inspections performed, additional drivers and vehicles operating with out-of-service (OOS) conditions will be removed from the roadway. Furthermore, all of the conditions leading to the OOS order will be fixed and "stay fixed" for a period of time after the inspection. This is based on the Safe-Miles model developed for FMCSA (VNTSC 1999a). The values used in the Safe-Miles program are 15,000 miles for vehicle OOS orders and 10,000 miles for driver OOS orders. Therefore, crashes that would have occurred during this period are prevented because the OOS conditions that would have caused the crashes were eliminated. The safety benefit of CVISN technologies is determined by using a probability model to compare the number of crashes avoided under a baseline scenario (i.e., with pre-CVISN roadside enforcement, or RE, strategies and technology) with the number of crashes avoided under a number of deployment scenarios involving CVISN:

- ***RE-0: Random Selection.*** Enforcement officers (inspectors) select commercial vehicles for inspection in a random manner without using personal experience, judgment, or any CVISN technologies. This is not one of the roadside enforcement strategies being considered, nor is it a realistic strategy to employ. However, the calculation of safety benefits under this scenario is useful for determining the contribution of the inspectors' knowledge and experience during the vehicle selection process.

- ***RE-1: Baseline—Pre-CVISN.*** Inspectors select commercial vehicles for inspection using personal experience and judgment, but without the aid of most CVISN technologies. ES is assumed to be used at its current level as of June 2007.

- ***RE-2: Mainline electronic screening based on Inspection Selection System (ISS) score.*** State deploys ES with safety snapshots at all major inspection sites. All motor carriers that are classified as low- or medium-risk based on ISS scores (comprising approximately 60% of trucks on the road) enroll in the ES program, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors use current practices to select vehicles for inspections from the remaining 40% of trucks in the high-risk and insufficient data categories.

- ***RE-3: Electronic screening based on high vehicle and driver out-of-service (OOS) rates.*** State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from the Safety and Fitness Electronic Record (SAFER) data source. In this scenario, each truck is screened based on the vehicle and driver OOS rate of the carrier. Threshold OOS rates are established for both vehicles and drivers such that all trucks with OOS rates exceeding the corresponding thresholds will be brought into the inspection station for inspection while all others will be allowed to bypass inspection sites. In Scenarios RE-3, RE-4, RE-5, and RE-6, three thresholds per scenario were modeled separately, representing the selection of only the "worst" (i.e., highest-risk) 5%, 10%, and 25% of the truck population. A supplemental analysis was also performed (RE-6), applying similar thresholds to the ISS scores used in RE-2, as described below.

- ***RE-4: Electronic screening based on high driver OOS and brake violation rates.*** State utilizes ES at all major inspection sites. Each truck is screened based on its OOS or violation rate for violations that have a high relative risk for crash. In this scenario, vehicles are screened based on their brake violation and overall driver OOS rates as they appear in SAFER. This scenario differs from RE-3 in that vehicles are screened on their brake violation rate as opposed to their overall vehicle violation rate in an attempt to identify those vehicles that have a violation that has a higher relative risk for crash.

- ***RE-5: Electronic screening based on infrared screening and high driver OOS violation rate.*** State utilizes some form of infrared screening (such as the IRISystem) at all major inspection sites. Each truck is screened via two criteria: the thermal (IR) images and the driver OOS rate of the particular carrier. In this scenario, vehicles are screened based on the presence of a brake violation as detected through the infrared image produced by the infrared system and the driver OOS rate as it appears in SAFER.

- ***RE-6: Electronic Screening based on high ISS scores.*** State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from SAFER. In this scenario, each truck is screened based on the ISS score of the carrier. A threshold ISS score is established for both vehicle and driver OOS violations such that all trucks with ISS scores exceeding the corresponding thresholds will be brought into the inspection station for inspection, while all others will be allowed to bypass inspection sites. Three threshold rates were chosen such that only trucks with the highest ISS scores are candidates for inspection.

Table ES-1 and Figure ES-2 summarize the major results of this safety benefits analysis. The target population is the nationwide population of CMVs, assuming instantaneous deployment of CVISN technologies in the entire United States, depending on the scenario. Benefits are expressed in numbers of events per year. In the figure, the mean number of crashes avoided as well as the 95 percent confidence interval for each scenario is provided.

Table ES-1. Estimated National Annual Safety Benefits of CVISN under Selected Deployment Scenarios and Assumptions

Scenario	Description		Numbers of Annual Safety Events Avoided[1]			Additional[2] Annual Safety Events Avoided (CVISN Benefit)		
			Crashes	Injuries	Fatalities	Crashes	Injuries	Fatalities
RE-0	Random Selection		2,426	628	29			
RE-1	Baseline – Pre CVISN		3,139	813	38			
RE-2	Mainline Electronic Screening Based on ISS Score		4,143	1,073	50	1,004	260	12
RE-3	Electronic Screening based on high vehicle and driver OOS rates[3]	5% 10% 25%	7,795 5,637 3,686	2,019 1,460 955	94 68 44	4,656 2,498 547	1,206 647 142	56 30 6
RE-4	Electronic screening based on high driver OOS and brake violation rates[3]	5% 10% 25%	15,530 11,550 7,626	4,022 2,991 1,975	186 139 92	12,391 8,411 4,487	3,209 2,178 1,162	148 101 54
RE-5	Electronic screening based on infrared screening and high driver OOS violation rate[3]	5% 10% 25%	21,046 18,025 15,366	5,451 4,668 3,980	253 216 184	17,907 14,886 12,227	4,638 3,855 3,167	215 178 146
RE-6	Electronic Screening based on high ISS score	5% 10% 25%	5,599 5,355 4,538	1,450 1,387 1,175	67 64 54	2,460 2,216 1,399	637 574 362	29 26 16

1 The estimated number of crashes avoided is based on the assumption that crashes are avoided when vehicles and drivers with safety violations are placed OOS. For reference, in 2005, there were 441,000 truck-related crashes nationwide resulting in 114,000 injuries and 5,212 deaths (USDOT 2007b).

2 Compared to baseline scenario (RE-1).

3 Safety Benefits shown for strategies RE-3, RE-4, RE-5, and RE-6 are dependent on the percentage of the truck population selected for inspection (top 5%, 10%, or 25% in terms of risk).

According to the model, current roadside enforcement strategies (RE-1) are responsible for avoiding 3,139 truck-related crashes, which represents about 0.7% of the 441,000 truck-related crashes nationwide that occur annually, based on 2005 crash statistics. Furthermore, it is estimated that current roadside enforcement activities are responsible for preventing 813 injuries and 38 fatalities.

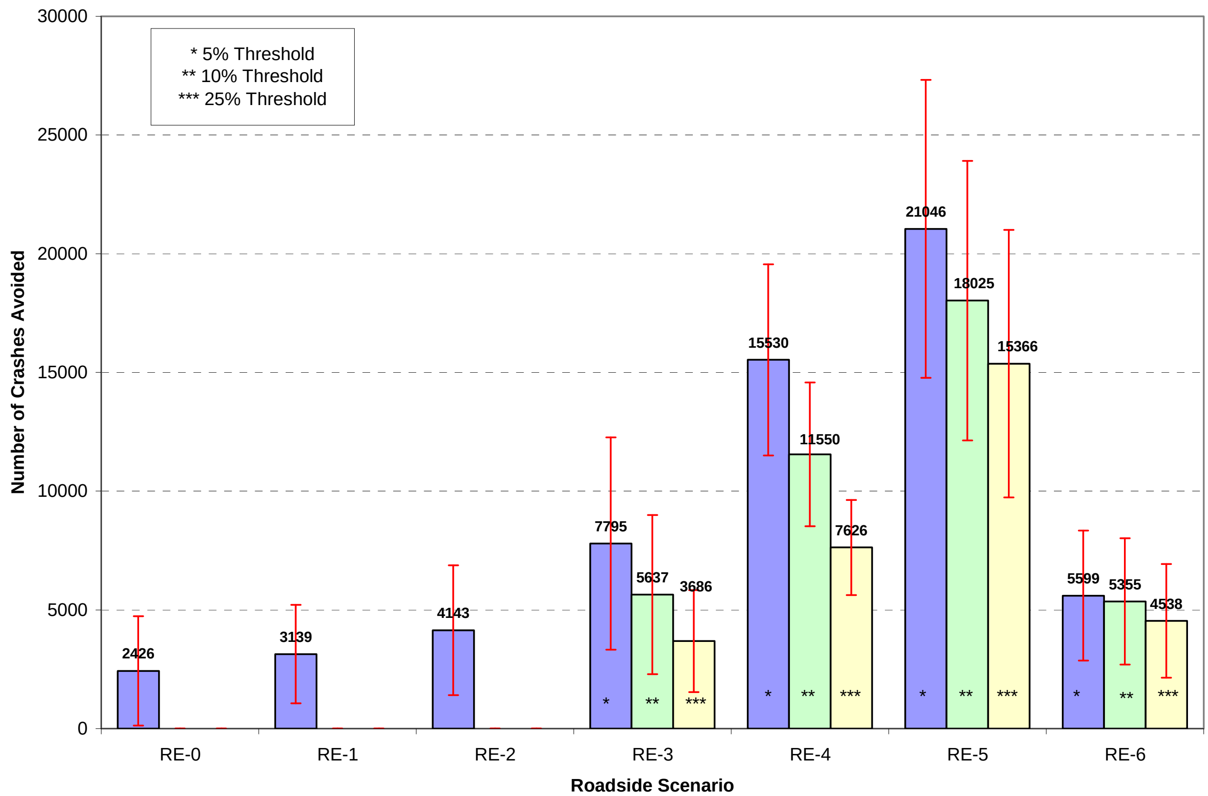

Figure ES-2. Estimated National Annual Number of Crashes Avoided (Mean Number of Crashes Avoided and 95 Percent Confidence Interval)

The safety benefits increase with each scenario RE-3 through RE-5. RE-6 utilizes the carrier's ISS score as a safety index in selecting trucks for inspection. At the 5% threshold level, using high vehicle and driver OOS rates to electronically screen vehicles (RE-3) would avoid 7,795 crashes nationally, a savings of 4,656 crashes from the baseline scenario. Using high brake violation or driver OOS rates (RE-4) would result in having 15,530 crashes avoided, a savings of 12,391 crashes from the baseline scenario. The maximum benefit is achieved with RE-5, where 21,046 crashes are avoided if the top 5% of vehicles in terms of driver OOS violations are inspected in conjunction with infrared screening. This implies that about 4.8% of the nation's 441,000 annual truck-related crashes could be avoided under RE-5.

To put this figure into perspective relative to crashes overall that are caused by OOS violations, the difference in violation rates between trucks involved in crashes and trucks not involved in crashes was examined. Examination of data from the LTCCS and the historical inspection reports from states involved in this evaluation have shown that there is a 7.2% increase in relative crash risk for driver OOS violations and a 0.6% increase in crash risk for vehicle violations. Because the same vehicle could have both a vehicle and driver violation, the two crash risk figures cannot be added to obtain the total increase in crash risk. However, these figures suggest that if there were no vehicle or driver OOS violations present in the population, no more than about 7.8% of the nation's 441,000 annual crashes involving large trucks could be avoided. This is the maximum possible benefit if all OOS violations were removed from trucks traveling on the road. This fact helps to put the crash avoidance results into context and to provide an upper bound on the number of crashes that could be avoided due to elimination of all OOS conditions.

Overall, by deploying and utilizing CVISN infrastructure and technologies as outlined in the above scenarios, substantial numbers of truck-involved crashes, injuries, and fatalities could be avoided directly through the increased inspection efficiency gained as a result of the availability and use of the real-time safety information.

Benefit-Cost Analysis Results

A comprehensive societal BCA was carried out for the National CVISN Deployment Program. It updates a similar analysis conducted in 2002 as part of the evaluation of the CVISN MDI, taking into account the progress that has been made since then toward more widespread deployment of CVISN technologies, and the additional data made possible by this current evaluation. The BCA relied on data from the CVISN National Evaluation cost analysis (Section 6.0) and safety analysis (Section 7.0). The BCA also made use of data from a separate CVISN motor carrier business case (FMCSA 2007a,b) and a review of the literature, focusing on crash-related costs and inspection-related costs. The current National Evaluation BCA evaluated CVISN roadside enforcement, according to five of the scenarios defined in the safety analysis, and EC throughout the United States.

For roadside enforcement (RE), considered to include both SIE and ES, the BCA factored in the following costs and benefits:

- RE Costs: Start-up, replacement capital, and annual operating costs to states, increased operating costs to carriers, and increased OOS costs to carriers.
- RE Benefits: Value of crashes avoided, value of transit time savings.

For EC, the BCA considered the following costs and benefits:

- EC Costs: Start-up and replacement capital costs to states, start-up and annual operating costs to carriers.
- EC Benefits: Operating cost savings to states, operating cost savings to carriers, truck inventory cost savings to carriers.

Each of the benefits and costs in a BCA was discounted to a present value over the economic life of a project. For the National CVISN Deployment Program, benefits were assumed to begin immediately with the one-time start-up costs in the year 2006, and extend for a 25-year period through 2030. This allows 25 years of economic returns for the project, which will include one or more replacement cycles for equipment and software at appropriate intervals.

Table ES-2 summarizes the results of the BCA for each of the five scenarios (four RE scenarios plus one EC scenario).[1] The results in the table reflect the present value of the stream of benefits

[1] Ten rows for the Roadside Enforcement economic models are shown in the table, because scenarios RE-3 through RE-5 have three different modeled threshold values each, designated A (5% threshold), B (10%), and C (25%).

and costs that was calculated to occur over the lifetime of the project, expressed in 2006 U.S. dollars ($2006) and discounted at 7%. The more detailed results presented in Section 8.0 also show the values using a 4% discount rate.

For the four RE scenarios, the table shows that the benefit/cost ratios range from 1.9 to 7.5, indicating that this CVISN deployment produces positive net benefits over the full range of assumptions contemplated in this study. The table also shows that the total benefits of EC are expected to exceed its total costs by more than a two-to-one margin, having a benefit/cost ratio of 2.6. Taken together, these results indicate that all aspects of the National CVISN Deployment Program examined in this BCA are expected to produce significant net benefits to society and are economically justified.

Table ES-2. Summary of CVISN Benefit/Costs Analysis Results ($2006)

CVISN Program	Scenario	Total Benefits	Total Costs	Net Present Value	Benefit/Cost Ratio
Roadside Enforcement	RE-2	$8,906,875,937	$4,110,657,662	$4,796,218,275	2.2
	RE-3A	$14,422,099,019	$6,838,922,219	$7,583,176,800	2.1
	RE-3B	$11,715,250,483	$5,774,709,138	$5,940,541,345	2.0
	RE-3C	$8,899,068,198	$4,626,101,527	$4,272,966,671	1.9
	RE-4A	$23,493,346,042	$5,544,961,109	$17,948,384,933	4.2
	RE-4B	$18,649,740,936	$4,804,238,306	$13,845,502,630	3.9
	RE-4C	$13,519,716,327	$4,158,837,793	$9,360,878,533	3.3
	RE-5A	$26,617,363,372	$3,607,051,636	$23,010,311,736	7.4
	RE-5B	$23,074,475,556	$3,081,989,018	$19,992,486,538	7.5
	RE-5C	$19,956,124,446	$2,688,192,054	$17,267,932,392	7.4
Electronic Credentialing		$8,220,221,144	$3,116,829,485	$5,103,391,660	2.6

Overall Conclusions and Implications

Changing circumstances in transportation funding, and continuing growth in the volume of commercial vehicle traffic in the U.S., have required state and federal transportation and public safety officials to learn to do more with less. Public-sector managers have been faced with the pressure to maintain consistent levels of service and performance while budgets have remained flat or declined, and the numbers of heavy trucks on the road have increased. Among other factors, these trends have hastened the deployment of computer-based technologies to automate many functions that had formerly been performed manually.

With reference to the safety analysis, Scenario RE-0 (random selection) and Scenario RE-1 (existing or pre-CVISN selection methods) are not included in the BCA, because they do not entail any incremental deployment of CVISN infrastructure, and therefore, no incremental costs compared to the baseline. Scenario RE-6 in the safety analysis was an offshoot of Scenario RE-2 and was generated after the completion of this BCA.

The CVISN program, which sprang up in part as an attempt to unify a series of state- and regional-based initiatives, has been and continues to be a successful mechanism for interstate cooperation and information sharing, not only in terms of real-time and historical carrier, vehicle, and driver-based data being applied today in roadside decision-making, but also in terms of programmatic, institutional, and procedural information that is readily passed from one jurisdiction to another.

In the more than 10 years that the CVISN program has been advancing from state to state, what has been accomplished? And what remains to be done? Beyond the specific conclusions described in the summaries above, some of the more noteworthy achievements of CVISN are as follows:

- States have a unified CVISN national architecture—subject to open, candid debate, adaptation, and revision over time—but nonetheless providing a baseline that brings a level of logic, consistency, and interoperability to what would otherwise be a patchwork of single-state systems.

- States have federal grants and other funding available, within limits and guidelines, to foster the deployment of hardware, software, other infrastructure, and personnel to increase the safety and efficiency of CVO.

- Many participating states have developed new cross-agency CVISN teams.

- States have a supportive network of direct communication to help them solve problems in CVISN deployment. This network includes monthly state program manager conference calls, support for state CVISN system architects, ad hoc team conference calls, periodic workshops and technology showcases, a SharePoint web site for announcements and document reviews/distribution, a secure web site for self-evaluation data collection and summary report viewing, online training opportunities, peer-to-peer site visit support, and other FMCSA-sponsored mechanisms to disseminate best practices and lessons learned.

Challenges for the future of CVISN are many. One constant barrier to widespread deployment has been funding, from both the state and federal levels. Many states that are otherwise qualified for federal CVISN grants cannot obtain them because the required nonfederal matching funds are not available. Some states made great strides in deploying their CVISN systems, only to see them decline or fall into disuse because budgetary pressures have restricted ongoing operations and maintenance resources.

Another challenge is engaging the support and participation of a larger number of motor carrier companies. For a variety of reasons, many carriers—and especially medium to small-sized motor carriers—choose not to take part in the EC and ES opportunities provided through CVISN and related technologies. This may be because the carriers are not aware of the services being offered in the states where they operate, or because they lack the resources to investigate and decide whether the service would be cost-effective for their business environment. Other reasons might include a cultural apprehensiveness toward any changes in operations, especially changes involving advanced technology and data exchange, for an industry that has traditionally prided itself on its independence. Even voluntary changes that promise to level the playing field by removing more unsafe vehicles and drivers from the roadways may be viewed by the motor carrier industry with suspicion until the benefits of such changes—both in terms of safety and economics—are proven in practice and widely acknowledged within the carrier community.

Despite these challenges, the future of CVISN is bright. Automated roadside identification of carriers, vehicles, and drivers promises to afford great benefits in allowing safe, compliant vehicles to deliver their freight more quickly and efficiently, while encouraging chronically unsafe carriers to improve their safety practices. The systems that states have been deploying and continuously operating since the mid-1990s provide a positive return on investment, when measured in terms of increased efficiency of operations and in terms of estimated reductions in truck-related crashes, injuries, and fatalities over the deployment life cycle of the CVISN systems. These substantial net benefits will accrue to the states, the carrier industry, and society in general to an extent comparable with the level at which the CVISN technologies are deployed and made available nationally.

Abbreviations

Abbreviation	Definition
A&I	Analysis and Information (FMCSA)
ACCB	Architecture Configuration Control Board
ATA	American Trucking Associations
AVI	Automatic vehicle identification
BCA	Benefit-cost analysis
BCR	Benefit-cost ratio
BOTA	Bridge of the Americas
BSIF	Border Safety Inspection Facility
BTS	Bureau of Transportation Statistics
CASRO	Council of American Survey Research Organizations
CATI	Computer-aided telephone interview
CDL	Commercial Driver License
CDLIS	Commercial Driver License Information System
CER	Community of European Railway and Infrastructure Companies
CFR	Code of Federal Regulations
CMV	Commercial motor vehicle
COTS	Commercial off-the-shelf
CPI	Consumer Price Index
CSA	Comprehensive Safety Analysis
CV	Commercial vehicle
CVIEW	Commercial Vehicle Information Exchange Window
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial vehicle operations
CVSA	Commercial Vehicle Safety Alliance
DBA	Doing business as
DOT	Department of Transportation
EC	Electronic credentialing
EDI	Electronic Data Interchange
EPA	U.S. Environmental Protection Agency
ES	Electronic screening (preclearance)
EWD	Extended Weight (Coal) Decal
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
FTE	Full-time equivalent
FY	Fiscal year
GES	General Estimates System
GHG	Greenhouse gas
GIS	Geographic Information System
HAZMAT	Hazardous material(s)
HELP	Heavy Equipment License Plate
HUT	Highway Use Tax
HVUT	Heavy Vehicle Use Tax
ICC	Interstate Commerce Commission
IDS	Integrated Data System
IFTA	International Fuel Tax Agreement
IR	Infrared
IRP	International Registration Plan
ISS	Inspection Selection System

Abbreviation	Definition
ISSES	Integrated Safety and Security Enforcement System
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation Systems
JHU/APL	Johns Hopkins University Applied Physics Laboratory
JPO	Joint Program Office
KCC	Kansas Corporation Commission
KIT	Kentucky Intrastate Tax
KVE	Kentucky Vehicle Enforcement
KYU	Kentucky Highway Use License (Number)
L&I	License and Insurance
LETS	Law Enforcement Tactical System
LTCCS	Large Truck Crash Causation Study
LTL	Less-than-truckload
MAIS	Maximum Abbreviated Injury Score
MCMIS	Motor Carrier Management Information System
MCSAP	Motor Carrier Safety Assistance Program
MCSIP	Motor Carrier Safety Improvement Program
MDI	Model Deployment Initiative
MDT	Montana Department of Transportation
NAFTA	North American Free Trade Agreement
NCIC	National Crime Information Center
NHTSA	National Highway Traffic Safety Administration
NLETS	National Law Enforcement Telecommunication System
Norpass	North American Preclearance and Safety System
NPSRI	National Public Services Research Institute
NPV	Net present value
NYSDOT	New York State Department of Transportation
O&M	Operation and maintenance
OCC	Office of Corporate Communications (Oklahoma)
OMB	U.S. Office of Management and Budget
OCR	Optical character recognition
OMC	Office of Motor Carriers (now FMCSA)
OOS	Out-of-service
OS/OW	Oversize/overweight (overdimension)
OSCAR	One-stop-credentialing and registration
PC	Personal computer
PIQ	Past Inspection Query
PRISM	Performance and Registration Information Management System
PSU	Primary sampling unit
PUCO	Public Utilities Commission of Ohio
R&D	Research and development
RE	Roadside enforcement
RFID	Radio frequency identification
RITA	Research and Innovative Technology Administration
ROI	Return on investment
SAFER	Safety and Fitness Electronic Records
SafeStat	Safety Status Measurement System
SAFETEA-LU	The Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users
SAS	Statistical Analysis Software
SDAPS	South Dakota Automated Permit System
SIE	Safety information exchange
SSRS	Single State Registration System

Abbreviation	Definition
SSU	Secondary sampling unit
TEA-21	Transportation Equity Act for the Twenty-first Century
TFSS	Truck Fleet Safety Survey
TL	Truckload
TRB	Transportation Research Board
TWIC	Transportation Worker Identification Credential
UGPTI	Upper Great Plains Transportation Institute
UIC	International Union of Railways
USDOT	U.S. Department of Transportation
UTC	Uniform Traffic Compliant
VII	Vehicle-infrastructure integration
VIN	Vehicle Identification Number
VINA	Vehicle Identification Number Analysis (South Dakota lookup system)
VISTA	Vehicle Information System for Tax Apportionment
VMT	Vehicle Miles Traveled
VNTSC	Volpe National Transportation Systems Center
VOT	Value of time
WDT	Weight-Distance Tax
WIM	Weigh in Motion
XML	Extensible Markup Language

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1.0 INTRODUCTION

Commercial Vehicle Information Systems and Networks (CVISN) is a collection of information systems, communications networks, and Intelligent Transportation Systems (ITS) that support commercial vehicle operations (CVO). Through a series of grants, earmark funds, research and development (R&D) funds, and other mechanisms, the Federal Motor Carrier Safety Administration (FMCSA)—in conjunction with the ITS Joint Program Office (JPO), formerly affiliated with the Federal Highway Administration (FHWA) and currently part of the Research and Innovative Technology Administration (RITA)—supports states in the deployment and evaluation of advanced technologies that constitute CVISN programs. A total of 44 states plus the District of Columbia had received some sort of CVISN funding from FMCSA between 1999, when the grant program began, and June 2008. For example, in the most recent grant cycle, federal matching-fund grants amounting to $25 million per year were allocated for fiscal years 2006 through 2009 to continue the deployment of "core" CVISN technologies and encourage expanded capabilities across the country (SAFETEA-LU 2005).[2]

CVISN systems, owned and operated by governments, motor carriers, and other stakeholders, are divided into three categories: *Core infrastructure elements*—managed by the federal government and other organizations—include databases for safety, registration, license, and insurance information; compliance review systems; and clearinghouses. *State-owned elements* include systems for in-state credential administration; safety administration, law enforcement, and information exchange; and some ES, preclearance, or transponder-based weigh station bypass systems. Finally, *carrier systems* include technologies for fleet and freight management and on-board communication. Expanded use and integration of these kinds of electronic systems are expected to improve the overall safety and efficiency of CVO nationwide.

Federal funds granted to the states support not only the purchase of computer hardware and the development of software, but also the purchase of peripheral equipment and the labor costs of engaging specialists within state government; outside consultants; and vendors who design, develop, install, and maintain the CVISN systems. States have great latitude in designing and executing their CVISN deployments to match their operational needs. The goals of the federal program are to

- Improve safety and productivity of motor carriers, commercial vehicles and their drivers
- Improve efficiency and effectiveness of commercial vehicle safety programs through targeted enforcement
- Improve commercial vehicle data sharing within states and between states and FMCSA
- Reduce Federal/State and industry regulatory and administrative costs.

[2] An excerpt of SAFETEA-LU, relevant to CVISN, is presented in Appendix I.

A commercial vehicle is defined at 49 CFR §390.5 as any self-propelled or towed motor vehicle used on a highway in interstate commerce to transport passengers or property when the vehicle (1) has a gross vehicle weight rating or gross combination weight rating, or gross vehicle weight or gross combination weight, of 10,001 pounds or more, whichever is greater; or (2) is designed or used to transport more than 8 passengers (including the driver) for compensation; or (3) is designed or used to transport more than 15 passengers, including the driver, and is not used to transport passengers for compensation; or (4) is used in transporting material found by the Secretary of Transportation to be hazardous and transported in a quantity requiring placarding under regulations prescribed by the Secretary (FMCSA 2002). In general, the focus of CVISN has been on the motor carrier industry, i.e., heavy trucks in the private-sector commercial freight hauling service, both for-hire and private-fleet carriers, and the federal and state government agencies that regulate the operation of such vehicles.

1.1 Scope of CVISN

As an integral element of the federal government's ITS initiative since the mid-1990s, CVISN services and technologies focus on three functional or capability areas:

- **Electronic Credentialing** (EC) systems for electronic submission, processing, approval, invoicing, payment, and issuance of commercial vehicle credentials and special permits; electronic tax filing and auditing; and participation in clearinghouses for electronic accounting and distribution of registration fee and tax payments among states.

- **Safety Information Exchange** (SIE) technologies to facilitate the collection, distribution, and retrieval of historical and real-time commercial vehicle information at the roadside and at central offices across jurisdictions. These data help enforcement staff focus scarce resources on the highest-risk carriers, vehicles, and drivers, removing them from service and in turn helping to reduce the number of crashes involving commercial vehicles.

- **Electronic Screening** (ES) systems, which allow transponder-equipped commercial vehicles that maintain good safety and legal status to bypass some roadside inspection and weigh stations. This preclearance process saves time and money for participating carriers and allows states to devote more resources toward removing unsafe and noncompliant carriers from service.[3]

CVISN services and technologies, described in more detail in Section 2.0, are expected to improve highway safety by reducing the incidence of truck-involved crashes, simplify government administrative credentialing operations, enhance productivity, and reduce delays for safe and legal carriers.

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[3] Advances in wireless truck inspection may result in E-screening methods that do not rely on transponders. Technologies such as optical character recognition (OCR), radio frequency identification (RFID) or the secure broadcast of selected onboard diagnostic information may eventually supplement or take the place of stationary inspection methods.

Further descriptions of CVISN systems, documents, architecture, and activities are available on the U.S. Department of Transportation (USDOT) web site, http://cvisn.fmcsa.dot.gov (2008).

1.2 Summary of ITS Program and CVISN Deployment Program

The ITS program, managed by USDOT, was formally established by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).[4] Federal ITS initiatives have been further supported by later funding measures, including the Transportation Equity Act for the Twenty-first Century (TEA-21) of 1998 and the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) of 2005.

The ITS program promotes the development and application of electronics, communications, and information systems to improve the efficiency and safety of surface transportation systems. The original goals of the national ITS program, as articulated in the 1995 National ITS Program Plan, were to

- Improve the safety of the nation's surface transportation system
- Increase the operational efficiency and capacity of the surface transportation system
- Reduce energy and environmental costs associated with traffic congestion
- Enhance present and future productivity
- Enhance the personal mobility and the convenience and comfort of the surface transportation system
- Create an environment in which the development and deployment of ITS can flourish (ITS JPO 1995).

While these goals are currently under review as of April 2008, the underlying ITS program directions and principles have remained consistent. In support of the 1995 goals, USDOT announced three major ITS deployment initiatives in 1996: the Metropolitan Model Deployment Initiative (MDI), the Advanced Rural Transportation System, and the CVISN MDI.

As described in more detail in Section 1.3, the CVISN MDI began as a cooperative agreement among the USDOT, two prototype states, and eight pilot states. The goal of the CVISN MDI was to have each state reach an "ambitious but achievable" level of deployment, originally called Level 1 and now known as CVISN core deployment, consisting of the following targets:

- An organizational framework for cooperative system development established among state agencies and motor carriers.
- A State CVISN System Design that conforms to the CVISN Architecture and can evolve to include new technology and capabilities.
- All the elements of three capability areas (below) implemented using applicable architectural guidelines, operational concepts, and standards.

[4] The CVISN Model Deployment Initiative Evaluation Report presents general historical background on USDOT's ITS program, focusing on the early stages of the National CVISN Deployment Program (USDOT 2002).

- **Electronic Credentialing**
    - Automated processing (application, state processing, issuance, tax filing) of at least International Registration Plan (IRP) and International Fuel Tax Agreement (IFTA) credentials; readiness to extend to other credentials [intrastate, titling, oversize/overweight (OS/OW), carrier registration, and hazardous material (HAZMAT)]. Does not necessarily include electronic payment of fees or taxes.
    - Connection to IRP and IFTA Clearinghouses
    - At least 10% of transaction volume handled electronically; readiness to sign up more carriers; readiness to extend to branch office where applicable.
- **Safety Information Exchange**
    - Use of Aspen (or equivalent software for access to centralized safety data) at all major inspection sites
    - Connection to the Safety and Fitness Electronic Record (SAFER) system so that states can exchange "snapshots" of information on interstate carriers and individual vehicles
    - Implementation of the Commercial Vehicle Information Exchange Window (CVIEW), or equivalent, system for exchange of intrastate snapshots and for integration of SAFER and other national/interstate data.
- **Electronic Screening**
    - Electronic screening at one or more fixed or mobile inspection sites
    - Readiness to replicate electronic screening capability at other sites (Richeson 2000).

FMCSA and its predecessor agency, the FHWA Office of Motor Carriers (OMC), provided oversight throughout the CVISN MDI, participated directly in system development, and offered technical and project management support to the states. As part of the deployment program, each state named a CVISN program manager and a system architect (typically a specialist in information technology, computer programming, networking, and/or telecommunications) to serve as liaisons with other states and with federal officials, and to participate in coordinating conference calls and periodic evaluation activities that have continued to the present. For more than a decade, FMCSA and its support contractors have facilitated numerous workshops, conferences, local training sessions, meetings, conference calls, and other outreach among states and the vendor community to foster the wider deployment of CVISN technologies.

CVISN remains an important element of the USDOT ITS program. The ITS JPO's current major initiatives include

- Vehicle-Infrastructure Integration (VII)
- Next Generation 9-1-1
- Cooperative Intersection Collision Avoidance Systems
- Integrated Vehicle-Based Safety Systems
- Integrated Corridor Management Systems
- Clarus (nationally available surface transportation weather observation network)
- Emergency Transportation Operations
- Mobility Services for All Americans

- Electronic Freight Manifest
- ITS Operational Testing for Congestion Mitigation.

Continuing key activities within the Federal ITS program are:

- CVISN
- 511 Travel Information
- ITS Architecture Implementation
- Wireless enhanced 9-1-1 (ITS JPO 2008).

As CVISN deployment expands beyond core capabilities in more and more states, stakeholders will continue to draw from and contribute to the knowledge base represented by the federal ITS program.

A number of other ITS-oriented developments, which are of interest in the area of CVO, share commonalities or intersect with CVISN priorities, such as

- Electronic commerce (e-commerce)
- Homeland security technology such as smart cards, security flags, e-seals, geofencing, and in-transit container security
- Transportation Worker Identification Credential (TWIC) cards and methods of electronically sharing driver information
- Smart roadside technology, such as wireless truck inspections and VII
- International border clearance
- Electronic toll collection
- Electronic processing of Heavy Vehicle Use Tax (HVUT)
- Related USDOT initiatives such as PRISM (Performance and Registration Information Systems Management), CSA 2010 (Comprehensive Safety Analysis), and the COMPASS information portal program.

CVISN, however, is concerned mainly with the three roadside and credential administration systems, EC, SIE, and ES.

1.3 Program Evaluation

In addition to providing funds directly to the states through the CVISN MDI and subsequent core and expanded CVISN deployment grant programs, FMCSA also supports ongoing activities to measure and evaluate the effectiveness of the CVISN deployments, individually and collectively, and to disseminate the results of these evaluations to all stakeholders. These evaluation and outreach activities are intended to aid the USDOT and participating states in recognizing innovative or successful approaches to CVISN deployment and to present a coherent account of the achievements of CVISN at a national level. Evaluations also help USDOT plan for future deployments and infrastructure investments and more effectively apply resources to programs, technologies, and approaches that are performing well in the field.

The information from various evaluations, when shared among the states, provides insight into navigating the many issues involved in specifying, procuring, setting up, operating, and maintaining advanced systems for enhancing commercial vehicle (CV) administration and safety. In particular, these insights help later-adopting states—or states with more challenging local situations—save time and effort in the course of their own CVISN deployments.

Model Deployment Initiative Evaluation. Beginning in 1996, the CVISN MDI demonstrated the technical and institutional feasibility, costs, and benefits of CVISN user services and encouraged further deployment. The initial participants included two prototype states (Maryland and Virginia) and eight pilot states (California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington). FMCSA, in conjunction with the ITS JPO, also sponsored an independent evaluation of the CVISN MDI, the results of which were issued in a two-volume report (USDOT 2002). A Transportation Research Board (TRB) paper and subsequent case study publication were also based on aspects of the independent evaluation (Brand et al. 2002, 2004).

In summary, the MDI Evaluation Report concluded that CVISN is a good investment for the U.S. CVISN can produce substantial cost savings for states and motor carriers, improve the efficiency and fairness of commercial vehicle operations and enforcement, and most importantly, save lives. The following list shows the major findings from the MDI evaluation.

2002 CVISN MDI Evaluation Key Findings

Safety. The CVISN Inspection Selection System (ISS), used in combination with manual prescreening to select commercial vehicles for inspection, was estimated to result in 84 fewer commercial vehicle crashes per year nationwide by removing unsafe vehicles and drivers from the roadway. If ISS were to be combined with ES, approximately 600 commercial vehicle-related crashes could be avoided per year, compared with the baseline scenario.

Cost. EC could offer substantial cost savings to states and motor carriers, depending on the level of motor carrier participation. Annual operating costs to the states for credentialing can be reduced by almost 35%, offsetting the start-up costs to deploy CVISN.

Customer Satisfaction. The general awareness throughout the national trucking industry of CVISN type initiatives is very low—especially among smaller trucking companies. State CVO administrators are generally enthusiastic about deploying CVISN.

Benefit/Cost Analysis. Benefit/cost ratios, considering start-up costs, operating costs, and crash avoidance over the expected life of CVISN systems, ranged from 0.6:1 for a minimal deployment of roadside enforcement technologies to 40:1 for full deployment of EC (USDOT 2002, pp. viii-x).

According to the MDI report, however, to achieve these benefits, CVISN must be deployed nationwide in keeping with consistent standards, and its major systems must be fully integrated (USDOT 2002). At the time of the MDI Evaluation, only a few of the ten participating states had made significant progress at deploying key CVISN components. Therefore, the MDI evaluation relied on benefits and cost data collected in a handful of prototype and pilot states that had made early progress at deploying certain CVISN components, as well as customer satisfaction data obtained from a broader sample of stakeholders in other states and the motor carrier industry. Much of the quantitative data in the 2002 report came from four states: Connecticut, Kentucky, Maryland, and, to a lesser extent, Virginia.

CVISN National Evaluation Strategy and Planning. Since the conclusion of the MDI, CVISN technologies and related capabilities have continued to be deployed across the country, in a great variety of settings. In light of this ongoing interest and the expanding deployment of CVISN technologies, and as a logical follow-on to the MDI Evaluation, in 2003 FMCSA initiated a five-year National Evaluation, which is the subject of this report. The goals and objectives of this evaluation are described in an Evaluation Strategy (USDOT 2006a); the hypotheses, tests, and analyses that make up the National Evaluation are described in an Evaluation Plan (USDOT 2006b).

The goals, objectives, and strategy for this National Evaluation grew from the National ITS Program Goals (USDOT 1997b) and through consultation with DOT program officials and the active participation of CVISN deployment states. Inputs to the CVISN National Evaluation strategy also included information gleaned from the DOT-sponsored CVISN MDI evaluation; CVISN partnering sessions held in 2003; state self-evaluation reports prepared between 2003 and the present; reports on expanded CVISN deployment from ad hoc committees formed in early 2005; and ongoing monthly conference calls with state CVISN program managers, system architects, and Federal officials among other resources. Also key to the strategy setting process was an evaluation options survey of participating CVISN states and follow-up contacts in 2004-2005. Appendix E presents the background of this survey; an account of the strategy evolution; the original information requests to the states; a set of evaluation options that were under consideration; candidate research objectives, methods, and products; a report on the survey results; and a summary of early contact with states that were interested in taking an active part in the National Evaluation.

The National Evaluation was conceived as a combination of four major analyses (motor carrier survey, cost analysis, safety analysis, benefit-cost analysis) plus a deployment analysis. Figure 1-1 shows the timeline for the CVISN National Evaluation. Because the evaluation was conducted in stages across several years, this report occasionally varies in the time points being referenced. Where appropriate, economic data have been adjusted such that they are expressed in constant dollars. However, portions of the deployment and safety data may refer to differing time frames between the study initiation in late 2003 and the date of publication in 2009. The body of this final evaluation report summarizes the findings from the major analyses, while the appendix provides a series of full-scale reports on the objectives, methods, results, conclusions, and supporting data from each of the constituent analyses, plus additional relevant background, archival, reference material.

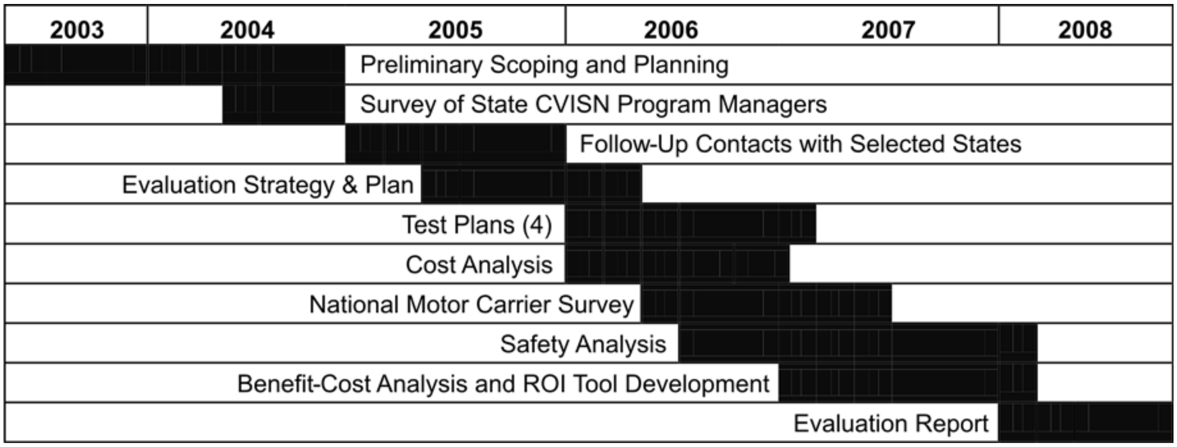

Figure 1-1. Timeline for CVISN National Evaluation

Document Review Process. A draft of this evaluation report was prepared and delivered to FMCSA on July 1, 2008. At the June and July 2008 CVISN state program manager conference calls, state officials were invited to review and comment on their deployment data as depicted in Section 4 and Appendix H. A number of states provided updated status information, which was incorporated into this report.

All states and other selected organizations and stakeholders were also invited to review and comment on the entire draft report in July 2008. The following jurisdictions and other organizations provided comments between June and December 2008:

- Arizona
- District of Columbia
- Indiana
- Kentucky (Univ. Trans. Ctr.)
- Maryland
- Mississippi
- Missouri
- South Dakota
- Texas
- ATRI
- Cambridge Systematics
- FMCSA Analysis Division
- HELP PrePass
- JHU/APL
- Norpass.

1.4 Organization of This Report

This National Evaluation report is organized into the following volumes and sections:

Volume 1

1. Introduction
2. CVISN Services and Technologies
3. Evaluation Goals and Approach
4. CVISN Deployment Analysis
5. Motor Carrier Survey
6. Cost Analysis

7. Safety Analysis
8. Benefit-Cost Analysis
9. Conclusions, Discussion, and Directions for the Future
10. References

Volume 2 Appendices A–C

A. Motor Carrier Survey Final Report
B. Cost Analysis Supporting Information
C. Safety Analysis Final Report

Volume 3 Appendices D–I

D. Benefit-Cost Analysis Supporting Information
E. Contacts with States in Developing Evaluation Strategy
F. Description of CVISN Benefits and Lessons Learned
G. CVISN Self-Evaluation Data Collection Templates
H. Selected CVISN Self-Evaluation Deployment Data
I. Excerpt from SAFETEA-LU Regarding CVISN Deployment Support.

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2.0 CVISN SERVICES AND TECHNOLOGIES

CVISN is not so much a recognizable, unified product, service, or brand in the marketplace as it is an agreed-upon, evolving set of advanced data transfer methods, tools, and technologies. As CVISN is adopted by one jurisdiction after another, hardware, software, and telecommunication network facilities are deployed according to a national network architecture, enabling states to share, view, and use data in their daily operations. The term "CVISN" itself is more widely recognized and used among FMCSA headquarters and field office staff and among state CV transportation/law enforcement/information technology officials than it is among the private-sector motor carrier industry. Carriers are more likely to refer to specific CVISN-related functions or services—such as PrePass or Norpass, or to state-specific programs that they know and use, such as "OSCAR" (One Stop Credentialing and Registration in New York) or the Kansas Online/TruckingKS System—than to the national CVISN program as such.

Chapter 2 of the CVISN MDI Evaluation Report presents a high-level summary of the technologies that were available at an early stage of deployment (USDOT 2002). Many of these technologies remain in place, while others have changed or have been supplanted.

The USDOT's CVISN web site (2008) contains links to a number of highly detailed guidance and planning/workshop documents reflecting a knowledge base of past experience and current thinking on how states may best design and deploy CVISN components. Figure 2-1 shows a sample screen image from the CVISN web site. The list of topics and categories on the left side of the screen illustrates the breadth of documents available for viewing and downloading. The SAFER (Safety and Fitness Electronic Record) heading, for example, includes system schema, software version and upgrade release notes, and other data documentation ranging from 1996 up through the present for an interactive database that states use to share current safety-related information.

The predominant CVISN technologies now in various stages of deployment in the states include systems to support EC administration, SIE, and ES (weigh station preclearance or bypass):

- User interfaces and supporting back-end data management applications that link motor carriers' offices to in-state licensing and tax/revenue agencies. With CVISN, carriers and license brokers/service bureaus can readily apply for, pay for, and obtain operating licenses, credentials, vehicle registrations, permits, and other required documents from their own offices, customarily using conventional web browsers through secure, password-protected interfaces. Carriers can obtain credentials for new vehicles or renew large fleets promptly and electronically, rather than manually preparing individual applications and mailing them in or driving to the state bureau. This saves time and labor for both the carrier and the state. Compared to the legacy (paper-based) information management system, electronic credentials information is generally of a higher quality and accuracy than hand-entered data and is more readily accessible to state enforcement personnel at the roadside, using CVISN technologies.

Figure 2-1. Example of Documents Available via the CVISN Web Site (cvisn.fmcsa.dot.gov, accessed 12/2008)

- Computer databases used to collect and disseminate information such as past carrier or vehicle inspection results, carrier safety history, law enforcement information, and current fuel tax and operating credentials/permitting status. Ideally, an inspector in the field can see relevant federal and state records indexed to a motor carrier company, a vehicle, and a specific driver, and use this information both in selecting which vehicles to inspect, and in deciding how to conduct the inspection most efficiently, once the vehicle has been selected.

- Wireless networks to enable real-time information sharing between administrative offices and enforcement personnel at roadside inspection stations or remote/mobile inspection locations. In most states, officers and inspectors use in-vehicle laptop computers, equipped with high-speed wireless modems, to upload inspection reports and to query a carrier's out-of-service (OOS) order history, Inspection Selection System (ISS) score, Motor Carrier Management Information System (MCMIS) profile, an individual driver's Commercial Driver's License (CDL) records, and other information needed to enforce federal and state safety regulations.

- Electronic screening through the combination of
    - In-vehicle radio-frequency transponders[5] and roadside readers/transmitters
    - High-speed weigh-in-motion (WIM) scales
    - High-speed, automatic, remote database queries

  that permit preclearance of transponder-equipped trucks, so that safe and legal trucks can avoid delays at many weigh/inspection stations, save fuel and labor costs, and deliver their payloads more quickly and efficiently. Some states also make use of low-speed, sorter-lane WIM scale data, overheight detectors, and other technologies in making screening and inspection decisions.

Reviews of several states' recent practices in using CVISN technologies for EC, SIE, ES, and roadside inspection selection; and the benefits of e-credentialing and e-screening as reported by the motor carrier industry were prepared under separate FMCSA-sponsored studies, and are available (FMCSA 2004a,b; 2007a,b; 2008a,b). Further details on the specific capabilities now in use in participating CVISN states are presented in Sections 4.0 through 7.0.

In addition to these technologies within the scope of the three main capabilities, advanced or expanded CVISN technologies are now being tested or deployed in many jurisdictions. These include enhanced driver information sharing; the creation of "virtual" or remote screening sites at locations away from fixed-site weigh stations; telecommunication of vehicle mechanical status to motor carrier offices and terminals; so-called Smart Roadside or wireless truck inspection technologies for improved safety, efficiency, and mobility; communications between vehicles and/or communications between a vehicle and the surrounding infrastructure; and improved motor carrier access to their own companies' safety data for improved data quality. Such developments offer the promise of further improvements in information systems and networks in support of the ITS goal areas.

Two other aspects of the current CVISN program demonstrate its adaptability to changing circumstances. Especially for those states that have surpassed the Core Deployment milestone, described in Section 4.0, a series of ad hoc teams and stakeholder working groups have emerged to coordinate the development of expanded CVISN technologies. Stakeholder groups concentrating on CVISN Deployment and Planning, Expanded CVISN, Grants, PRISM/CVISN Deployment, and CVISN Marketing, among other topics, confer periodically to coordinate their

[5] A "transponder" (i.e., transmitter + responder), also known as a "tag," is an electronic device that automatically receives and transmits predetermined radio signals. In CVO, battery-powered transponders are typically installed inside the upper windshield of a tractor cab, and can be used for weigh station bypass (electronic screening) and electronic toll collection administration (e.g., E-ZPass®).

efforts and decide on future actions. Ad hoc teams have been formed to face specific challenges and issues, such as roadside identification, COMPASS coordination, driver information sharing, and CVISN lessons learned. Groups such as these, which address real needs of the CVO community, are essential to the continued growth of CVISN.

The CVISN National Architecture is maintained and modified according to a set of established principles. Guiding this process is an Architecture Configuration Control Board (ACCB), which holds monthly conference calls at which changes are proposed, evaluated, deliberated, and decided on as appropriate. The ACCB is an advisory group of interested stakeholders, including states that have completed the CVISN Workshops, vendors supporting those states, representatives of the motor carrier industry, FMCSA contractors, and officials of the FMCSA and the ITS JPO. The primary CVISN ACCB functions are to review, analyze, discuss, and make recommendations about proposed changes to the CVISN architecture and generic top-level design. Besides the main tasks of tracking the CVISN National Architecture, within the ACCB focus groups currently concentrate on e-screening and data integrity.

FMCSA also supports CVISN deployment through

- Improvements in the infrastructure on which states can build systems that are customized for their own business needs and situations while efficiently exchanging valid, comparable, actionable data across state boundaries

- Assistance to states in technology transfer and program evaluation, so that best practices can be determined and disseminated

- Federal grant funding to support the planning, implementation, and operation of CVISN systems;

- Customized on-site training in support of states' CVISN programs.

3.0 EVALUATION GOALS AND APPROACH

As documented in the CVISN National Evaluation Plan (USDOT 2006b), several broad goal areas, accompanied by objectives and research measures, have guided the CVISN National Evaluation. Hypotheses, or "if-then" statements that are linked to the goals, objectives, and measures, and that reflect the expected outcomes of the ITS project, have been developed and, where possible, tested.

3.1 Strategy Development

The approach to developing the evaluation strategy was to synthesize the evaluation data generated and assembled to date, identify gaps in information and knowledge, and set forth the overall direction that the National Evaluation should pursue. The strategy (a) defined and prioritized evaluation goals and objectives and (b) recommended methods for achieving the objectives through a series of data collection and data analysis activities.

Building on the information base from the CVISN MDI Evaluation, the CVISN self-evaluation reports, and ongoing contacts with CVISN states through participation in monthly conference calls among the CVISN state program managers and system architects, the research team conducted an informal survey, inviting state CVISN program managers to rank-order a set of candidate options for a National Evaluation of CVISN and identify ideas or areas in which each state might be able to participate in the evaluation. Results were documented in an internal memorandum to the states on October 18, 2004. Twenty CVISN states returned the survey reply form. A simple scoring algorithm was used to establish a composite ranking, as shown in Table 3-1, and described further in Appendix E.

The objective receiving the highest score was homeland security applications. While CVISN has provided useful information to individuals concerned with homeland security, this topic is not a specified objective of the CVISN National Evaluation, because it is not directly aligned with the ITS program goals of safety, efficiency, productivity, mobility, and energy/environmental improvements.

Besides homeland security, during the 2004 survey, three safety objectives and the one benefit-cost objective related to state return-on-investment (ROI) analysis were also highly rated. Based in part on these inputs, the main focus of the research was turned toward measuring improvements in safety, benefit-cost ratios, and customer (i.e., motor carrier) satisfaction. Appendix E presents more detailed results from the survey of states and from follow-up contacts with selected states in 2004 and 2005.

Table 3-1. State-Assigned Priorities for Candidate Evaluation Objectives

Objective	Score[1]	Rank
(Safety) Evaluate alternative inspection selection algorithms.	24	4
(Safety) Evaluate the effectiveness of innovative uses of CVISN for roadside enforcement.	26	2
(Safety) Estimate potential reductions in crashes, injuries, and fatalities nationwide.	22	6
(Cust. Satis.) Characterize motor carrier satisfaction and factors affecting participation.	N/A	N/A
Survey report on motor carrier attitudes and factors affecting participation in CVISN – based on national sample of carriers	23	5
Multiple survey reports on motor carriers participating in selected states. A summary analysis will compare responses obtained from different states.	16	8
(Cust. Satis.) Characterize driver satisfaction.	13	11
(Cust. Satis.) Characterize motor carrier inspector satisfaction.	15	9
(Ben./Cost) Tool for states to estimate their return on investment.	25	3
(Ben./Cost) Compare states at various stages of deployment.	15	10
(Ben./Cost) Overall costs of deploying CVISN nationwide vs. overall benefits.	19	7
(Home Sec.) Innovative applications of CVISN for homeland security.	30	1

1. Score = 1 x (no. of states with medium priority) + 2 x (no. of states with high priority)

Source: Twenty state CVISN program managers responding to written survey between October 4 and October 15, 2004 (See Appendix E for further details). N/A = not applicable.

3.2 Evaluation Goals, Objectives, and Hypotheses

The listing below summarizes the goals and objectives. Below each numbered objective are the research hypotheses that were tested in this evaluation.

GOAL 1. Measure the effects of CVISN technologies on the **safety** of trucks and the general traveling public, through improved roadside enforcement and administrative processes

Objective 1.1 Evaluate current and potential future inspection selection methods used (e.g., ISS and Query Central)

- Inspectors use national and state data at the roadside **in different ways** to help make inspection selection decisions
- Various national and state data sources can be effectively **integrated** (consistent with the National ITS Architecture) for efficient use by roadside inspectors

- If inspectors could have access to **real-time, updated safety information** based on accurate vehicle or carrier identity, then inspectors would use that information to help make **inspection selection decisions**

- Inspectors' use of **visual cues and intuition** to select trucks for inspection will decline as the ready availability of more accurate, convenient, historical data increases at the roadside check station

Objective 1.2 Determine effectiveness of CVISN at increasing the efficiency of inspections (i.e., focusing on high-risk or noncompliant carriers, vehicles, and drivers)

- The availability of real-time **safety** information at the roadside, combined with other available or developmental roadside measures (e.g., license plate readers, WIM scales, remote video imagery), will help inspectors more effectively **target higher-risk carriers,** vehicles, and drivers

- The availability of real-time **credentials and licensing** information at the roadside will help inspectors more effectively **target noncompliant carriers,** vehicles, and drivers

Objective 1.3 Determine reductions in crashes, injuries, and fatalities nationwide under various deployment scenarios

- If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided directly, through increased **inspection efficiency**

- If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided indirectly, through increased **motor carrier compliance** with safety and licensing regulations

GOAL 2. Measure and analyze the **costs** of deploying and operating CVISN technologies in several typical configurations

Objective 2.1 Document start-up costs and annual operating costs for various scenarios

- In deploying CVISN technologies, states incur **one-time start-up costs** (labor, capital investment, and other costs) that are clearly defined and measurable

- In operating CVISN technologies over time, states incur **annual labor and operating/maintenance costs** that are clearly defined and measurable

GOAL 3. At a national level, compare the **costs** of deployment **versus** the **benefits** realized through improved efficiency, improved safety, and reductions in other costs

Objective 3.1 Calculate ratios of societal benefits to costs for various deployment scenarios and life cycles

- The net societal **benefits** are greater than the net societal **costs** of deployment, assuming a reasonable equipment life cycle and depending on the deployment scenario being modeled

Objective 3.2 Calculate net present values of the (net) benefits of CVISN deployment for various scenarios

- The **net present value** of CVISN benefits, compared with the investment required to deploy CVISN, makes CVISN a worthwhile investment at the Federal level

GOAL 4. Enable states to **estimate** the costs and benefits particular to their CVO setting

Objective 4.1 Develop a software tool for states to use in estimating their own return on investment from deploying CVISN EC systems

- States can use information from cost and benefit analyses to **customize and model** their own CVISN e-credentialing deployment situations and estimate the internal rate of return on the state's investment over a reasonable period of deployment and operation

GOAL 5. Document and analyze the **attitudes** of **motor carriers** regarding CVISN deployment

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

- Motor carrier officials are **aware** of CVISN technologies for electronic credentialing and electronic screening

- Motor carrier officials **recognize the potential benefits** that CVISN technologies offer to their companies

- Motor carrier officials use factors such as **costs, benefits, and institutional issues** in deciding whether their companies should participate in CVISN deployment

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

3.3 Evaluation Approaches and Methods

Table 3-2 graphically correlates the four main studies with the evaluation goals of the CVISN National Evaluation. As shown in the table, some studies feed into more than one of the evaluation goals.

Table 3-2. Correlation of CVISN National Evaluation Main Studies with Goals

Study	Evaluation Goal				
	Safety	Cost	National BCA	State ROI Estimates	Motor Carrier Attitudes
Motor Carrier Survey					■
Cost Analysis		■	■	■	
Safety Analysis	■		■		
BCA & ROI Tool			■	■	

Table 3-3 shows the report sections and supporting appendices for each of the four main studies in the CVISN National Evaluation.

Table 3-3. CVISN National Evaluation Main Studies and Report Sections

Study	Section(s)	Appendices
Motor carrier survey	5.0	A
Cost analysis	6.0	B
Safety analysis	7.0	C
Benefit-cost analysis	8.0	D

The four test plans that outlined the purposes and directions of the studies are documented in (USDOT 2006c,d,e; 2007a). Figure 3-1 illustrates the relationships among the main study components and the various outputs of the National Evaluation. The fifth task, listed as “Deployment Analysis,” is an ongoing support task, which developed a realistic picture of various deployment scenarios and thus fed into all of the goal areas.

The general approach was to begin each analysis with a review of the relevant literature, augmented by reference to the latest deployment, cost, and benefits information reflected in the CVISN self-evaluation reports. Analysts also consulted with federal and state officials and those in the contractor/vendor/research community to learn their views on various aspects of CVISN deployment under consideration. Findings from related FMCSA-sponsored studies and other studies were also incorporated as appropriate.

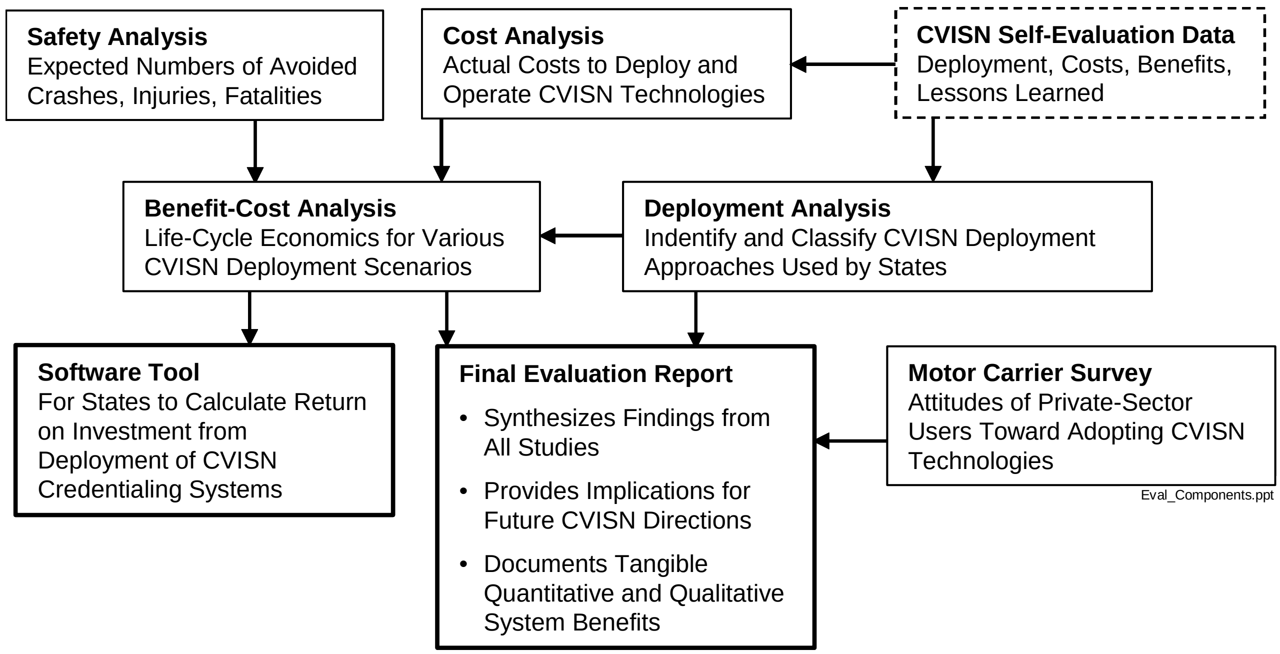

Figure 3-1. CVISN National Evaluation: Studies, Selected Data Sources, and Evaluation Outputs

Following this kind of background or secondary research, original data were collected from sources in the field for the first three analyses listed above. These sources included motor carrier company representatives, state business operations and ITS officials, and state law enforcement personnel choosing commercial vehicles for inspection. For the cost analysis, researchers visited CV administrative offices in four states to gain an understanding of actual deployment and operating costs and monetary benefits for various configurations of CVISN technologies. For the safety analysis, researchers visited five truck inspection sites in three states, and analyzed supplementary, relevant data from a sixth field site that had been the subject of a separate FMCSA-funded evaluation in 2007 (FMCSA 2008a,b). At all sites, the research team made observations and collected both quantitative and qualitative data. Likewise for the motor carrier survey, researchers attempted to contact more than 1800 companies, and completed more than 800 brief telephone interviews.

The benefit-cost analysis study was based on the results of the CVISN national cost analysis and from the safety analysis, which were combined with a careful review of the open literature to yield an economic life-cycle assessment. One outcome of the cost study and the benefit-cost analysis was a robust return-on-investment tool, distributed to CVISN Program Managers, which states can use to estimate or calculate their particular costs and savings from deploying CVISN EC over a defined life cycle. The spreadsheet software tool was prepopulated with economic data as reported by CVISN states, but it allows users to override the default values with actual or updated values when available, for more accurate economic modeling.

4.0 CVISN DEPLOYMENT ANALYSIS

While Section 2.0 provided an overview of the technologies and functions that constitute CVISN, this section presents an analysis of current data relevant to the CVISN hardware, software, and systems actually being deployed and used in the states. Most information has been compiled from self-evaluation reports, supplemented with information from program support organizations, such as the Johns Hopkins University Applied Physics Laboratory (JHU/APL) and the Volpe National Transportation Systems Center (VNTSC), plus contacts with standing and ad hoc industry and transportation committees. Descriptive scenarios are outlined, to group states with similar CVISN deployment configurations and CVO circumstances for comparison and analysis.

4.1 Overview of Deployment Status

When the MDI Evaluation Report was issued, four states (Maryland, Virginia, Kentucky, and Washington) had demonstrated core deployment in all three capability areas (USDOT 2002). As of fall 2008, 20 states had completed core deployment. Among the other states, 25 plus DC are now active in working toward core deployment, and the remaining five states are in the planning and design phase. A map illustrating the status by state is shown in Figure 4-1.

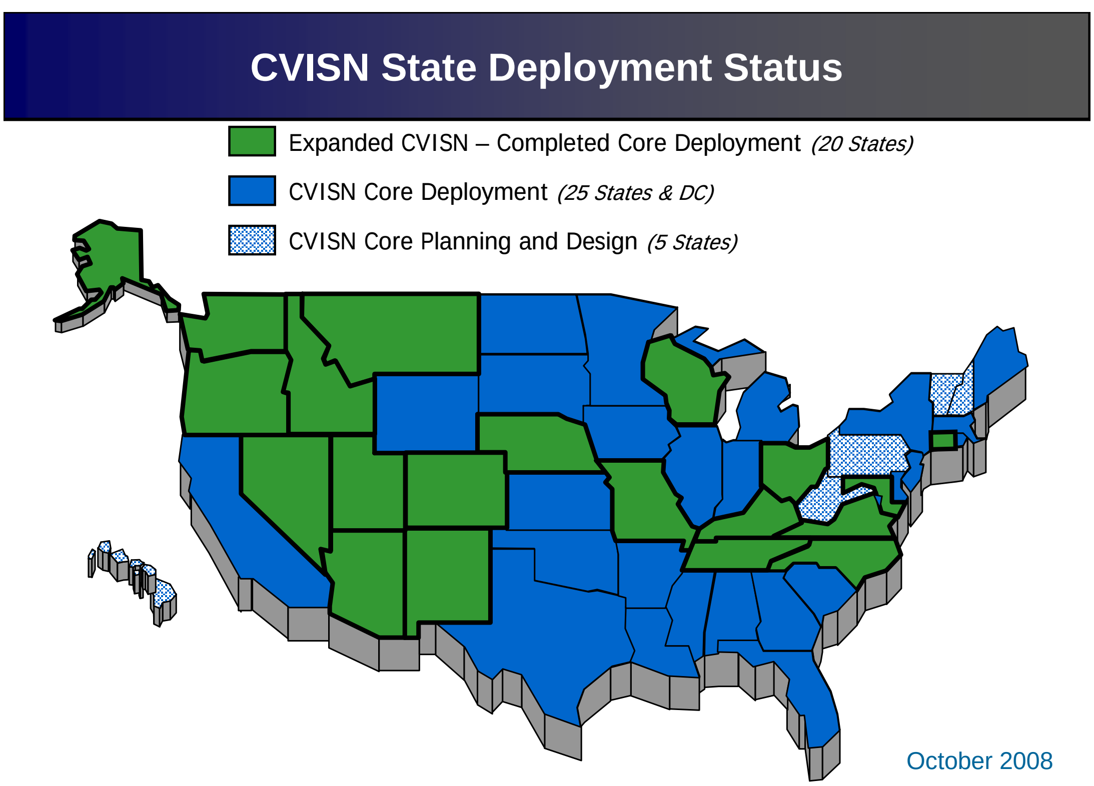

Figure 4-1. Expanded CVISN, Core Deployment, and Planning/Design Status (Oct. 2008)

Table 4-1 depicts the deployment status of a number of CVISN technologies across the U.S. by state, in the three CVISN technology areas. The table was provided by JHU/APL and was current as of December 2007. This information is continually monitored and updated by JHU/APL with information provided by the states, so it varies somewhat from the map presented previously.

Table 4-1. CVISN Deployment Status by State (as of December 2007)

			Safety Info Exchange			E-Credentialing				E-Screening	
CVISN Status	State	PRISM State	ASPEN (or equivalent) and Upload IRs to SAFER	CVIEW (or equivalent)	Exchange IR/Safety Data with SAFER	End-to-End IRP	IRP Clearinghouse	End-to-End IFTA	IFTA Clearinghouse	At one or more fixed/mobile sites	Use SAFER/CVIEW Snapshots
EXPANDED CVISN	Arizona	Y	Y	Y	Y	Y	Y	Y	Y	P	
	Colorado		Y		Y	Y	Y	Y	Y	P	
	Connecticut	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
	Idaho	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
	Kentucky	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
	Maryland		Y	Y	Y	Y	Y	Y	Y	P	Y
	Missouri	Y	Y	Y	Y	Y	Y	Y	Y	P	
	Nebraska	Y	Y	Y	Y	Y	Y	Y	Y	P	
	New Mexico	Y	Y	Y	Y	Y	Y	Y	Y	P	Y
	Ohio	Y	Y	Y	Y	Y	Y	Y	Y	P	Y
	Oregon	Y	Y	Y	Y	Y	Y	Y	Y	O	Y
	Tennessee	Y	Y	Y	Y	Y	Y	Y	Y	P	
	Utah	Y	Y	Y	Y	Y	Y	Y	Y	P	
	Virginia		Y		Y	Y	Y	Y	Y	P	
	Washington	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
	Wisconsin		Y	Y	Y	Y	Y	Y	Y	P	
CORE DEPLOYMENT	Alabama	Y	Y	Y	Y	Y	Y	Y	Y	P	Y
	Alaska	Y	Y	Y	Y						Y
	Arkansas	Y	Y	Y	Y	Y	Y	Y	Y	P	
	California	Y	Y							P	
	Florida	Y	Y		Y		Y	Y	Y	P	
	Georgia	Y	Y		Y		Y		Y	P	
	Illinois	Y	Y			Y		Y	Y	P	
	Indiana	Y	Y		Y	Y			Y	P	
	Iowa	Y	Y		Y	Y	Y	Y		P	
	Kansas	Y	Y		Y	Y	Y	Y	Y	P	
	Louisiana	Y	Y	Y	Y		Y		Y	P	
	Maine	Y	Y		Y	Y	Y	Y	Y		
	Massachusetts	Y	Y		Y		Y		Y		
	Michigan		Y		Y		Y		Y		
	Minnesota	Y	Y	Y	Y	Y	Y	Y	Y		
	Mississippi		Y		Y	Y	Y		Y	P	
	Montana		Y	Y	Y	Y	Y	Y	Y	P	Y

			Safety Info Exchange			E-Credentialing				E-Screening	
CVISN Status	State	PRISM State	ASPEN (or equivalent) and Upload IRs to SAFER	CVIEW (or equivalent)	Exchange IR/Safety Data with SAFER	End-to-End IRP	IRP Clearinghouse	End-to-End IFTA	IFTA Clearinghouse	At one or more fixed/mobile sites	Use SAFER/CVIEW Snapshots
	Nevada		Y	Y	Y	Y	Y	Y	Y	P	
	New Jersey	Y	Y		Y	Y	Y		Y		
	New York		Y		Y	Y	Y	Y	Y		
	North Carolina	Y	Y	Y	Y	Y	Y	Y	Y	O	Y
	North Dakota		Y		Y	Y		Y			
	Oklahoma		Y	Y	Y	Y		Y		P	
	South Carolina	Y	Y	Y	Y						
	South Dakota	Y	Y	Y	Y		Y		Y	N	Y
	Texas	Y	Y		Y	Y	Y	Y	Y		
	Wyoming	Y	Y	Y	Y		Y		Y	P	
PLANNING AND DESIGN	Delaware	Y	Y		Y		Y				
	Hawaii		Y		Y						
	New Hampshire	Y									
	Pennsylvania	Y	Y		Y						
	Rhode Island	Y	Y		Y				Y		
	Vermont	Y	Y		Y		Y		Y		
	West Virginia	Y	Y		Y		Y			P	
	Washington DC		Y		Y		Y				

Source: Johns Hopkins University Applied Physics Laboratory
Key: Y = Implemented/Active User; P = HELP/PrePass; N = Norpass; G = Oregon Green Light; O= Other

As shown in the table, states vary in their participation across the CVISN functional areas. Figure 4-2, for example, shows the numbers of states that are uploading commercial vehicle credentials data to the SAFER system as of December 2008.

Electronic Credentialing. Electronic credentialing, or the automation of commercial vehicle credentials administration, consists of the process whereby a motor carrier can apply for, pay for, and receive operating credentials (e.g., International Registration Plan, or IRP; International Fuel Tax Agreement, or IFTA; and other types of credentials or permits) remotely, using a computer-based interface. The EC process saves administrative time for the carrier and the state and enables carriers to get their trucks on the road more quickly.

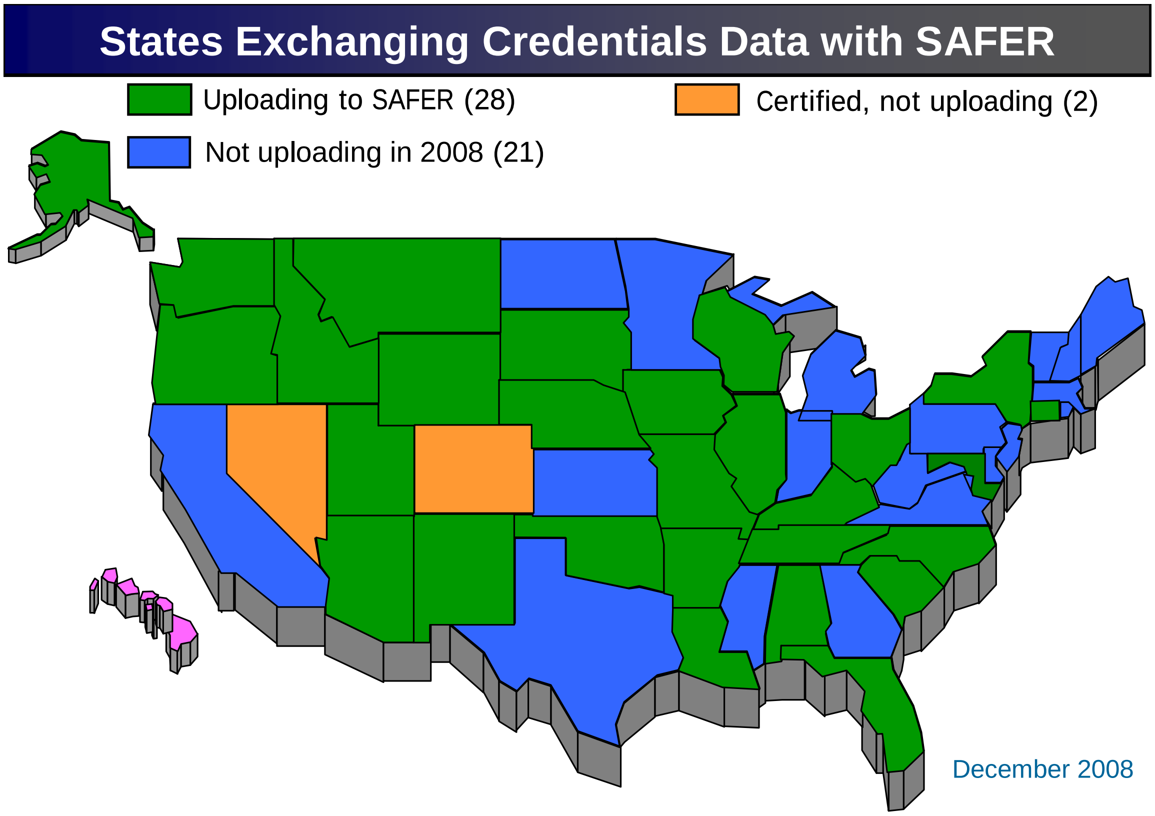

Figure 4-2. Patterns of Uploading CV Credentials Data to SAFER System by State (Dec. 2008)

Due to the many technical challenges involved in establishing interfaces between new and legacy, or archival, databases and software systems, states' efforts to develop EC systems were slow to develop and, at first, did not achieve the same level of widespread deployment as roadside systems. However, partly as a result of CVISN grants, states have made significant progress in the past five years in the automated processing of credentials, mainly focusing on IRP and IFTA. As of May 2008, 28 states support EC for IRP and IFTA, with an additional four states supporting only IRP entries. All these states support the electronic submission of applications, evaluation processing, and application response. In addition, all but a few of these IRP and IFTA supporting states proactively provide updates to vehicle snapshots as needed when IRP and IFTA credentials actions are taken.

The IRP and IFTA clearinghouses were developed to facilitate distribution of registration funds and tax revenues among states and provinces have also seen an increase in state participation in recent years. As of December 2007 (Table 4-1 above), 40 states were providing IRP credential application information to the IRP clearinghouse and supporting electronic state-to-state fee payments via the clearinghouse. For IFTA, 39 states were providing the IFTA clearinghouse with IFTA credential application information using electronic data interface standards.

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

Safety Information Exchange. Safety Information Exchange is the exchange of carrier, vehicle, and driver data to and from the roadside and central offices for use in support of enforcement and inspection decisions, such as deciding which vehicle to inspect, or learning what a given carrier's past history of out-of-service (OOS) orders has been. SIE facilitates the collection, distribution, storage, retrieval, use, and evaluation of current and historical safety information.

The use of motor carrier and vehicle-specific safety performance data by state agencies conducting roadside inspections has grown significantly in recent years. As of December 2007, 49 of the 50 states (98%) plus the District of Columbia were using Aspen or an equivalent system at inspection sites to record inspections. This is up from 84% of states in December of 1999 as reported in the CVISN MDI final report (USDOT 2002). Also, 48 of the 50 states submit interstate and intrastate reports to Safety and Fitness Electronic Records (SAFER) through SafetyNet. Because of Aspen's ability to pull data from other sources such as the Inspection Selection System (ISS), Past Inspection Query (PIQ), and Query Central, inspectors have more data (both historical as well as real-time) at their disposal when performing inspections. Further, Aspen's connectivity to SAFER and/or SafetyNet allows for a quicker exchange of inspection data.

A key factor in the enhancement of roadside enforcement activities involves the deployment of a Commercial Vehicle Information Exchange Window (CVIEW) or an equivalent system. The purpose of a CVIEW is to integrate interstate and intrastate carrier safety data, driver and vehicle information, and a variety of carrier credentials and insurance data. The CVIEW facilitates the state-level exchange of inter- and intrastate carrier, vehicle, and driver safety and credential data to support ES operations and to allow states greater control and flexibility for establishing interfaces with internal state legacy systems. As of May 2008, 23 states have implemented a CVIEW or equivalent system for exchanging interstate and intrastate data within the state and established a connection with SAFER to exchange interstate data through snapshots. An additional 15 states expect to have this functionality deployed by the end of 2008.

Another tool available to states for information exchange is Query Central, which has been operational since 2001. Query Central is a secure intranet web application that provides Federal and state safety enforcement personnel with a single location where they can enter one query and obtain targeted safety data on commercial motor vehicle carriers, vehicles, and drivers from multiple sources.

Query Central does not maintain a database of its own, but instead pulls data from the authoritative sources in real-time.[6] The data are specific to the needs of safety enforcement personnel and include automated summaries and alerts to free staff from reading through data to

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[6] Examples of these authoritative sources include the Motor Carrier Management Information System (MCMIS), SAFER, Licensing and Insurance (L&I), Performance and Registration Information System Management (PRISM), and the Commercial Driver License Information System (CDLIS).

determine if there may be issues. Result data can pre-populate Aspen to increase data integrity for inspections.

Some states that have achieved core deployment have participated in efforts to grow CVISN through the Expanded CVISN program. Areas related to SIE in Expanded CVISN include driver information sharing and expanded safety information sharing. Driver information sharing involves establishing, maintaining and providing controlled access to driver snapshots. These driver snapshots would be used in all processes (e.g. enforcement, credentialing, hiring, inspection) that require information about drivers. In addition, another goal is to improve enforcement's and carriers' access to driver information to target driver safety risk. This emphasis on driver factors and driver information sharing fills a valuable niche, in part because until recently, the focus of CVISN data exchange technologies has been on motor carriers and vehicles. Adding driver factors complements these previous efforts.

Electronic Screening. ES—the ability to detect, identify, and weigh commercial motor vehicles at mainline or ramp speeds—is the system that can give certain transponder-equipped, enrolled vehicles a green light in the cab to bypass static weigh and inspection stations. The bypass ordinarily occurs if (a) the carrier and vehicle credentials are up-to-date; (b) the carrier has a good history of safety performance as defined state by state; and (c) vehicle weights are in order. ES can save both time and money for safe, compliant carriers and drivers, and allow states to focus enforcement resources on higher-risk carriers.

Most of the growth in ES has occurred due to the emergence of three programs or partnerships: HELP (Heavy Vehicle Electronic License Plate) PrePass, Norpass (North American Preclearance and Safety System) and Oregon's Green Light. Currently 72% of the states are participating in such ES programs. This is up from about 50% in 2002. Ten of these participating states use snapshots updated by a SAFER/CVIEW description in an automated process to support screening decisions.

Total truck enrollment in the three programs has grown by 181% since 2001. Enrollment as of November 2007 stands at about 562,000 trucks, which is still a small fraction of the 8 million trucks in the U.S. Table 4-2 shows how enrollment is distributed among the three programs.

Table 4-2. Participation in Electronic Screening Programs

Numbers of:	PrePass	Norpass	Green Light
States	28	8*	1
Sites	279	77	22
Trucks	420,382	100,000	42,000

As of November, 2007 – Data gathered from www.prepass.com, www.norpass.com, www.oregon.gov/ODOT/MCT/GREEN.shtml
* Includes 7 member jurisdictions plus one partner jurisdiction (Oregon) in U.S.

The **PrePass** ES system is operated by HELP Inc., a nonprofit partnership between motor carriers and government agencies. According to HELP, the mission of PrePass is to develop and deploy advanced technology systems that create a cooperative operating and regulatory environment which improves the efficient and safe movement of commercial vehicles and the performance of highway systems. PrePass has seen substantial growth in the numbers of operational trucks, sites, and motor carriers enrolled in the system since 1996, as shown in Table 4-3.

Table 4-3. PrePass Growth 1996 to 2007

Year	Numbers of		
	Operational Trucks	**Sites**	**Motor Carriers**
1996	4,632	10	262
1997	27,995	29	690
1998	62,114	55	1,696
1999	110,445	87	3,026
2000	164,881	135	7,255
2001	187,311	191	13,088
2002	219,868	228	20,856
2003	247,210	242	30,907
2004	285,906	248	44,873
2005	352,154	256	60,105
2006	398,960	263	N/A*
2007 (Through Oct)	420,382	269	N/A*

* N/A = not available. In 2006, PrePass stopped counting participants in terms of motor carriers and now uses number of registered USDOT numbers. Source: HELP Inc.

Norpass is a public-private partnership consisting of state/provincial agencies and motor carrier industry representatives. Norpass exists to enhance the safety and efficiency of commercial vehicle operations in North America through implementation of open, interoperable systems for commercial vehicle ES. Norpass has been deployed at weigh and inspection stations in five states in the U.S. (Connecticut, Kentucky, Idaho, South Dakota and Washington) and two Canadian provinces. Kentucky and Washington State serve as system administrators, providing electronic vehicle identification database services and marketing support for Norpass: Washington for the western region and Kentucky for the eastern region. Norpass transponders can also be used in states such as North Carolina and Oregon at no cost to the motor carrier. Norpass transponders are operable in PrePass states provided the truck registers in the PrePass system, agrees to certain terms and conditions, and pays for preclearance in PrePass states. As of November 2007, Norpass has 77 operational sites and over 100,000 commercial vehicles with transponders representing about 11,000 motor carriers. Since 2003, Norpass has seen truck enrollment grow by approximately 61% per year.

Oregon's **Green Light** system of ES consists of 22 weigh stations equipped with high-speed WIM devices and transponder readers. Green Light has issued about 42,000 transponders to approximately 4,025 motor carriers. As of November 2007, Green Light was on pace to pre-clear about 1.5 million trucks in 2007, a 42.5% increase since 2002. The Green Light system allows the state to perform a quick check of each participating truck's size, weight, height, and carrier credential and safety status. This system is administered by the Oregon Department of Transportation. Oregon offers preclearance to motor carriers at no charge and transponders are operable in Norpass states as well as PrePass states (subject to carrier enrolling in PrePass system, agreeing to certain terms and conditions and paying for preclearance in PrePass states).

One persistent issue in the growth of ES is the question of business models, interoperability, and data ownership/access. The motor carrier industry continues to advocate consistent application of screening programs and criteria from state to state. However, under CVISN each state has a high level of freedom to configure and operate its ES program, for example, by setting the safety and credentialing criteria used to make the instantaneous red/green light decision, or by choosing either to develop and operate its own screening system or else outsource the screening program to a private party.

The HELP/PrePass business model emphasizes data privacy and is funded through a program of user (i.e., truck owner) payments for the privilege of utilizing the not-for-profit, public-private partnership's weigh station bypass service. These pro-rata fees enable the program to recover the capital cost of deploying roadside equipment and transponders, maintain the privately held, central databases used to feed the decision algorithm, and market the program to unenrolled trucking companies. By contrast, the Norpass and Green Light business model emphasizes open systems, interoperabilty, and using the CVISN model for sharing safety and credentials data among authorized agencies. Norpass and Green Light depend on state government funding of the equipment and database systems, so participation in those two partnerships carries no user fee for the privilege of bypassing open weigh stations. These two programs are funded through tax revenues. With regard to data privacy, Norpass member jurisdictions agree to use the information collected by Norpass solely for the purpose of determining each truck's eligibility to bypass.

At the risk of oversimplifying a complex question, the PrePass model is based on the assumption that motor carriers will be more likely to enroll their trucks if they know that the bypass data will be held by a third party, separate from government and law enforcement. The Norpass model assumes that true interoperability and resulting safety benefits depend on all jurisdictions being able to identify carriers and compare vehicle and carrier identities against state and national safety data in a transparent and automatic manner, regardless of the screening program in which the carrier is enrolled. One result of this division in prevailing business models is that a single power unit may be equipped with two or more transponders, depending on the routes it travels.[7]

Expanded CVISN activities in the ES area include the Smart Roadside Program. Through Smart Roadside (related to the concept of wireless truck inspections), inspectors would have more access to safety related truck data for inspection selection decisions. Also, virtual and remote roadside sites are being pursued by a few states such as Kentucky, Indiana, Florida, and New York in an effort to obtain safety and credentialing information from a truck at mainline speeds to ease the burden on existing fixed site facilities.

4.2 Summary of CVISN State Self-Evaluation Data on Infrastructure Deployment

A program of state self-evaluation has been in place since the first CVISN partnership agreements were entered into between the USDOT and state governments. In exchange for receiving federal grant and research funds, states have been expected to submit periodic self-

[7] Motor carriers can operate in both Norpass and PrePass with a single transponder—as long as they obtain the transponder from Norpass and then register it in PrePass.

evaluation reports, focusing on infrastructure deployment, costs, benefits, and lessons learned. The purpose of this section is to provide a brief background on the CVISN state self-evaluation program and to present a summary of the deployment data. Detailed deployment data are presented in table format in Appendix H. Cost data are summarized in Section 6.0 and Appendix B. Benefits and lessons learned, as self-reported by the states, are summarized in Appendix F.

Background on Self-Evaluation. The CVISN self-evaluation program was formalized in October 2003, with the CVISN program managers and their teams in all participating states being invited to log onto a password-protected web site containing three online templates or questionnaire forms along with guidance and definitions intended to assist the states in providing comparable data. The templates, covering

- Deployment
- Costs (start-up and recurring/annual costs)
- Benefits and Lessons Learned

had been beta-tested among a handful of CVISN states in 2002-2003, to help ensure that the templates captured an adequate level of detail on the most useful dimensions of CVISN deployment, while keeping respondent burden to a minimum. At the forefront of the template and database design process was the intention to provide all CVISN states with the information they needed the most as they set about planning and refining their own deployments, ideally saving states the effort of individually polling other states to learn the status and specifics of CVISN deployments. In 2005 and 2006, a data reporting interface was added to the self-evaluation web site, enabling states to log in and view raw data from individual states and summary tabulations across all states that had completed their self-evaluation reports.

Appendix G shows the self-evaluation templates as announced to the states in 2003. States have had full, continuous access to add, modify, and delete information from their own self-evaluation templates from October 2003 to the present. Approximately 40 states have provided some self-evaluation information, and more than 20 have completed all three templates to date. In practice, some states found it difficult to complete and update the templates, because of reasons such as schedule and resource limitations, states that may not have tracked some of the requested deployment and cost data at the same level of detail envisioned in the self-evaluation templates, staff turnover, and other factors restraining the states from providing full and up-to-date information.

Also, the data presented here are as they were entered and modified by the state CVISN program managers and their teams, in response to periodic FMCSA requests. The data have not been subject to any kind of external verification or audit, beyond what the states themselves have done. Occasionally, obvious errors were observed in the course of reviewing or extracting the data, and some of these have been corrected when possible. That said, the self-evaluation data should be regarded as a fair, first-of-its-kind guide to what a large number of CVISN states have deployed over the past five years, or are planning to deploy. The data should not be regarded as an exhaustive, audited accounting.

Time Frames of Reference in Self-Evaluation. FMCSA provided periodic reminders and announcements to the states, requesting that they visit the self-evaluation data collection and reporting web site to add and update their information, and a number of states did. Table 4-4 shows the number of states providing self-evaluation data that were last modified or updated in each of the years from 2003 to 2008. The table shows that the bulk of the self-evaluation data were current as of approximately 2004 to 2006. As a point of reference for interpreting the state-specific data in this section and in Appendix H, Table 4-5 shows the year when each state's deployment self-evaluation report was last modified. The self-evaluation database used in this report was downloaded from the web site in March 2008.

Table 4-4. Years in Which Self-Evaluation Data Were Last Modified by States

Year	Number of States
2003	1
2004	11
2005	12
2006	11
2007	0
2008	6
TOTAL	**41**

Table 4-5. Each State's Latest Year of Deployment Data Update

STATE	YEAR
AK	2006
AL	2006
AR	2005
AZ	2006
CA	2006
CO	2005
CT	2006
DE	2006
FL	2005
GA	2004
ID	2004
IL	2005
IN	2004
KS	2005
KY	2008
MA	2005
MD	2008
ME	2005
MI	2004
MN	2006
MO	2008

STATE	YEAR
MT	2004
ND	2003
NE	2006
NJ	2004
NM	2004
NY	2004
OH	2004
OK	2005
OR	2008
RI	2006
SC	2005
SD	2008
TN	2005
TX	2008
UT	2006
VA	2005
WA	2004
WI	2006
WV	2005
WY	2004

A number of questions were intended to capture information about states' near-term plans for infrastructure deployment, by asking for three-part answers, such as Question 46:

> **46. How many of your state's permanent weigh/inspection sites (where a scale is installed in the ground) are connected now to CVIEW (or equivalent) for carrier or vehicle electronic data "snapshots" (or equivalent)? How many new sites are expected to be connected soon for snapshots?**
>
> **Number of sites**
> - **Now**
> - **In 6 Months**
> - **In 12 Months.**

FMCSA wanted to capture meaningful information from states that were just on the verge of deploying a given technology. However, because the states have had continuous access to the data entry interface for nearly five years, questions concerning current status and 6-month or 12-month plans, as well as questions concerning the most recent 12-month period, may refer to widely differing periods of time across states, depending on when the state answered the question. Each state's self-evaluation data are assumed to be reflective of the time that the state completed or updated its template.

Analysts should view each state's data with the understanding that the data values may represent different situations, depending on how the state interpreted the time-related questions. The data, therefore, are more suggestive of general levels of deployment activity within and across the states than they are highly consistent, audit-level representations of actual status and plans.

This summary is intended to give a national-scale perspective, based on the data as reported by participating CVISN states. For by-state data, readers are referred to the tabulations in Appendix H, where each state's raw deployment data are presented alphabetically by state abbreviation. If a state did not respond to a given question, then that state will not appear in the tabulations for that question. Thus, the sets of states included will vary when looking across all tables.

Summary of Key Findings. The findings presented in this section are based on the deployment portion of the CVISN self-evaluation database as of March 2008. A total of 41 states have some self-evaluation deployment data in the database. Those states having no data in the deployment database are Hawaii, Iowa, Louisiana, Mississippi, Nevada, New Hampshire, North Carolina, Pennsylvania, and Vermont, plus the District of Columbia. A number of these states or jurisdictions are participating in CVISN deployment, but their data are not reflected in the self-evaluation deployment information.

For one state, Florida, several state agencies submitted separate self-evaluation templates. In consultation with the state CVISN team, the various responses were compiled into a single record intended to combine the sum of information from all of the following agencies: Florida DOT, ITS Administration; Departments of Agriculture and Consumer Services; Revenue; Highway Safety and Motor Vehicles; and the Florida Motor Carrier Compliance Office.

IRP Electronic Credentialing. To get an overall picture of the volume of credentialing activity in the states—both conventional (legacy system, or paper-based credentialing) and CVISN electronic or web-based credentialing—states were asked the numbers of IRP carrier accounts and vehicles. Table 4-6 shows the total volumes reported by all states, along with simple descriptive statistics.

Table 4-6. IRP Credentialing Volume: Carriers and Vehicles (CVISN and non-CVISN)

STATE	IRP Carrier Accounts	IRP Vehicles
AL	7,300	37,100
AR	3,600	11,000
AZ	2,100	150,000
CA	14,600	97,260
CO	2,543	10,233
CT	2,400	12,000
FL	12,100	32,900
ID	2,800	14,500
IL	16,000	165,800
IN	9,600	110,000
KS	3,200	20,000
KY	5,025	17,700
MA	4,800	20,500
MD	7,221	28,763
ME	2,800	8,300
MI	7,500	55,200
MN	6,800	35,000
MO	6,878	48,606
MT	1,500	17,800
ND	2,100	9,000
NE	4,000	38,200
NJ	14,000	60,000
NM	2,300	9,800
NY	9,100	39,000
OH	15,000	78,000
OK	11,609	179,000
OR	5,500	4,800
SC	6,354	20,353
SD	2,500	9,300
TN	8,100	71,200
TX	18,000	103,700
UT	3,100	28,700
VA	7,400	41,000
WA	2,500	26,000
WI	5,100	48,000
WV	3,300	12,500
WY	1,100	14,800
AVG	**6,482**	**45,568**
MED	**5,100**	**28,763**
STDEV	**4,576**	**45,286**

States ranged from a low of 1,100 carrier accounts (WY) to a high of 18,000 accounts (TX), with an average of 6,482 and a median of 5,100. As for the number of IRP credentialed vehicles, states ranged from a low of 4,800 vehicles (OR) to a high of 179,000 vehicles (OK). The average state reported 45,568 IRP vehicles and the median value was 28,763 IRP vehicles.

Looking at IRP credentialing volume another way, in terms of annual transaction types and numbers of vehicles credentialed in the most recent 12-month period, states reported an average of 1,618 new transactions, 7,144 renewal transactions, and 8,258 supplemental transactions. The median values for these transaction types were 845, 5,380, and 5,107, respectively. Likewise, for the numbers of IRP vehicles credentialed in the past year, states averaged 3,511 new vehicle credentials issued per year, 31,376 renewal vehicle credentials per year, and 15,610 supplemental vehicle credentials per year. The median values for these vehicle-based volumes were 1,100, 20,000, and 7,000, respectively. A number of states had missing values for this question.

States were asked to report and predict the percentages of four IRP credentialing transaction steps (transmitting application, processing application, payment of fees, and issuance of credential) that were performed using CVISN electronic technology at the time of the response, and at 6 and 12 months thereafter. Table 4-7 summarizes the degree to which states predict that carriers will be able to complete IRP transaction steps electronically 12 months after the time of each state's response to the CVISN self evaluation. Taken as a whole, states are expecting between about 10 and 30% of each step to be completed using CVISN EC in the near future.

Table 4-7. Percent of IRP Credentialing Transaction Steps Predicted to be Completed Electronically in Next 12 Months

IRP Transaction Step	Average % Reported	Median % Reported
Carrier Transmits IRP App. to State	27	20
State Processes IRP Application	29	10
Carrier Pays IRP Fee to State	20	10
State Issues IRP Credential	33	18

Similarly, when asked to predict the percent of all motor carrier accounts that will apply for IRP credentials electronically, those states reporting expected an average of 22% and a median of 15% of accounts to be applying electronically within the next 12 months.

States were asked about whether the state owns and operates the IRP EC system, or whether those ownership and operation functions were contracted out to a vendor. For this question, the credentialing system was broken down into its front-end, user interface component and its back-end database management component. For the front-end component of IRP e-credentialing, states reported 20 state-owned versus 15 vendor-owned systems, and nearly twice as many state-operated as vendor-operated systems (19 to 11). For the back-end component, the results were more evenly split, with states owning 19 systems and vendors owning 16 systems, and with states operating 18 systems themselves and contracting out the operation of 14 back-end systems to vendors.

Among states reporting vendor involvement in any aspect of IRP credentialing, the results were fairly evenly split between ACS/VISTA (11 states) and Polk/COVERS (eight states), with six states reporting the use of other vendors' systems.

Regarding options available to carriers for the payment of IRP credentialing fees, Table 4-8 shows the numbers of states reporting current and near-future payment methods offered in their state's electronic IRP credentialing programs. A single state could check more than one payment method. Credit cards and automatic clearinghouse credit and debit methods appear to be the most prevalent payment methods.

Table 4-8. Present and Future Methods for Electronic Payment of IRP Credentialing Fees

Payment Method	Numbers of States Where IRP Carriers Can Use This Method: Now	In 6 Months	In 12 Months
Credit card	17	9	12
Debit card	4	0	4
Automatic clearinghouse (ACH) credit	5	3	9
ACH debit	9	6	13
Other Automatic withdrawal or account sweep service	0	0	2
Other electronic payment method (please specify)			
Billing to an MCTD account	1		
e-check	2	1	3
vitalcheck	1	1	1
Wire transfer	1		1

A total of 30 states reported already belonging to the IRP Clearinghouse, with eight more states expecting to join sometime within the next 2 years. Almost all responding states reported using an internet/HTML/web-based system for carriers to use to perform IRP EC transactions.

When asked about the frequency of uploading IRP credentials data to CVIEW or a similar central repository for use at the roadside, 11 states reported using real-time, near-real-time, or hourly updates; 15 states reported daily updates, and a handful of states reported less frequent intervals, e.g., weekly or quarterly (Apx. Table H-12 and continuation).

IFTA Electronic Credentialing. To get an overall picture of the volume of credentialing activity in the states—both conventional (legacy system, or paper-based credentialing) and CVISN electronic or web-based credentialing—states were also asked the numbers of IFTA carrier accounts administered in their state. Table 4-9 lists the reported numbers of IFTA carrier accounts by state.

States ranged from a low of 1,200 IFTA carrier accounts (WY) to a high of 13,000 accounts (NJ, TX), with an average of 5,185 and a median of 4,200.

Looking at IFTA credentialing volume another way, in terms of annual transaction types and numbers of vehicles credentialed in the most recent 12-month period, states reported an average of 1,254 new transactions, 5,722 renewal transactions, and 3,637 supplemental transactions. The median values for these transaction types were 857, 4,152, and 850, respectively.

States were asked to report and predict the percentages of four IFTA credentialing transaction steps (transmitting application, processing application, payment of fees, and issuance of credential) that were performed using CVISN electronic technology at the time of the response, and at 6 and 12 months thereafter. Table 4-10 summarizes the degree to which states predict that carriers will be able to complete IFTA transaction steps electronically 12 months after the time of each state's response to the CVISN self evaluation. Taken as a whole, states are expecting between about 15 and 30% of each step to be completed using CVISN EC in the near future.

Table 4-9. IFTA Credentialing Volume: Carriers (CVISN and non-CVISN)

STATE	IFTA Carrier Accounts
AL	4,700
AR	3,100
AZ	1,800
CA	12,100
CO	2,316
FL	7,300
ID	3,100
IL	11,900
IN	6,000
KS	3,100
KY	4,000
MA	4,300
MD	6,200
ME	2,300
MI	5,800
MN	5,200
MO	7,147
MT	1,300
ND	2,343
NE	4,200
NJ	13,000
NM	1,800
NY	11,000
OH	11,200
OK	4,200
OR	4,200
RI	1,400
SC	6,000
SD	2,800
TN	4,600
TX	13,000
UT	2,400
VA	7,000
WA	3,000
WI	4,100
WV	2,750
WY	1,200
AVG	**5,185**
MED	**4,200**
STDEV	**3,481**

Table 4-10. Percent of IFTA Credentialing Transaction Steps Predicted to be Completed Electronically in Next 12 Months

IFTA Transaction Step	Average % Reported	Median % Reported
Carrier Transmits IFTA App. to State	30	20
State Processes IFTA Application	29	20
Carrier Pays IFTA Fee to State	21	15
State Issues IFTA Credential	30	18

Similarly, when asked to predict the percent of all motor carrier accounts that will apply for IFTA credentials electronically, those states reporting expected an average of 22% and a median of 18% of accounts to be applying electronically within the next 12 months.

States were asked about whether the state owns and operates the IFTA EC system, or whether those ownership and operation functions were contracted out to a vendor. For this question, the credentialing system was broken down into its front-end user interface component and its back-end database management component. For the front-end component of IFTA e-credentialing, states reported twice as many (24) state-owned versus 12 vendor-owned systems, and slightly more state-operated as vendor-operated systems (19 to 13). For the back-end component, the results favored the states, with states owning 22 systems and vendors owning 14 systems, and with states operating 20 systems themselves and contracting out the operation of only half as many (10) back-end systems to vendors.

Among states reporting vendor involvement in any aspect of IFTA credentialing, the results were fairly evenly split between ACS/VISTA (nine states) and Polk/COVERS (seven states), with seven states reporting the use of other vendors' systems.

Regarding options available to carriers for the payment of IFTA credentialing fees, Table 4-11 shows the numbers of states reporting current and near-future payment methods offered in their state's electronic IFTA credentialing programs. A single state could check more than one payment method. As was the case with the IRP credentials, credit cards and automatic clearinghouse credit and debit methods appear to be the most prevalent payment methods.

A total of 28 states reported already belonging to the IFTA Clearinghouse, with 10 more states expecting to join sometime within the next 2 years. All responding states reported using an internet/HTML/web-based system for carriers to use to perform IFTA EC transactions.

When asked about the frequency of uploading IFTA credentials data to CVIEW or a similar central repository for use at the roadside, six states reported using real-time or hourly updates; 12 states reported daily updates, and a handful of states reported less frequent intervals, e.g., weekly or monthly (Apx. Table H-25 and continuation).

Table 4-11. Present and Future Methods for Electronic Payment of IFTA Credentialing Fees

Payment Method	Numbers of States Where IFTA Carriers Can Use This Method:		
	Now	In 6 Months	In 12 Months
Credit card	11	5	10
Debit card	5	1	4
Automatic clearinghouse (ACH) credit	4	3	6
ACH debit	5	4	10
Other Automatic withdrawal or account sweep service			
Other electronic payment method (please specify)			
Unspecified			2
Electronic Check(ing)	1		2
Wire transfer			1

Other Permits and Credentials. States were asked about commercial vehicle credentials or permits other than IRP and IFTA credentials, and the number of applications received during the most recent year, including the total of both CVISN electronic and legacy or paper-based applications. States were further asked to report the number of those applications received using CVISN EC.

States reported processing the following approximate total numbers of various permit types:

- Oversize/overweight—2,449,000
- Single trip (motor carrier, use fuel, permit)—1,063,000
- Registration (30-, 60-, 90-day)—356,000
- Single-State Registration System—180,000
- Envelope permits—136,000

plus fewer volumes of various additional types of permits (e.g., weight/distance and highway use tax credentials). States also reported nearly 40 additional types of credentials, beyond those listed above.

In general, states reported very few of these permits other than IRP and IFTA as being applied for electronically. There were some exceptions, such as the following selected examples:

- Kansas reported 3,500 out of 10,000 Single-State Registration System credentials (35%) applied for electronically and 9,400 out of 41,800 oversize/overweight permits (22%) applied for electronically per year.

- Connecticut reported that 100% of its 112,000 oversize/overweight permits were applied for electronically.

- Kentucky reported 51,450 of its 73,500 oversize/overweight permits (70%) were applied for electronically.

- Idaho reported that 6,680 of its 45,576 envelope permits (15%) were applied for electronically, and 15,000 out of its 70,000 hazardous materials permits (21%) were applied for electronically.

Overall, it appears that, as of early 2008, states are fairly limited in the proportion of credentials other than IRP and IFTA that can be applied for electronically, compared with the consistent 10 to 30% levels of CVISN electronic processing seen in the cases of IRP and IFTA credentials administration.

Safety Information Exchange. States were asked about the numbers of permanent, fixed weigh scale sites they currently operate, and about the numbers of those permanent sites that were also used for commercial vehicle inspections. This question was intended to judge the potential scope of operations for SIE technologies, whether or not the state weigh/inspection sites were equipped with CVISN infrastructure. Table 4-12 shows the numbers of permanent scale sites reported per state. Regarding the numbers of commercial vehicles weighed per year at permanent weigh scale sites, states reported an average of approximately 3.6 million commercial vehicles weighed per year, with a median value of about 1.6 million vehicles, also shown in Table 4-12. The table also compares the annual total numbers of vehicles weighed with the number of fixed-site scales reported, to yield a calculated value of the number of vehicles weighed per site on average, per year.

States reported an average of 18 permanent scale sites (median = 13). Not shown in the table, slightly fewer permanent sites were also used for commercial vehicle inspections, with an average of 17 sites per state and a median of 13 sites.

Very few states reported having “plug-and-run” weigh scale sites, where scales are installed in the ground, but there are no buildings or other supporting equipment nearby, and officers or inspectors can set up an inspection area quickly and then move on. Only three states reported having more than ten such plug-and-run sites, Texas with 260, California with 58, and Oregon with 28.

Table 4-12. Weigh Scale Sites (Fixed-Site) and Numbers of CVs Weighed per Year

STATE	Number of Permanent Scale Sites	Number of CVs Weighed/Year at Permanent Scale Sites	Avg. No. of Weighings per Site[a]
AK	8	80,717	10,090
AL	1	161,000	161,000
AR	12	N/A	N/A
AZ	22	4,200,000	190,909
CA	54	15,090,363	279,451
CO	16	4,754,963	297,185
CT	5	N/A	N/A
FL	29	4,785,220	165,008
GA	21	9,755,375	464,542
ID	19	1,860,180	97,904
IN	10	1,323,182	132,318
KS	9	1,385,959	153,995
KY	14	99,401	7,100
MD	12	1,591,300	132,608
MI	15	158,918	10,595
MN	7	354,376	50,625
MO	19	6,528,861	343,624
MT	30	482,157	16,072
ND	11	593,789	53,981
NE	13	625,878	48,144
NJ	3	5,700	1,900
NM	11	1,178,500	107,136
OH	19	6,662,025	350,633
OK	9	1,700,000	188,889
OR	55	2,524,000	45,891
SC	9	3,259,562	362,174
SD	13	426,138	32,780
TN	9	11,014,538	1,223,838
TX	49	339,963	6,938
UT	9	5,455,637	606,182
VA	23	20,000,000	869,565
WA	52	6,922,473	133,124
WI	13	1,352,819	104,063
WY	15	2,298,337	153,222
AVG	**18**	**3,655,354**	**200,044**
MED	**13**	**1,645,650**	**132,463**
STDEV	**14**	**4,697,268**	**263,077**

a. Annual average number of weighings per permanent site = annual number of weighings/number of permanent sites reported in the state.
N/A = Complete data not available.

States reported having and using an average of 151 portable scale systems (median = 46). These portable scales were used to weigh an average of 20,639 commercial vehicles per year, with a median value of 6,963 vehicles weighed per year. States reported a widely varying number of inspection-only sites, with no permanent scales installed. Twenty states reported having no such sites, while four states (Colorado, Idaho, New York, and Texas) reported having more than 200 such sites.

Turning from commercial vehicle weight enforcement to the number of safety inspections performed per year, Table 4-13 shows the number of commercial vehicles inspected per year, and the number of full-time equivalent (FTE) officers or inspectors employed to perform safety inspections in the state.

States reported an average of 69,381 commercial vehicles inspected at Commercial Vehicle Safety Alliance (CVSA) Levels I, II, or III, at all of the state's weigh/inspection stations combined. The median number of vehicles inspected was 44,165. To perform these inspections, states reported employing an average of just under 200 FTE officers or inspectors, with a median value of 110 FTEs. Not shown in the table, the vast majority of these inspectors use a laptop computer to support the inspection process, with 27 out of 36 states reporting 100% of their inspectors now using laptops or expected to be using a laptop within the next 12 months.

The vast majority, or nearly 90% of states reporting (33 out of 37), indicated that CVISN technologies (for example, Aspen with Inspection Selection System, ISS, or connection to SAFER) are being used at one or more of their inspection sites. When asked how inspectors use CVISN-type computer-based information (in particular, the Inspection Selection System, or ISS, score) to aid in the inspection selection decision, nearly equal numbers of states reported that the inspector typically queries ISS **before** deciding whether to inspect a given vehicle (21 states) as reported that the inspector queries ISS **after** deciding whether to inspect a given vehicle (23 states). A given state could select both of these options, indicating that inspectors from site to site or day by day may vary in their typical methods of selecting vehicles for closer inspection.

As shown in Table 4-14, states reported having as few as 1 or as many as 55 permanent weigh/inspection sites connected to CVISN technology such as CVIEW or equivalent in some way, either currently or anticipated within the next 12 months. Expressed as a percentage of all of a state's permanent sites, about half (13 of 25 states reporting) said that 100% of their sites were connected to CVIEW. Two states reported more than 90% of their sites connected, and nine states reported more than 10% and less than 50% of their sites connected to CVIEW.

Sixteen states reported updating their roadside computers with safety and credential information from a central database at least daily (Apx. Table H-36 and continuation).

Table 4-13. Total Annual CV Inspections and Inspectors

STATE	Number of CVs Inspected at All Sites	Numbers of FTEs Employed as Inspectors
AK	9,933	31
AL	190,000	40
AR	62,917	
AZ	2,500	52
CA	528,968	1,012
CO	31,356	50
CT	18,000	21
FL	66,202	416
GA	95,000	75
ID	8,434	21
IL	16,323	1,126
IN	58,600	95
KS	45,000	400
KY	89,250	200
MA	19,749	30
MD	105,753	221
MI	53,950	185
MN	43,329	110
MO	79,285	215
MT	35,000	98
ND	14,566	25
NE	23,428	12
NJ	40,500	106
NM	60,000	185
NY	91,028	150
OH	81,948	144
OK	16,053	20
OR	59,510	438
SC	13,194	112
SD	26,564	71
TN	112,360	175
TX	187,567	700
UT	36,000	45
WA	115,000	200
WI	40,144	117
WY	20,304	10
AVG	**69,381**	**197**
MED	**44,165**	**110**
STDEV	**90,878**	**263**

Table 4-14. Permanent Weigh/Inspection Sites Connected to CVIEW

ST	Max. Reported Number of Permanent Sites Connected to CVIEW[a]	Total Number of Permanent Sites[b]	Percent of Perm. Sites Connected to CVIEW[c]
AK	2	8	25
AL	1	1	100
AR	12	12	100
AZ	7	22	32
CO	17	16	100[d]
CT	1	5	20
ID	18	19	95
KY	14	14	100
MD	12	12	100
MN	1	7	14
MT	28	30	93
NE	13	13	100
NJ	1	3	33
NM	11	11	100
OH	19	19	100
OK	11	9	100[d]
OR	55	55	100
SC	3	9	33
SD	4	13	31
TN	10	9	100[d]
TX	2	49	4
UT	9	9	100
WA	10	52	19
WI	13	13	100
WY	14	29	48
AVG	**12**	**18**	**72**
MED	**11**	**13**	**100**
STDEV	**11**	**15**	**39**

a. Maximum value from each state's current, 6-month, and 12-month reports.
b. From Table 4-12 above, including both CVISN and non-CVISN permanent weigh scale sites.
c. Percent = (Max. Value/Permanent Sites)*100.
d. State reported more CVISN sites within next 12 months than permanent sites currently open. Percent was corrected to read 100.

As shown in Table 4-15, states reported having deployed an average of 71 wireless laptop computers configured for CVISN access into the field, with a median value of 40. The minimum reported number of laptops per state was 1 and the maximum was 240. The reported method of wireless connectivity was predominantly digital cellular (21 of 29 states reporting), with analog cellular and satellite technology reported by 6 states each, and a few states giving other responses. The same state could report more than one wireless system in use or planned.

Table 4-15. Numbers of Wireless Laptop Computers Configured for CVISN Access

STATE	Number of Laptops Configured for Wireless Access to Central Data			
	Now	In 6 Mo.	In 12 Mo.	Max. Value[a]
AK	2	0	0	2
AR	0	185	185	185
CA	4	4	4	4
CO	5	0	0	5
CT	77	77	77	77
FL	235	235	240	240
ID	21	21	21	21
KS	35	35	35	35
KY	40	75	100	100
MA	100	100	100	100
MD	73	73	73	73
MI	2	10		10
MN	120	0	0	120
MO	0	0	8	8
MT	0	1	1	1
NJ	150	150	150	150
NM	7	0	0	7
NY	210	210	210	210
OH	34	34	34	34
OK	20	20	20	20
SC	112	0	0	112
SD	0	0	28	28
UT	45	45	45	45
WA	60	90	120	120
AVG	**56**	**57**	**63**	**71**
MED	**35**	**28**	**34**	**40**
STDEV	**67**	**72**	**73**	**71**

a. Maximum value from each state's current, 6-month, and 12-month reports.

Electronic Screening. Out of 36 states reporting, only two indicated that they do not plan to offer ES within the next 12 months. A total of 28 states reported currently offering ES at one or more weigh stations. As for the program or partnership states were using to achieve ES, 61% (22 of 36 states) reported participating in HELP/PrePass, and 22% (8 of 36 states) reported participating in Norpass.

As for the penetration of e-screening into the permanent weigh/inspection sites across the states, Table 4-16 shows that a range of 6% to 100% of sites were reported as being equipped with e-screening technology. Across all states, an average of 9 out of 19 permanent weigh stations were involved in e-screening (median = 7 out of 13 stations), for an average of just over half of the sites.

Most states reported having deployed (or planned to deploy within the next 12 months) at least one high-speed mainline weigh-in-motion (WIM) scale system. The states with the most high-speed WIMs were California (136 scales), New Jersey (40), Indiana (35), and Montana (34). Sorter-lane (low-speed) WIM scales were reported less frequently. Across all states reporting, approximately 400 high-speed WIMs and 150 sorter-lane WIMs had been installed and were in operation, or were in the near-term planning stages.

Table 4-16. Numbers of Permanent Sites Offering Electronic Screening

ST	Max. Reported Number of Permanent Sites with E-Screening[a]	Total Number of Permanent Sites[b]	Percent of Perm. Sites with E-Screening[c]
AK	1	8	13
AL	1	1	100
AR	8	12	67
AZ	7	22	32
CA	35	54	65
CO	15	16	94
CT	2	5	40
DE	1	N/A	N/A
FL	20	29	69
GA	17	21	81
ID	3	19	16
IL	20	30	67
IN	10	10	100
KS	6	9	67
KY	12	14	86
MD	2	12	17
MN	1	7	14
MO	19	19	100
MT	7	30	23
ND	35	11	100[d]
NE	4	13	31
NJ	1	3	33
NM	5	11	45
OK	7	9	78
OR	22	55	40
SC	2	9	22
SD	1	13	8
TN	10	9	100[d]
TX	3	49	6
UT	9	9	100
VA	14	23	61
WA	10	52	19
WI	3	13	23
WV	7	7	100
WY	4	29	14
AVG	**9**	**19**	**54**
MED	**7**	**13**	**53**
STDEV	**9**	**15**	**34**

a. Maximum value from each state's current, 6-month, and 12-month reports.
b. From QD-33 above, including both CVISN and non-CVISN permanent weigh scale sites.
c. Percent = (Max. Value/Permanent Sites)*100.
d. State reported more CVISN e-screening sites within next 12 months than permanent sites currently open. Percent was corrected to read 100.
N/A = Complete data not available.

States were asked to quantify the numbers of mainline ES events and the automated results of those screening events within the previous 12 months. Table 4-17 shows the counts per state, the numbers of green light (bypass) signals issued to transponders, and the number of red-light (report to scale house) signals issued. The table shows that, looking across all states reporting, e-screening systems evaluated an average of just over 1.25 million vehicles per state per year (median = 728,000), and the screening systems automatically pulled in an average of approximately 15% to 16% of transponder-equipped trucks.

Table 4-17. Numbers of Electronic Screening Events and Various Outcomes per Year

STATE	No. of E-Screenings	No. of Green Light Signals	No. of Red Light Signals	Reported Percent of Red Light Signals[a]
AL	249,000	204,000	45,000	18
AZ	1,300,000	1,000,000	336,000	26
CA	5,666,150	4,318,083	1,348,067	24
CO	1,576,145	1,444,077	130,095	8
FL	3,725,954	3,200,903	548,885	15
ID	62,633	56,939	5,694	9
IL	3,118,322	2,296,657	821,665	26
IN	800,000	725,000	75,000	9
KS	48,500	43,000	5,500	11
KY	728,000	640,640	87,360	12
MD	149,223	112,835	36,388	24
MO	2,915,211	2,287,772	627,439	22
MT	112,424	79,721	32,703	29
NE	931,737	321,575	75,321	8
NM	1,455,810	1,322,379	133,431	9
OK	403,818	357,026	46,792	12
OR	1,675,567	1,370,991	304,576	18
TN	243,190	225,456	17,734	7
WA	598,907	510,580	88,327	15
WI	143,047	111,635	31,412	22
WY	486,545	437,168	41,305	8
AVG	**1,256,675**	**1,003,164**	**230,414**	**16**
MED	**728,000**	**510,580**	**75,321**	**15**
STDEV	**1,468,452**	**1,156,040**	**342,730**	**7**

a. Percent = (number of red lights /number of e-screenings)*100.

States were also asked about their prevailing random pull-in rate, which is the preset rate at which transponder-equipped trucks will be issued a red light signal in the cab, regardless of their safety or credential status. The random pull-in is used in part to verify the appropriate use of the e-screening system (e.g., Is the transponder tag attached to the correct truck? Is the truck within the legal size/weight limits). A total of 13 states reported random pull-in rates of between 0 and 5%, and six states reported random rates of between 6 and 10%. Other pull-in rates were represented less frequently in the database.

The vast majority of states, 34, reported using the XML (Extensible Markup Language) computer programming format or language as their standard for CVISN deployment, while only six states reported using the EDI (Electronic Data Interchange) language. Again, some states reported using both systems.

Table 4-18 lists the funding sources identified by the states as being used for CVISN deployment and operation/maintenance, in descending order of frequency.

Table 4-18. Funding Sources for Deploying and Operating CVISN Technologies

Funding Source	Numbers of States
Federal grants	28
State dedicated funds (special taxes, registration fees, or permit fee surcharges) collected from users (that is, from motor carriers)	19
Federal matching funds or subsidies	19
State general revenue funds budgeted for department of transportation/highways	18
State general revenue funds budgeted for law enforcement	15
Private sources	5
Other	5
Up-front transponder fees charged to motor carriers	4
R&D or deployment funds from alternative sources	4
State general revenue funds budgeted for safety/public utilities	2
Per-bypass fees charged to motor carriers	1
Local government (city, county, regional planning) sources	0
Not applicable	0

The list below shows the sources cited by those states indicating other funding sources:

- A $10.00 surcharge on permits was initiated and supported by the trucking community to offset costs of CVISN and congestion relief
- Federal ITS Funds
- FMCSA CVISN Grant
- Funding has come from various sources. Most has been CVISN 50/50 match with 50% Federal funding and 50% state match. Some has been from various other grants and funding avenues.
- General Fund for Revenue Department
- General Revenue
- HELP PrePass in-kind contributions to e-screening installations at scales, per-bypass fee to motor carriers.
- Research Committee Funds development, MCSAP (Motor Carrier Safety Assistance Program) is used for safety application, such as CVIEW
- State Department of Transportation Budget is authorized by the State Legislature.
- State Planning and Research Funds; NHTSA (National Highway Traffic Safety Administration) Funds
- Toll match used for CVISN matching funds; MCSAP funds used for satellite communications; CVISN deployment funding used for most other CVISN deployment projects.

Relative Progress in Deployment

To provide a self-reported, deployment-based grouping of states, which reflects the relative CVISN activity of states regardless of the size or scale of their CVO environment, an assessment was made across the four self-evaluation dimensions listed below. The “QD” designations refer to the deployment question numbers as shown in Appendix H.

- Percent of IRP carrier accounts being applied for electronically (QD-9)

- Percent of IFTA carrier accounts being applied for electronically (QD-22)
- Percent of permanent weigh/inspection sites connected to CVIEW or equivalent for carrier snapshots (QD-46)
- Percent of permanent weigh sites offering electronic screening (QD-53).

This assessment could be considered a rough approximation of the market penetration of CVISN, where all reporting states are somewhere between 0% and 100% covered across the three functional areas of CVISN deployment. The percentages from the four listings were divided into three groups, with those states above the 75th percentile assigned an arbitrary rank of 3, those in the middle two quartiles, between the 25th and 75th quartiles, assigned a rank of 2, and those below the 25th percentile assigned a rank of 1. Any state not represented in the listing was assigned a rank value of 0. The four ranking values per state were then summed, to yield a cumulative rank for each state across all dimensions.

As noted elsewhere, some states may have achieved great goals in their CVISN deployment, but because they did not contribute data to the CVISN self-evaluation web site, their accomplishments are not reflected in this summary. Because the questions on which these groupings are based were phrased in terms of current and estimated future levels of deployment, they may not reflect what some states actually achieved. This kind of audit-level accuracy was beyond the scope of the current evaluation.

Some states may have been performing at a high level of deployment when they completed their self-evaluation reports, but have since closed, suspended, or otherwise changed their CVISN operations. If these states submitted their self-evaluation reports prior to their change in operations, and did not modify the database values, then this summary does not reflect the current status. Readers wanting to learn specific, current information regarding a given state's deployment are encouraged to contact that state's CVISN program manager or the respective FMCSA field or headquarters personnel directly.

Table 4-19 shows which jurisdictions reported high, medium, or low activity, and which did not provide self-evaluation data, in terms of the four percentage-based deployment dimensions listed above.

There are various ways to view CVISN activity. For purposes of comparison, Table 4-20 shows which states belong to each of three strata as defined for purposes of the motor carrier survey (Section 5.0) and which was also used to bin similar states for the CVISN cost analysis (Section 6.0). A state that is rated as highly active from one perspective may be medium or low, when different criteria are used. For example, Alabama rated high in the self-evaluation rankings above, but low in the overall CVISN activity measures as defined in the motor carrier survey. Likewise, California rated itself low according to the criteria used above, but was included in the highly active states for purposes of the carrier survey stratification.

Table 4-19. Strata Used to Group States by Self-Reported CVISN Deployment Status

HIGH	MEDIUM	LOW	NO REPORT
Alabama	Idaho	Alaska	Dist. of Columbia
Arkansas	Indiana	California	Hawaii
Arizona	Kansas	Connecticut	Iowa
Colorado	Maryland	Delaware	Louisiana
Kentucky	Michigan	Florida	Massachusetts
North Dakota	Missouri	Georgia	Mississippi
Nebraska	Montana	Illinois	North Carolina
New Mexico	New Jersey	Maine	New Hampshire
Tennessee	New York	Minnesota	Nevada
Wisconsin	Oklahoma	Ohio	Pennsylvania
	Oregon	South Dakota	Rhode Island
	South Carolina	Texas	Vermont
	Utah	Washington	
	Virginia	West Virginia	
	Wyoming		

Table 4-20. Strata Used to Group States by Overall CVISN Activity Measures

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

4.3 Selected CVISN State Status Reports and Achievements (2007 to mid-2008)

FMCSA has sponsored a series of voluntary monthly conference calls among CVISN state program managers and other stakeholders, for the purpose of coordination, information sharing, and decision-making. Each call is facilitated by FMCSA staff and contractors, who prepare and disseminate a monthly summary of the major news items reported by each state. To provide a sampling of the progress some CVISN states have reported recently in CVISN deployment, this section presents information selected from all monthly CVISN program manager conference call reports from January 2007 through May 2008.

Some CVISN states do not participate on the calls, and some states have made significant progress in deploying CVISN infrastructure, which is not reflected in this selective summary. However, for those states that do provide inputs to the monthly calls, this section presents a quick summary of the noteworthy events taking place.

ALABAMA

- Award for IRP/IFTA rewrite is pending contracts and legislative review. Holding talks with other state agencies in Alabama to gather needs for an upgrade of the current CVIEW, which was designed to support PRISM.
- Approved for a CVISN Grant for roadside enforcement, electronic verification of records and a new CVIEW.
- Meeting with involved agencies on the components of a CVIEW database.
- Expect a PRISM compliance review in the near future.
- Implemented a new IRP/IFTA system, which promotes e-filing and timely submission of data. Able to provide information to the roadside.
- Planning to apply for another PRISM grant to help with new PRISM requirements.
- Work has started on a comprehensive AL-CVIEW provided under a 2007 CVISN grant.
- Alabama has begun work on non-Uniform Traffic Compliant (UTC) system for law enforcement officers as part of the e-screening project provided under a 2007 CVISN grant. Developing a non-UTC database as part of the state's Law Enforcement Tactical System (LETS). LETS currently has a e-citation program that is used to electronically process uniform traffic citations (UTC). This CVISN project would provide a non-UTC e-citation module to LETS.

ALASKA

- Foundation, bases and wiring for automatic vehicle identification (AVI) system are in.
- Final acceptance testing is underway at the AVI site.
- Upgrading two WIM sites with USDOT readers (cameras).
- Beginning to issue transponders to pilot customers in Anchorage for use in testing systems at the Glenn outbound weigh station.
- Level 1 Checklist has been accepted.
- Currently purchasing components for mobile WIM scales. System includes a motor home, semi-portable scales and communications.

ARKANSAS

- Phase 3 of the automated permitting system has added all 16,000 miles of state highway to the system. Have uploaded software and training is underway. Should improve the e-permitting program and capabilities for the consumer.
- Recently equipped all patrol units with wireless data cards for their onboard laptop computers. This means inspection reports can be transmitted immediately from the roadside for review and forwarding to SAFER.

CONNECTICUT

- Submitted Expanded CVISN Program Plan and Top Level Design.

DELAWARE

- Seeking vendor to implement IRP and CVIEW. Received authority to pursue legislation to implement requirements of PRISM.
- PRISM legislation passed this year allowing DE to rescind/cancel/suspend the registration of a commercial vehicle for safety reasons. Have stronger enforcement powers.
- Reached tentative agreement with PrePass to be deployed for e-screening at the new US 301 Truck Weigh Station and Inspection Facility.
- CVISN team took a field trip to Perryville, MD (on I-95) to see PrePass in operation.
- CVISN Team visited Port of Wilmington to explore possible port applications for future e-screening. Port of Wilmington's Operations Manager has also agreed to join the Delaware CVISN Team.

DISTRICT OF COLUMBIA

- Visited Washington State for an in-depth review of their XCVIEW system. Also visited the Ft. Lewis weigh station on I-5 to look at their electronic screening system.
- Continuing to gather information on virtual weigh stations. Visited VWS site at Punta Gorda (FL).
- Conducting Feasibility Study for improvements to enable I-295 WIM sites to be used for e-screening. Visited weigh stations in Maryland and Virginia in conjunction with the Feasibility Study.
- Working on a proposal to identify and track Haz Mat carriers in DC.
- Gathering information to determine the feasibility of joining IFTA.
- Working with the I-95 Corridor Coalition CVO group on their credentialing project.
- Held a ribbon-cutting ceremony for the I-295 VWS.
- Anticipate starting an overweight truck study with Howard University.
- Received PRISM grant, working to coordinate CVISN and PRISM.

FLORIDA

- The biggest remaining CVISN project is e-credentialing. Turning attention to Expanded CVISN projects. Tested infrared lighting for license plate reader by CCTV at virtual weigh station. Now testing LED lighting for nighttime operations.
- Will be testing the e-credentialing web services application. Will be sending IFTA and IRP information to SAFER using the existing AAMVAnet connection.
- Evaluating adding additional electrical service to rest areas and weigh stations to provide trucks a place to park and plug in to reduce idle time and pollution.
- Continuing to work on LPR lighting for the Punta Gorda VWS.
- Working with Volpe to test their web services applications for data upload to SAFER. Successfully tested upload. Now working on getting records back, error checking, etc.
- In October 2007 the FDOT CVO Programs Office conducted a very successful workshop on CVO and the important relationship CVO has with traffic engineering, transportation operations and planning in Tampa Florida.
- JaxPort: In conjunction with a current FHWA earmark project for data sharing of freight information (container data, contents, etc.) coming out of the Port of Jacksonville, FDOT has a project to look at the weights of containers as they leave the port via truck. In Phase I, the trucks leaving the port drive over a WIM and are given a notification of their weight. If over 80,000 pounds they know they need a permit and can take necessary action to get an OS/OW permit if they do not have one. Phase II is to transmit the data for those trucks that are overweight to enforcement officers in the area. WIM and camera equipment for Phase I were installed in September 2007 and the DMS component was installed in November 2007.
- Hoping to test uploads of credentials data to SAFER this week. FL will be one of the first states to upload via web services application.
- FL's Office of Motor Carrier Compliance has deployed a plate reader system with a DHS grant. Having problems reading apportioned plates.
- Online credentialing for IFTA and IRP was completed.

HAWAII

- Submitted ITS/CVO Business Plan
- Will be choosing a Steering Committee and working on Program Plan and Top Level Design documents.

IDAHO

- Started the process for development of the Expanded CVISN Top-Level Design and Program Plan
- Completing first draft of the Expanded CVISN Program Plan.

ILLINOIS

- Signed CVIEW contract with vendor.
- Changing OS/OW permit application forms to capture USDOT number so will be ready to exchange this information with CVIEW.
- CVIEW should be ready to go soon.

INDIANA

- Partnered with Bureau of Motor Vehicles to continue development of CDL physical exam project. Investigating alternatives for receiving the CDL physical exam results. Currently using paper and fax.
- OS/OW permitting system is in production with pilot carriers. Working with pilot companies and permit services to resolve remaining problems with the OS/OW system. Receiving approximately 50% of the applications over the Internet. Hope to open this up to all customers in the near future.
- Developing a Strategic Weight Enforcement Plan, including VWS activities.
- State Police are working on an e-citation and warning system. Will be able to scan documents at the roadside easing data entry into Aspen. Pilot should start in a couple of months.
- INDOT has been asked to work on construction plans for an inspection facility on I-69 in southern Indiana, connecting Indianapolis with Evansville. Will have WIM and PrePass, will be set up for truck inspections and will be CVISN compliant.
- Working on the "Super 70 Project," a rebuild of I-70 through downtown Indianapolis.
- State troopers are making electronic queries on every stopped commercial motor vehicle.
- Testing new Voice Response Unit, which will allow drivers and carriers to check status of the USDOT CDL Medical Examinations.
- Infrared Thermography Pilot continues. Inspectors are using infrared thermometers to check for overheated truck hubs and wheels. The pilot hopes to demonstrate the value of the infrared thermometer in detecting overheated bearings and wheels during roadside inspections.

IOWA

- Successfully uploaded inspections from TraCS to SAFER in beta testing. Will soon start uploading Level 3 inspections from the Iowa State Patrol.
- Beta testing upload and download of inspections directly to SAFER. Planning to begin full uploading of inspections to SAFER in September 2007.

KANSAS

- Working on IRP rewrite and PRISM implementation.
- Kansas Highway Patrol has a signed contract with vendor to implement a CVIEW. Work will begin soon.
- UCR uploads are functional.

KENTUCKY

- Continuing to work on CVIEW procurement. Working with Washington State to install XCVIEW as an interim means of sharing transponder enrollment data until the CVIEW procurement is complete and the system is operational.
- New CVIEW is finished. Running into problems with the quality of vehicle and company data available.
- Have installed three ISSES (Integrated Safety and Security Enforcement System) locations: two on I-75 and one on I-65. Would like to add one more. ISSES includes a radiation scanner, LPR, automated USDOT number reader, laser scanner for vehicle classification and infrared camera for brake screening. Have a contract for on-site support from the vendor. Also, funding is in place to enhance the system to scan for Haz Mat placards.
- Have been working with and evaluating LPR and USDOT number reader systems in three locations. Now developing a concept of operations and algorithm for using these readers to perform automated roadside screening.
- Four projects identified for Expanded CVISN funds:
  - OS/OW automated routing and bridge analysis system.
  - Pilot study for an electronic license plate.
  - Develop a next-generation Virtual Weigh Station (VWS).
  - Implement IFTA decal renewals on the web.

LOUISIANA

- Developing an RFP for a CVISN consultant to handle project management functions.
- Department of Public Safety (responsible for IRP) has selected a consultant and is developing online IRP.
- Department of Revenue is working on the IFTA online element.

- Contractor is continuing to work on the direct link from CVIEW to SAFER.

MAINE

- Worked on RFP language for an IRP system. Still gathering information on developing and installing a CVIEW.
- IFTA e-filing went live for 80 carriers. 25 have filed so far. Working well in trial mode. Working on a new IRP system.
- Working to deploy CVISN capabilities at the Kittery weigh station.
- Will be installing optical character readers (USDOT and plate numbers) and WIM technology at Kittery. Want a screening system that is integrated with CVIEW. Need to generate a screening query to CVIEW and deliver the results to the officer at the facility. Will need hardware, software, communication and information integration services.
- Posting RFP for the Kittery southbound enforcement station. Includes OCR capability, ramp WIMs.

MARYLAND

- Held kickoff meeting for Expanded CVISN Program Plan development with state and federal agencies. Working with vendor on upgrading CVIEW. Perryville site is running with PrePass. Working out calibration problems to get WIM results in line with static scale results.
- Perryville upgrade project is closed. Continue to get satisfactory readings from the WIM auto-calibration software using the PrePass tag method. Sample size has been kept constant at 100 trucks that get flagged for random pull-ins and other PrePass violations (random pull-in rate is 10%).
- First pilot of the virtual weigh station in Howard County, Maryland: Consortium agreement for a research pilot project has been completed with the University of Maryland.
- CVIEW development continues with the vendor. Procedures for agency data transfers, alerts and error messages for IFTA, HVRS (Heavy Vehicle Registration System), and MIRP (Maryland IRP) data are being worked.
- PreVIEW training was completed. Still working out some software and data quality issues.
- Gathering information on deploying virtual weigh stations (VWS). Implementing and testing some expanded PreVIEW capabilities.
- PreVIEW was put in production. Meeting with law enforcement to demonstrate its use. They have access to it in the field and in scale houses through their PCs (personal computers) and laptop computers.
- Started planning for Phase II, expansion of PreVIEW for hauling permits and Aspen-related data exchange.
- A request for bid is currently in the works for a thermal imaging system at one Maryland truck weigh and inspection site (Finzel, MD).
- Awarded a contract to vendor to install thermal imaging at the Finzel weigh station in Garrett County near the WV border.
- Investigating providing carriers access to CVIEW.

MASSACHUSETTS

- OS/OW web link up and running and currently processing permits.

MICHIGAN

- New web-based OS/OW permit system “MI-PARS” (Michigan Permitting and Routing System) is running using a vendor system that provides automated routing. The system automatically updates bridge condition and other factors affecting routing.

MISSISSIPPI

- Will be presenting CVISN to a number of trucking industry meetings.
- Projects in e-credentialing and roadside information are running ahead of schedule.
- Will be attending a demonstration of the Integrated Safety and Security Enforcement System (ISSES) van.

MISSOURI

- Major computer system fully implemented.
- CVISN deployment finished.
- Working on documentation to establish CVISN Level 1 Core Deployment.

- Working on the last elements of PRISM. Need to be able to issue suspension orders, and to implement intrastate as well as interstate.
- Working on a fully automated OS/OW routing and permitting system. Currently have a restricted system in operation covering portions of the Interstate system. Will include the entire Interstate system as part of this phase. Will add state highways in Phase 2.
- Missouri's computer integration project, which took three years and replaced three mainframe systems and several databases, was selected by the Computerworld Honors Program for a 2006 Laureate Award.

MONTANA
- MOVE trailer is operational with satellite communications. Issuing permits.
- The MT Department of Justice is working on an e-citation project, which could be coordinated with CVISN.

NEBRASKA
- Renewal season went well with excellent response to Internet renewals. This alleviated in-house staffing requirements.
- Investigating how to take advantage of HVUT e-filing.

NEVADA
- Formally at Level 1 core deployment.
- Creating a web site for sharing information.

NEW JERSEY
- Working with vendor on e-screening feasibility study
- NJ State Police are looking at an open system for e-screening that would accommodate all transponders (Norpass, PrePass, others). Want all options open.
- Should be able to complete Core Deployment
- Presently working on an Electronic Screening Feasibility Study with vendor. As part of this study, representatives from the core group participated in a site visit to the Perryville, MD weigh station to review the application of PrePass.
- The focus on the credentials side is a new IRP system that will serve PRISM and electronic credentialing purposes. It is in the detailed design and development phase.
- CVIEW also will be developed.

NEW MEXICO
- Santa Teresa Border Crossing Project involves FMCSA, NM Department of Safety inspectors, PrePass, UNM, and vendors. NM has signed up participating carriers that use RFID tags on their trucks. About 90% of the trucks crossing the border have these tags. The screening system reads the RFID tags and runs it through a basic screening algorithm that looks at a variety of compliance and safety factors. Generates a go/no-go decision. Hope to be able to use this approach at many border-crossing locations, and ultimately tie it into the International Trade Dataset that U. S. Customs uses in its screening activities. FMCSA now has access to this dataset. It is a very interesting project testing new screening concepts.
- Work continues on the Santa Teresa project. This is an e-screening project funded through an FMCSA border enforcement grant that would enable electronic identification and screening of the truck, trailer and driver at border crossings with Mexico or Canada.
- Developing an RFP for a virtual weigh station (VWS).

NEW YORK
- Advancing the Champlain international border project. Environmental review, site assessment, initial design reports are complete. Cost estimates currently range from $4 million to $7 million depending on the type of building and site improvements.
- Work on the e-screening program continues. Completed procurements for WIM and License Plate Readers (LPR). Will be installing three WIM technologies (piezo-quartz, piezo-electric and single load cell) in the same stretch of asphalt pavement for head-to-head comparison and evaluation.
  - Three WIM types (piezo-electric, quartz and single load cells) should be installed in a single lane of I-90 within the next two months.

- A highway data collection system covering all lanes will be installed at the same time.
- Research Bureau developed a detailed evaluation process for this WIM comparison project. Will gather dynamic output of the mainline WIMs, and will be stopping a subset of vehicles to gather static weights for comparison purposes.

- Installing an LPR, video recognition system and complete weather station.
- Working on a project with the NY Thruway for deploying an e-screening/VII site between Albany and the Tappan Zee Bridge, possibly including some feeder routes. This is targeted toward the 2008 ITS World Congress (being held in NY) for a demonstration corridor.
- Heading up an I-95 Corridor Coalition survey to determine the status of all 16 corridor states for sending IFTA and IRP information to/from SAFER. Goal is to create an implementation plan (costs, schedule and process) to enable all I-95 corridor states to participate.
- Received I-95 Corridor Coalition grant funding to start hardware and software development needed to allow commercial vehicle activities to work with USDOT's VII initiative. Until now, this initiative has been focused solely on light passenger vehicles.
- Should reach Level 1 deployment at some point this year. Nearly done with IRP to SAFER certification.
- All equipment is installed at the first integrated e-screening site at Schodack, NY. WIM, LPR are both operating. Hope to start evaluating three WIM types and LPR.
- Working with FMCSA and vendor on additional development for a smart infrared inspection system for bearings and tires.
- Almost done with integration of OS/OW and OSCAR (NY e-credentialing system).

NORTH CAROLINA

- Update to SAFER 5.0 is nearly complete.
- Working with vendor on a transponder project.
- Work continues with Domestic Nuclear Detection Office (DNDO) activities in the southeast. Getting a radiation monitoring portal for one location. A grant from DHS' Domestic Nuclear Detection Office is in place. Pacific Northwest National Lab will be installing detection systems at Hillsboro sites in the spring of 2008.
- Now have 11 sites operational for transponder screening.
- Uploading information to SAFER. Vendor says states uploading their information to SAFER should check to see that the information provided other states is accurate and correct.

OHIO

- Currently working with vendor to turn off a portion of our PreVIEW system. The state will continue to upload and download data to the backend PreVIEW system and that information will still be used by our OS/OW staff in the Ohio DOT. However, for purposes of roadside enforcement, the PreVIEW system will no longer be used. Instead, Query Central, L&I and a variety of other systems will be employed by inspectors.
- Scaled back CVIEW and are in the process of developing a new contract with vendor that would keep back end processes going so information can be fed to Ohio DOT for use in OS/OW online permitting.
- Will be using Query Central (or something similar) for CVIEW functionality at the roadside.
- Hazmat group at the Public Utilities Commission of Ohio (PUCO) has been awarded a grant from DHS for the purchase of personal radiation detection equipment.

OKLAHOMA

- Received SAFER certification letter.
- Hope to complete the CVIEW implementation project.
- Legislature passed a bill to fund the weigh station program. It will be phased in over a period of years. Weigh stations (Ports of Entry) are now a high profile/priority project. Oklahoma has publicly announced construction of 9 state-of-the-art Ports of Entry within the next 6 years. Unexpectedly, funding came not from the legislature, but from the Oklahoma Corporation Commission, which operates the weigh stations.
- OCC is working on a major project to move IRP/IFTA data into a more usable format, from the Tax Commission legacy systems to a transportation database, moving away from COBOL to a relational database. Projected time of completion is approximately three years.
- ODOT's Bridge Division is developing an RFP for OS/OW automated routing.
- Beginning to think in terms of Level 1 compliance.

RHODE ISLAND

- Working with vendor on the CVISN Program Plan and Top-Level Design.
- Gathering information about roadside screening and transponder administration.
- CVIEW implementation scheduled for 2010. Will probably need an interim solution to get data to SAFER.

SOUTH CAROLINA

- Working with vendor to update the CVISN Program Plan in preparation for completing Level 1 deployment.

SOUTH DAKOTA

- Nearly all permits—oversize/over weight, single state, temporary etc.—are issued electronically through our South Dakota Automated Permitting System. That system can be accessed directly from the internet via our SDDOT web site.
- Vendor will be conducting e-screening training for motor carrier enforcement personnel at the Jefferson POE.
- Finalizing IFTA/IRP requirements RFP. Will go through a Senior IT Committee review prior to publication. Once requirements analysis is complete, will issue a second RFP for acquisition or development of an IRP/IFTA system.
- Will be working with the new Norpass CVIEW and with WA on a regional CVIEW database so e-screening can pick up carriers/vehicles from states that are not currently supplying information to SAFER.
- Beginning work on developing a new Port of Entry (POE) for e-screening at Sisseton near the North Dakota border on I-29.
- Jefferson POE has been operating for four years. Still facing problems having different transponder systems in operation. Would like to see full communication and coordination among the various systems.

TENNESSEE

- Ran a nuclear detection exercise with several southeastern states and the DHS Office of Domestic Nuclear Detection. Working on a consistent set of plans and procedures for the southeastern states.
- FMCSA, the TN Department of Safety (TDOS) and TnDOT hosted a Commercial Motor Vehicle (CMV) Roadside Technology Showcase to demonstrate current and prototype large truck and bus safety inspection technologies. The Showcase highlighted the establishment of a permanent truck and bus roadside technology testing corridor on I-81. Other key partners include the Oak Ridge National Laboratory and the University of Tennessee. Current inspection technologies and systems include:
  - Inspection Selection System
  - Query Central Data Portal
  - Aspen Inspection Software
  - Performance-Based Brake Testing (PBBT)
  - ComVIS Portable Inspection Data Collection
  - PrePass Electronic Screening System

  Future technology inspection prototypes include:
  - Smart Infrared Inspection Systems, which check thermal signatures of wheel components and automatically alert inspectors to anomalies needing further attention.
  - Wireless Roadside Inspection systems where driver, vehicle and carrier safety data will be retrieved in real time, from both a Class-8 tractor-trailer and a commercial motor coach as they pass by the inspection station at highway speed.
- TN is developing SIRIS (Smart Infrared Inspection System). Dan Cline said SIRIS will have a place in the overall weigh station inspection system. Clearly shows whether brakes are working. Oak Ridge National Lab did extensive testing on the technology.

TEXAS

- The IRP system has been upgraded for PRISM functionality.
- Developing state CVIEW.
- Selected an e-screening pilot site on I-35 in Devine, southwest of San Antonio. Necessary upgrades to the site will take about a year.
- Planning for eight border safety inspection facilities. Two are nearly done at El Paso. Work is being done under the state ITS contract. Sites will have cameras, WIM, multi-platform scales and dimensional

VERMONT

- Satellite communication to the roadside is working well. Despite mountainous terrain, getting close to 90% geographic coverage. All inspection sites and pull-out areas are covered. Can screen through NLETS (National Law Enforcement Telecommunication System) and CDLIS from the roadside. Working with vendor to push Aspen inspections to SAFER. Limiting factor is the 9600 baud transmission rate.

VIRGINIA

- Meeting with Pacific Northwest National Lab at the Stephens City site on I-81 in northern VA to review the final design for a nuclear detection installation. Conducted pre-bid conference with vendors.
- The Domestic Nuclear Detection Office of DHS (DNDO) conducted a workshop on the nuclear detection equipment that will be installed at the Stephens City site. Developing standard operating procedures.
- VA DMV IT personnel are working with the VA Information Technology Agency and DNDO to work out criteria to connect the radiation detection portal to the state network.
- Finalizing installation and start-up of radiation monitor at Stephens City.
- Evaluating location and design for Prince William County for the Route 234 bypass project. Want to install WIM equipment on new Route 234, and establish an inspection site on an old Route 234 location.
- Continue to use NOMAD mobile equipment for data gathering.
- Issued a contract to install a license plate reader (LPR) in conjunction with a WIM location on I-95 in Prince George County, south of Richmond.

WASHINGTON STATE

- Working on a pilot project to track containers from seaports throughout the state. Would like tracking throughout the entire CVISN system. Incompatible transponder technology and needed changes in vendor software and firmware present the greatest difficulty.
- Working on hazardous materials tracking in the I-5 corridor
- The new weigh station on I-82 at Prosser is coming on line.
- Deployed a van with mobile LPR equipment. Hasn't worked as well as hoped.
- Have no funding for new weigh stations in the next biennium, but have a lot of work to do on Expanded CVISN, LPR, infrared, radiation detection, etc.
- Trying to create a "virtual officer" to take advantage of all this technology.
- Currently working on license plate readers (LPR), USDOT number readers, portable static scales, and dimension and motion technology.
- Working to simplify station operations for the officers.
- Working on a data quality grant to provide an interface to NLETS for the LPRs and for validation of non-authoritative source data.

5.0 MOTOR CARRIER SURVEY

The purpose of the motor carrier survey was to identify and gauge the factors affecting motor carriers' decisions to adopt CVISN technologies, such as transponder-based ES and EC. The survey also determined the market barriers to further deployment among motor carriers. Further details on the approach, methods, and results of the motor carrier survey are presented in Appendix A.

Summary of Motor Carrier Survey Results

A total of 848 commercial motor carrier companies responded to telephone interviews between December 29, 2006, and March 19, 2007. While the carriers participating in this national survey had fairly even levels of awareness of both ES and EC (representing about 64% of power units in the survey), carriers had very different levels of actual participation in the two programs or services. When looking at the proportion of commercial trucks (power units) represented in this survey, only about 15% were taking part in ES, while more than 46% were taking part in e-credentialing.

As for the reasons for participating, companies tend to take part in e-credentialing because it is convenient, it saves staff time, it enables carriers to get trucks into service more quickly, and it increases the accuracy of data.

There is a positive attitude toward ES among those carriers who participate. Nearly 100% of these carriers report savings in shipping time plus increases in convenience and efficiency. For nonparticipating motor carrier companies, the ES fee appears to be a barrier. When looking at which companies are most likely to participate in ES, giant and large motor carrier companies are much more likely to take part in ES than smaller carriers.

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

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

Hypotheses

- Motor carrier officials are aware of CVISN technologies for electronic credentialing and electronic screening.
- Motor carrier officials recognize the potential benefits that CVISN technologies offer to their companies.
- Motor carrier officials use factors such as costs, benefits, and institutional issues in deciding whether their companies should participate in CVISN deployment.

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

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

One ancillary objective of the National Evaluation motor carrier survey was to follow up on the results of the CVISN MDI carrier survey (USDOT 2002). The MDI survey involved a questionnaire distributed by mail to a sample of motor carriers stratified by carrier size and state. The survey was conducted from July to December in 2000 and yielded 158 motor carrier participants.

At nearly the same time as the present motor carrier survey was being conducted as part of the CVISN National Evaluation, focused on the attitudes of motor carriers and the operational decision factors affecting carriers' participation or nonparticipation in CVISN, a motor carrier business case was concurrently being developed on a separate FMCSA-sponsored task order. The CVISN motor carrier business case involved more in-depth surveys of a smaller population of carriers, and it focused on the economic factors—including actual and estimated costs and tangible economic benefits—of participation in CVISN from a commercial/industrial return-on-investment perspective (FMCSA 2007a,b).

5.1 Motor Carrier Survey Design and Methodology

The target population for this survey was comprised of commercial vehicle motor carriers that are based in the contiguous 48 states. The sample frame was constructed from a combination of the FMCSA Motor Carrier Management Information System (MCMIS) Census database with supplemental data on registered carriers from selected states. State databases from Kansas, Kentucky, and Washington State were used to supplement MCMIS. The benefit of these state registration systems was that they contained detailed registers of carriers who participate in CVISN services such as EC and ES, but who are not present in MCMIS. This piece of information was helpful in designing a sample where both participants and nonparticipants of CVISN were sampled to make comparisons between the two groups. For purposes of this report, "CVISN participation" is defined as obtaining one or more credentials electronically or using transponders to legally bypass inspection stations through a program such as HELP/PrePass, Norpass, or Oregon Green Light.

The sample frame for the motor carrier survey was stratified by three variables: 1) Level of state CVISN services offered in e-screening and e-credentialing; 2) Carrier size; and 3) Whether or not the carrier is participating in CVISN services (applicable only to the three focus states—Kansas, Kentucky, and Washington). The main reason for stratifying the sample in this manner is that the opinions and attitudes of motor carriers are believed to vary with these three variables and we wanted to estimate population parameters associated with CVISN attitudes and opinions for some of these subgroups. Nationwide industry estimates of opinions and attitudes were estimated with weighting.

All states were placed into one of three levels (High, Medium, Low) based on the level of e-credentialing and e-screening services they offered. Carrier size categories were defined as follows:

- "Giants" operate 250 or more power units. They account for only 0.2% of the carriers nationally, but 45% of the total power units.
- "Large" carriers operate between 100 and 249 power units (0.3% of all firms but 7% of the power units).
- "Medium" carriers operate between 10 and 99 power units (almost 6% of firms, 22% of the power units).
- "Small" carriers, with fewer than 10 power units, constitute almost 94% of firms operating 26% of the power units.

Although giant carriers were treated as a separate explicit stratum for sample design purposes, the number of these carriers sampled was not sufficiently large to present separate results. Therefore, the data for giant carriers were aggregated with that of the large firms. Carrier participation in CVISN was determined through state databases in Kansas, Kentucky, and Washington.

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

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

Telephone surveys were used as the sole data collection mechanism in the interest of increasing the response rate. This approach was chosen because it is easy to administer, can target specific individuals, provide better interpretation of responses, and typically results in a higher response rate than mail or internet surveys. Surveying via telephone helped to ensure that the survey questions got to the appropriate person in an organization, a key need in order to make sure that the responses received were from those individuals whose opinions matter most and who were the intended focus of the survey. Telephone surveys also are more likely to result in immediate responses, thereby increasing the response rate. The telephone interview questionnaire is presented in Appendix A.1.

A total of 1,824 motor carrier contacts were released for use by the telephone interviewers. Roughly half of these carriers (900) were allocated to the three focus states: Kansas, Kentucky, and Washington; while the other 924 were distributed among the other 28 states in the sample. The sample for the focus states was inflated so that analyses could be performed comparing the attitudes and opinions of both participating and nonparticipating carriers toward CVISN services. Since the total number of motor carriers who participate in CVISN is low relative to the total number of motor carriers in the country, over-sampling of motor carriers in states where CVISN participation status was known was necessary to ensure that there would be a sufficient number of CVISN-participating carriers to be able to make statistically valid comparisons. Attempts were made to contact all 1,824 carriers released to the interviewers.

5.2 Motor Carrier Survey Data Analysis

Data collection began on December 29, 2006, and continued until March 19, 2007. Calls were placed between 8:00 a.m. and 5:00 p.m. local time in all regions of the country. All calls were initiated from phone centers in St. Louis, Missouri, and Seattle, Washington. A total of 848 completed interviews were obtained from the list of carriers contacted, representing an overall response rate for the survey of 52%. The goal of 600 completed surveys was surpassed due to the higher than expected response rate. The higher response rates were present across all strata and therefore it is unlikely that any biases were introduced.

Analysis of the information collected through the motor carrier survey was conducted to address the main objectives of the study and to test the study hypotheses.

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

Based on the results of this exploratory statistical analysis, estimates of population parameters were prepared and a corresponding confidence interval calculated through the use of stratified sampling techniques. Regression and logistic regression techniques were used to model motor carrier behaviors and opinions against a variety of factors such as carrier size and level of state CVISN services.

Appropriate statistical weights were used in all analyses. The final analysis weight used for each responding carrier took into account the probability of carrier selection and included adjustments for eligibility, nonresponse, and a post-stratification adjustment to the target population.

5.3 Motor Carrier Survey Results

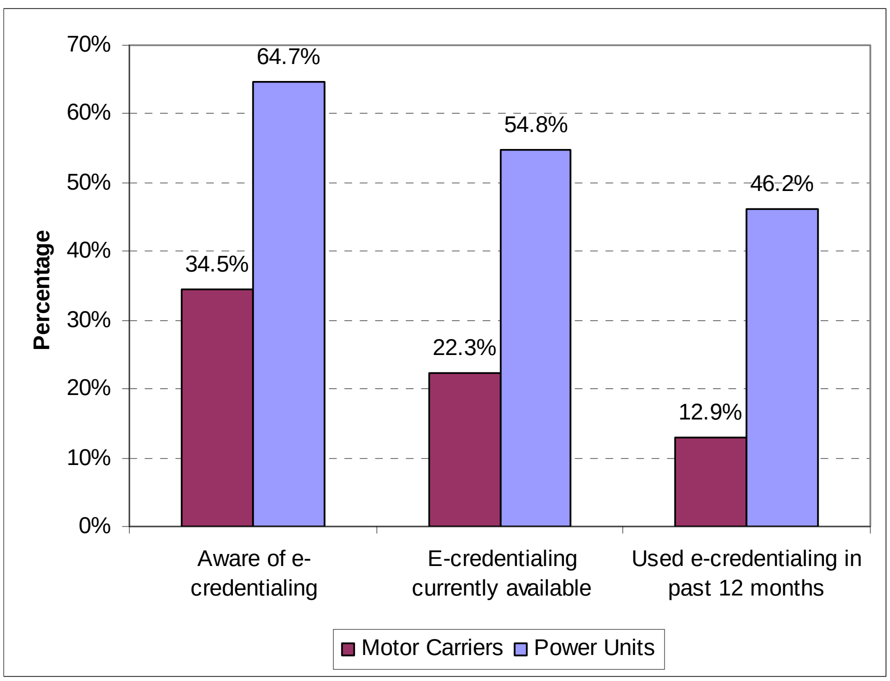
This section presents a summary-level view of the survey results. A full, detailed account of the survey results is presented in Appendix A. The survey questionnaire is presented in Appendix A.1, and summary statistics on the answers to each of the survey questions are presented in Appendix A.2.

<u>Electronic Credentialing</u>

Survey respondents were told that

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

Based on this description, motor carriers were asked whether they had ever heard of e-credentialing at all and, if so, had they used e-credentialing in the past 12 months in one or more states. Figure 5-1 illustrates motor carrier awareness of and participation in e-credentialing.

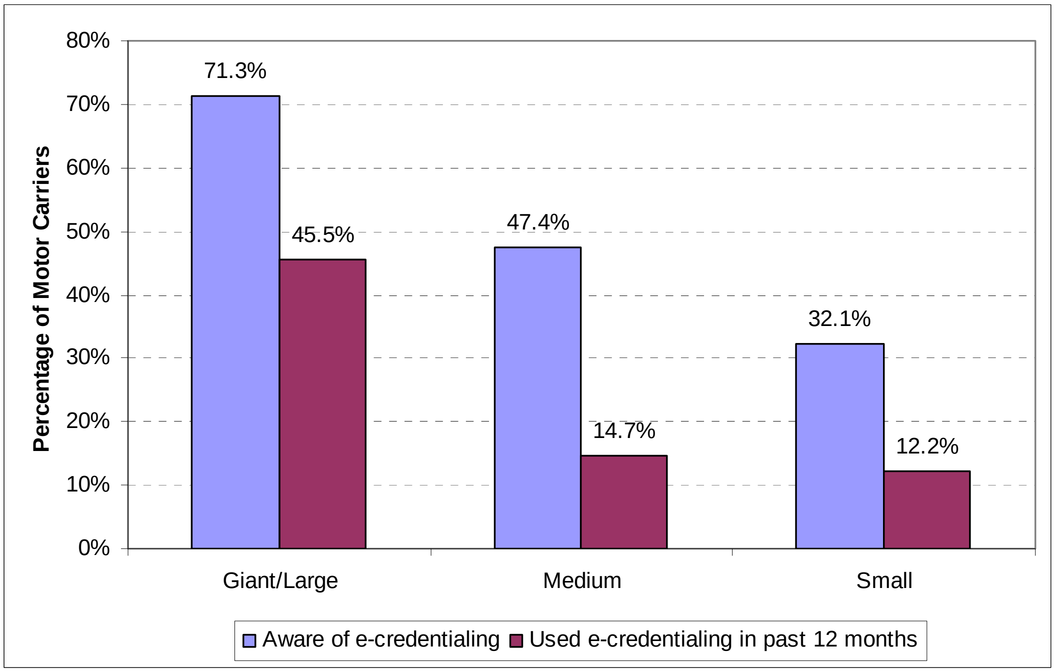


Source: Survey Questions 3.2, 3.3, 3.4

Figure 5-1. Percentage of All Motor Carriers (and representative power units) Aware of and Participating in E-Credentialing

A little over one third of motor carriers (35%) are aware of the ability to obtain and pay for credentials electronically. These carriers represent roughly 64% of all power units. About 22% of carriers reported that EC was available to them through their base states. The percentage of carriers using electronic means to obtain at least one operating credential is about 13%. These participating carriers represent approximately 46% of all power units.

The degree of motor carrier awareness of and participation in EC varies by the size of the carrier. Figure 5-2 illustrates this point.



Source: Survey Questions 3.2, 3.4

Figure 5-2. Percentage of All Motor Carriers Aware of and Participating in E-Credentialing by Carrier Size

A larger percentage, roughly 71%, of giant and large carriers is aware of EC compared to 47% of medium carriers and 32% for small carriers. About 46% of giant/large carriers have participated in e-credentialing in the past 12 months compared to roughly 15% and 12% for medium and small carriers, respectively. The higher awareness of power units versus motor carriers having e-credentialing available and using e-credentialing shown in Figure 5-1 is due to the higher participation and larger potential benefits as the size of the carrier increases.

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

The results for e-credentialing participating carriers overall and by carrier size are shown in Table 5-1. Each of the 44 mean importance scores in Table 5-1 was individually tested to see if it was significantly greater than 5. An importance score above 5 indicated that the factor had a high level of importance in a carrier's decision to participate in e-credentialing. Cells with an asterisk (*) represent mean importance scores that are significantly greater than 5. Each of the 44 cells in the table was tested individually at a confidence level of 99.5%. Thus, these tests were collectively performed at an overall confidence level of 80%.[8] The importance factors with the highest three mean scores are shaded and in bold text in each column.

For e-credentialing participants, the three factors garnering greatest importance when considering their participation status were convenience of obtaining credentials, potential staff time savings, and getting trucks into service more quickly. These three factors had the highest mean importance score across all levels of carrier size. There was also a significant level of importance placed on the increased accuracy of registration information and potential dollar cost savings. Lesser importance was placed on concerns about cost of using e-credentialing and the size of the company.

For factors with mean importance scores significantly above 5 either overall or for a specific level of carrier size, pairwise comparisons were made across all carrier size levels to determine if any differences in mean importance scores were statistically significant. For each concern factor, the overall confidence level for the three comparisons was 95%. Giant/large carriers did rate company size as an important factor in deciding to participate as compared to medium and small carriers. The mean importance score of 6.40 for giant/large carriers is significantly different from that of the small carriers. Apart from this difference, no other statistically significant differences in importance scores were found between the levels of carrier size when looking at factors with importance scores significantly above 5. Thus, carriers of all sizes have similar reasons for adopting e-credentialing, namely convenience, saving staff time, getting trucks on the road more quickly, increased accuracy of registration information, and potential dollar cost savings.

For motor carriers that decided to participate in e-credentialing, they may achieve a variety of benefits. Given a list of potential benefits, carriers were asked to indicate which benefits they have realized through participation in e-credentialing. Figure 5-3 illustrates the percent of e-credentialing carriers achieving various benefits.

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[8] Each of these 44 tests was performed individually with a confidence level of about 99.5% (i.e. there is a 0.5% chance that the test will incorrectly conclude that the mean score is larger than 5 when in fact it is not). When performing multiple statistical tests, it is desirable to control the simultaneous confidence level in addition to the confidence level of each individual test.

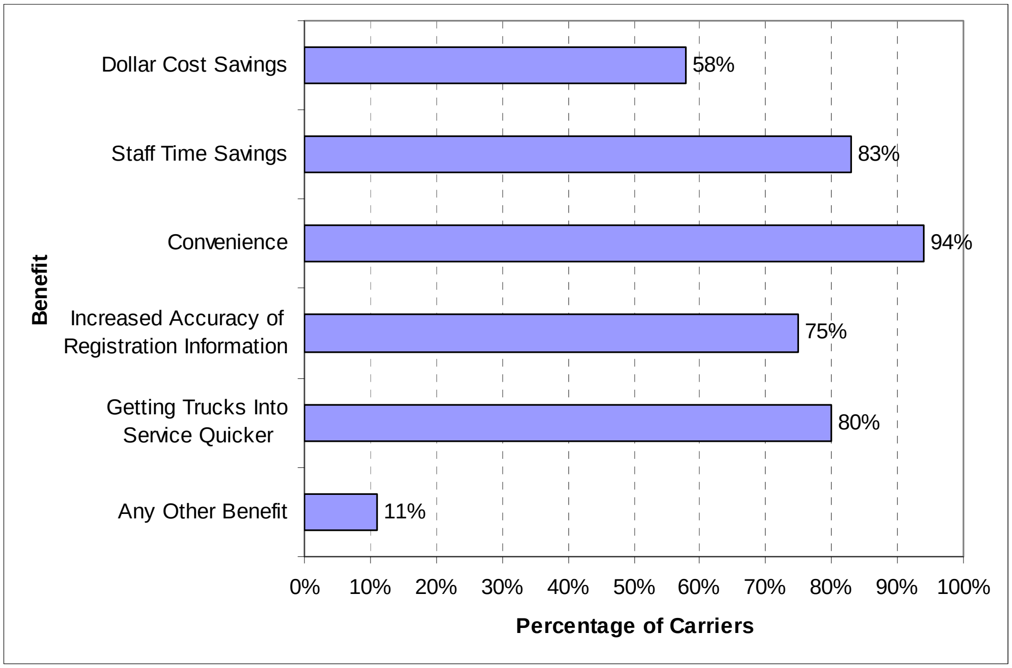
The simultaneous confidence level for all 44 tests together is (99.5%)^44 or about 80%. This means that there is at most a 20% chance that at least one individual test will conclude the mean importance score is above 5 when in fact it is not.

Table 5-1. Mean Importance Score (with Standard Error) For E-Credentialing Carrier Participation Factors (1 = Low; 10 = High) (E-Credentialing Participants Only)

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

Source: Survey Question 3.5

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



Source: Survey Question 4.2

Figure 5-3. Percentage of E-Credentialing Participating Carriers Achieving Various Benefits through Use of E-Credentialing

About 94% of participating carriers found e-credentialing a more convenient way to obtain credentials. Over 80% of participating carriers realized savings in staff time worked. A smaller percentage of participating carriers (58%) achieved cost savings through the use of e-credentialing. Comments received from carriers indicate that the increased speed and accuracy of the process have significantly reduced the frustration level at companies and have made it easier to fix any mistakes made in the process.

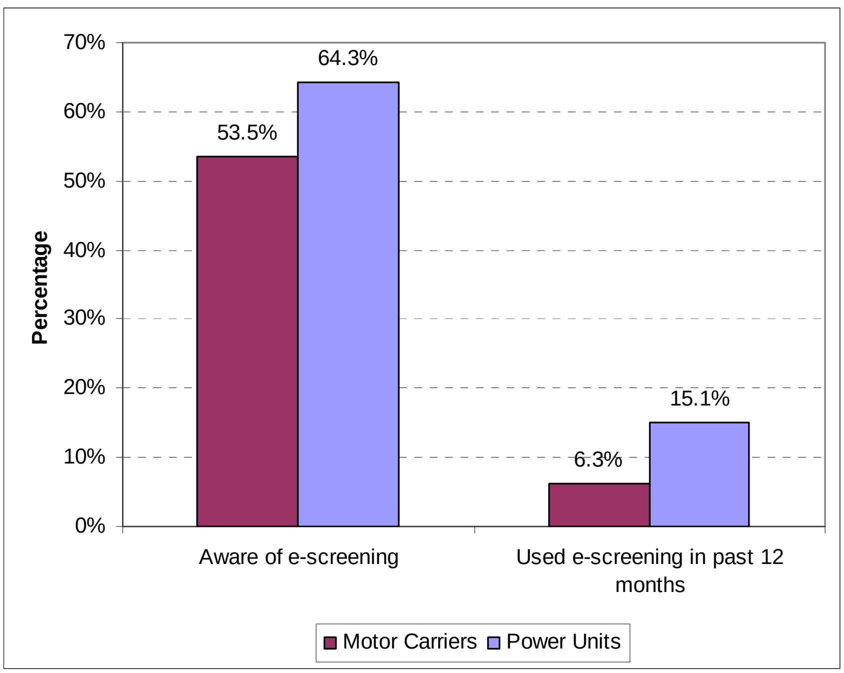
It is also important to understand the reasons some carriers choose not to participate in e-credentialing. Motor carriers not participating in e-credentialing were presented the same participation factors as e-credentialing participants and were asked what factors they found most important in deciding not to participate. Roughly three quarters of nonparticipating carriers cited concern about privacy/security of company data as a significant factor affecting their decision not to participate. Lack of technology resources was cited by about 38% of nonparticipating carriers and was mainly an issue with small carriers. Lack of staff resources also was a significant factor in deciding not to participate with about 36% of nonparticipating carriers.

Electronic Screening

Survey respondents were told that

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

Based on this description, motor carriers were asked whether they had ever heard of e-screening at all and, if so, have they used e-screening in the past 12 months in some or all of their trucks. Figure 5-4 illustrates motor carrier awareness of and participation in e-screening.

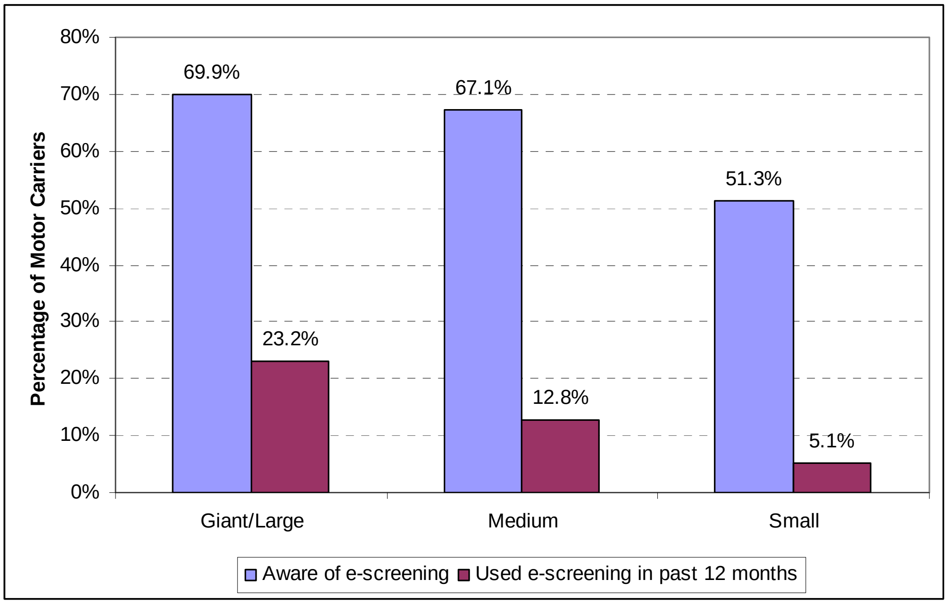


Source: Survey Questions 5.1, 5.2

Figure 5-4. Percentage of All Motor Carriers (and representative power units) Aware of and Participating in E-Screening

Over half (54%) of carriers said that have heard about e-screening. The carriers aware of e-screening represent roughly 64% of all power units in the population. Overall, only 6.3% of motor carriers are currently using e-screening or have used it in the past 12 months, representing 15.1% of all power units.

The degree of motor carrier awareness of and participation in ES varies by the size of the carrier. Figure 5-5 illustrates this fact.



Source: Survey Questions 5.1, 5.2

Figure 5-5. Percentage of All Motor Carriers Aware of and Participating in E-Screening by Carrier Size

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

As for participation in e-screening, about 23% of giant/large carriers participate in e-screening compared to a participation rate of roughly 13% for medium carriers and 5% for small carriers. The difference between giant/large and small carriers is statistically significant.

A variety of factors may play a role in a carrier's decision to use or not use e-screening. To help understand those factors that most influence a carrier's decision, carriers were asked to rate on a 10-point scale from 1 ("Not Important at All") to 10 ("Highest Importance") how important they found various factors when making their participation decision. Both participating and nonparticipating carriers in e-screening were asked this question. The results for e-screening participating carriers are shown in Table 5-2. Cells with an asterisk (*) represent means that are significantly greater than 5. Each of the 36 cells in the table was tested individually at a confidence level of 99.4%. Thus, these tests were collectively performed at an overall confidence level of 80%. The importance factors with the highest three mean scores are shaded and in bold text in each column.

Table 5-2. Mean Importance Score (with Standard Error) For E-Screening Carrier Participation Factors (1 + Low; 10 = High) (E-Screening Participants Only)

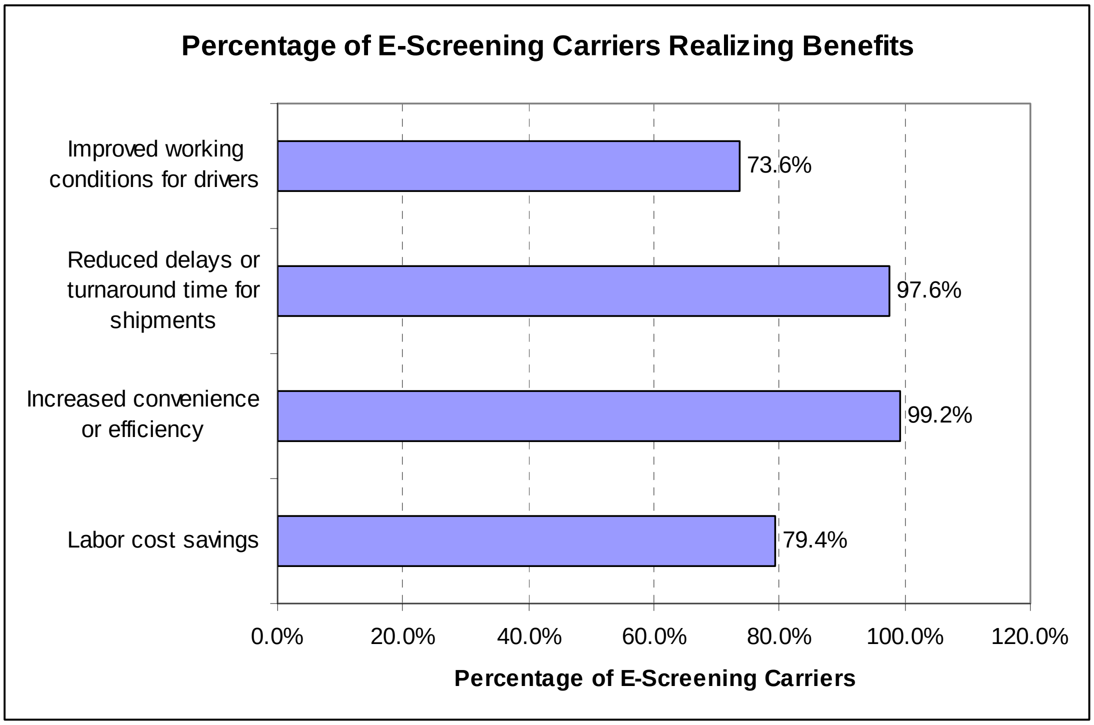
	Mean Importance Score (with Standard Error)			
Importance Factor in Deciding to Participate in E-Screening	**All E-Screening Carriers**	**Giant/Large**	**Medium**	**Small**
Availability of E-screening in states you drive	7.95 (0.84)*	7.79 (0.43)*	9.15 (0.46)*	7.54 (1.16)
Potential labor cost saving	7.46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

Source: Survey Question 6.2

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

The most important factors that play a role in carriers' decisions to participate in e-screening are the potential for reduced delays or turnaround time for shipments, the convenience or efficiency provided by e-screening, and the ability of e-screening in states where the carrier operates. Management support for e-screening was also a key factor for giant/large and medium carriers. The management structure at small carriers is fundamentally different from that of larger carriers, since most small carriers have only a few employees or are owner/operators. Thus, it stands to reason that management support is also crucial to a small carrier participating. A potential savings in labor cost and the cost of participation in e-screening were also highly influential factors in the decision making process. Concerns about privacy of company data were not as important; their mean importance scores were not significantly above 5 overall or for any of the carrier size categories.

Motor carriers may achieve a variety of benefits through participation in e-screening. Given a list of potential benefits, carriers were asked to indicate which benefits they have realized through participation in e-screening. Figure 5-6 illustrates the percent of e-screening carriers achieving various benefits.



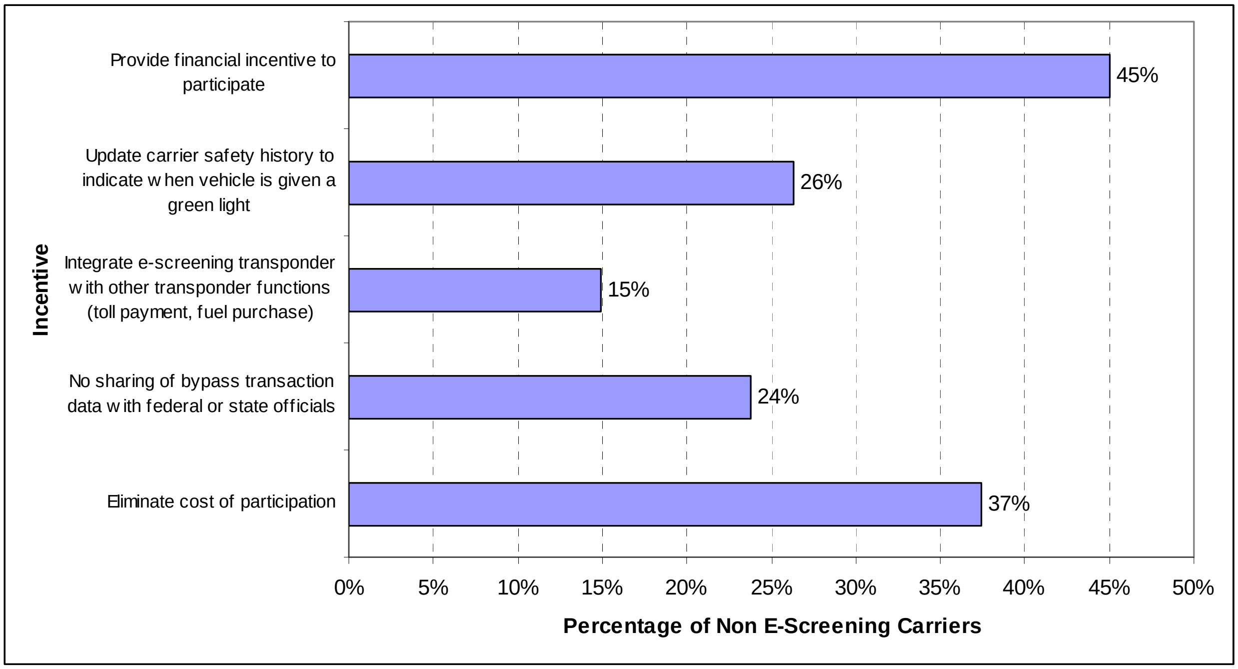
Source: Survey Question 6.3

Figure 5-6. Percentage of E-Screening Carriers Realizing Benefits

Over 99% of e-screening participating carriers experienced more convenience and efficiency by participating in e-screening. Almost 98% of e-screening carriers experienced a reduction in shipping or turnaround time delays. A very high percentage of participating carriers, over three quarters, also experienced improved working conditions for drivers and a decrease in labor costs. Participating carriers were asked if there were any other benefits they realized. The most common responses were increased safety of their drivers and savings on fuel costs.

It is also important to understand the reasons carriers choose not to participate in e-screening. Motor carriers not participating in e-screening were presented the same participation factors as e-screening participants and were asked what factors they found most important in deciding not to participate. Roughly 59% of nonparticipating carriers cited cost of participation as a significant factor affecting their decision not to participate. A larger percentage of medium nonparticipating carriers (almost 80%) cited cost as a significant factor. Concerns about privacy of carrier data were mentioned by about 45% of nonparticipating carriers. Management opposition and availability of e-screening in states where the carrier operates were mentioned by about 30% of nonparticipating carriers.

Carriers not currently participating in e-screening were asked what steps e-screening programs or partnerships could take in the future to encourage them to participate. Figure 5-7 illustrates the results. Carriers were allowed to select more than one incentive.



Source: Survey Question 7.1

Figure 5-7. Percent of Nonparticipating E-Screening Carriers That Would Consider Participation Given Certain Incentives

The two incentives that produced the largest carrier response were related to finances. About 45% of nonparticipating carriers responded that they would consider participation in e-screening if there was some sort of financial incentive for them while 37% indicated that eliminating the cost of participation would increase their chances of signing up for e-screening. About one quarter of nonparticipating carriers wanted to see their carrier safety history updated when the vehicle is allowed to bypass the station. A few carriers commented that their ISS and other safety scores only change when they get an inspection and a violation is found. Also, 24% of non e-screening carriers would consider e-screening more if bypass transaction data were not shared with federal or state officials. This may be because of concerns that competitive intelligence about a company's operations could be misappropriated.

5.4 Motor Carrier Survey Conclusions

The following summarizes the main conclusions from the survey results:

- **Motor Carrier Awareness of CVISN Technologies:** Electronic credentialing is a success story, being used by nearly 13% of motor carriers (representing nearly half of the power units) responding to the current survey. This is compared with results from the CVISN MDI evaluation survey conducted in 2000, when less than 1% of carriers had any experience with e-credentialing. General awareness of e-credentialing has also increased substantially, from about 4% of carriers in 2000 to more than one-third of carriers in 2007, representing nearly two-thirds (64.7%) of power units.

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

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

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

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

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

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

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

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

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

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

6.0 COST ANALYSIS

6.1 Introduction

This section presents the result of an analysis of cost data used to achieve one of the major goals of the evaluation, namely to **“measure and analyze the costs [to states] of deploying and operating CVISN technologies in several typical configurations.”** A related objective is to document cost savings that states are accruing since deploying CVISN EC technology. Whereas the national-scale benefit-cost analysis (Section 8.0) considers societal costs and benefits of CVISN deployment, this national cost analysis is concerned with only those costs (and cost savings) reported by state government agencies—primarily transportation and law enforcement departments—relative to CVISN deployment and operation. Further details on the approach, methods, and results of the cost analysis are presented in Appendix B. Costs and benefits of CVISN from the motor carrier industry perspective are discussed in the context of the national motor carrier survey (Section 5.0) and in the recent reports from the CVISN motor carrier business case project (FMCSA 2007a,b).

Both one-time start-up (capital) costs and recurring (annual) costs are included in the cost analysis. The costs associated with CVISN deployment were analyzed at a basic or unit cost level, including discrete cost elements for hardware, software, labor, consulting and vendor fees, and other types of costs incurred by the states. In this cost analysis, the unit costs are aggregated into system costs to represent the cost to a state for deploying CVISN, given different investment levels.

Summary of Cost Analysis Results

The average per-state start-up cost of **electronic credentialing** is about $1.35 million. However, this start-up cost ranges widely between a high of nearly $8.5 million in one state to a low of $28,037 in another. In terms of total annual cost to operate and maintain EC systems for IRP and IFTA credentials, states reported an average cost per state of about $250,000 per year, with the range extending from a low of $22,645 to a high of $1,091,968 per year.

On average, the states paid roughly $680,000 in **safety information exchange** start-up costs. However, this average hides a large variation in first costs ranging from a high of almost $2.7 million to a low of about $31,000. On average, the annual SIE system costs each state roughly $74,000 to operate.

On average, the states invested between $1 million and $2.8 million in **electronic screening** as one-time start-up costs. Depending on the business model or the ES program or partnership chosen by a given state, some states have very low start-up costs for screening. The average state spent almost $160,000 annually to operate and maintain an ES system. However, the range is significant, from a high of $902,258 annually to a low of $11,071. All costs are expressed in constant 2006 U.S. dollars, adjusted as needed from the year when each state reported its costs.

6.2 Data Collection

Data have been collected from two major sources:

- Self-evaluation templates from approximately 28 states as of April 2006, at the time of the initiation of the CVISN National Evaluation cost analysis
- Site visits to four states (Montana, New Jersey, New York, South Dakota), intended to collect detailed cost data and contextual information about specific deployments.

These sources capture different aspects of CVISN deployment and cost items and build on each other. The self-evaluation template data used in this cost analysis were completed by state officials between 2003 and the 2006. The site visits were completed in September 2006.

6.2.1 Self-Evaluation Templates

The CVISN self-evaluation report consists of three templates: deployment, costs, and benefits/lessons learned.

CVISN Deployment Templates. The deployment template of the CVISN self-evaluation survey contains five sections and 62 questions, which collectively provide general information, including 1) information about the respondents; 2) credential administration information such as IFTA, IRP and other credentials statistics; 3) roadside SIE data; 4) roadside ES system overviews; and 5) general information about CVISN deployment. The information provided by the states in the deployment template plays a central role in determining the scale of a state's operations, level of investment in transportation information technology, and near-future plans to increase investment in CVISN infrastructure. It was also used to detect and examine varying deployment strategies.

CVISN Cost Templates. The cost templates, completed by many states in the CVISN self-evaluation process, provide substantial and significant data that largely served as the basis of the cost analysis. Figure 6-1 lists the major items and subitems requested in the self-evaluation cost templates. The templates also include limited data on avoided costs (benefits). In this analysis, new data were collected and analyzed to supplement the existing self-evaluation data, to fill gaps in the cost data, and to present a more complete picture. Validated unit cost data were fed into the separate benefit-cost analysis (BCA) task (Section 8.0) within the National Evaluation. The analysis of template cost data focused on the three systems (functional areas) outlined in the remainder of this section.

A- Costs of Electronic Credentialing Deployment

A-1- Initial Costs (One-time Start-Up Costs)

- A-1-1 Purchase Costs of Equipment and Material
- A-1-2 Purchase Costs of Software
- A-1-3 Costs of Labor

A-2- Operating Costs (Annual Recurring Costs)

- A-2-1 Annual Costs of Operating and Maintaining Electronic IRP Credentialing
- A-2-2 Annual Labor Costs for IRP Credentialing
- A-2-1 Annual Costs of Operating and Maintaining Electronic IFTA Credentialing
- A-2-2 Annual Labor Costs for IFTA Credentialing System

B- Costs of Safety Information Exchange Deployment

B-1- Initial Costs (One-time Start-Up Costs)

- B-1-1 Purchase Costs of Equipment and Material
- B-1-2 Purchase Costs of Software
- B-1-3 Costs of Labor

B-2- Operating Costs (Annual Recurring Costs)

- B-2-1 Annual Costs of Operating and Maintaining Safety Information Exchange System
- B-2-2 Annual Labor Costs for Safety Information Exchange System

C- Costs of Electronic Screening Deployment

C-1- Initial Costs (One-time Start-Up Costs)

- C-1-1 Purchase Costs of Equipment and Material
- C-1-2 Purchase Costs of Software
- C-1-3 Costs of Labor

C-2- Operating Costs (Annual Recurring Costs)

- C-2-1 Annual Costs of Operating and Maintaining Electronic Screening System
- C-2-2 Annual Labor Costs for Electronic Screening System

Figure 6-1. Cost Data Categories from CVISN Self-Evaluation Reports

Electronic Credentialing Cost Data. The cost of EC is borne by states providing systems that enable motor carriers to apply for, pay for, and receive various operating credentials using transportation data management information systems, such as central IRP and IFTA credentials systems.

Safety Information Exchange Cost Data. SIE costs include those paid by states to support roadside computer-based activities and systems that improve the safety of CVO. Similar to the EC costs, SIE cost components include start-up and recurring annual costs.

Electronic Screening Cost Data. For the EC and SIE functions, the cost data are fairly straightforward. The ES function, however, varies in its cost profile because of different business models being deployed, as described below. ES costs are state costs associated with supporting activities and programs to maintain safety data and enable trucks to bypass roadside inspection and weigh stations legally. ES is an area where the deployment approach will significantly impact the costs incurred by the state. The HELP/PrePass business model represents a national program capitalized by the private sector and funded by user fees collected from enrolled motor carriers. Under this model, the start-up costs to the state are minimal. By contrast, the Norpass business model involves systems that are developed and funded by each state, which shares data with other states for purposes of supporting the bypass/pull-in decision and, beyond the cost of the transponder (currently around $40 to $50 each), does not charge user fees to enrolled motor carriers. In Norpass states, the start-up costs associated with the development of automated vehicle identification (AVI) and transponder/reader/telecom system and infrastructure are borne by the state.

CVISN Benefits/Lessons Learned Templates. Although less directly relevant to the cost analysis, the benefits/lessons learned templates yield insights into the quantitative benefits (e.g., labor savings or increased efficiency) that states have seen since deploying CVISN. To the extent that these benefits affect the overall cost picture for a given state, they are applied to the creation of the cost scenarios and are used to document cost savings associated with EC. A tabulation of the CVISN benefits and lessons learned self-evaluation reports is presented in Appendix F.

6.2.2 Detailed Cost Data from Four States

Almost all of the states in the U.S. are participating at some level in CVISN deployment, whether it is at an early planning stage, active deployment of so-called Core (Level 1) CVISN technologies, or the deployment of expanded systems and functions. To gauge the interest of the states in various kinds of information to be collected and analyzed in the CVISN National Evaluation, an informal survey was conducted on behalf of FMCSA in late 2004.[9] As part of this survey, states were invited to describe ways in which they might be able to participate actively in the data collection for the National Evaluation. For example, some states have advanced, unique EC or roadside vehicle identification and enforcement systems. Further, some have ongoing in-house research activities, which might serve as test sites for collaborative research with FMCSA.

In the course of analyzing the results of the 2004 survey, along with the data collected as of April 2006 in the CVISN self-evaluation, several states emerged as candidates for further evaluation and cooperative data collection. To increase the geographic diversity of the National Evaluation while complementing the cost analysis work done in the CVISN MDI evaluation, the states chosen for site visits in the cost analysis were not any of the four states that had provided the

[9] This survey and its results are described in more detail in the Evaluation Strategy for the CVISN National Evaluation (April 2006a) for U.S. DOT, Contract No. DTFH61-02-C-00134, Task Order BA34007. A summary of this state survey is also presented in Appendix E.

bulk of the cost data in the earlier study (Connecticut, Kentucky, Maryland, and Virginia). It was decided that site visits and/or detailed review of the cost data from approximately four states would provide a suitable data set to augment the self-evaluation data. Preliminary contacts were made with officials in Kansas, Montana, New Jersey, New Mexico, New York, Oklahoma, South Dakota, and Wisconsin. Based on these contacts, the following four states were chosen for site visits as part of the cost analysis:

- **Montana** deployed much of its CVISN infrastructure through contractors, for cost reasons, and has been active in deploying CVISN and its predecessor technologies since 1994. For example, Montana began planning its program for e-credentialing in 1991.

- **New Jersey** is representative of a program that is still under development, but the state has prepared a detailed proposal, including a cost analysis, to expand its current operations.

- **New York** deployed and is operating an advanced, one-stop credentialing system. While the state currently has no fixed-site weigh stations for commercial vehicle enforcement (all inspections are performed by mobile units), New York is well along in planning for a new Canadian border crossing and screening station, in cooperation with U.S. Customs at the Champlain, New York, site.

- **South Dakota** has observed cost savings from the deployment of an extensive automated permitting system.

Appendix B.1 presents the interview protocol form used during the visits, and Appendix B.2 lists the points of contact for each state.

6.3 Site Visit Reports

Site visits were conducted in September 2006, during which a member of the research team met with state officials in Montana, New Jersey, New York, and South Dakota to investigate the states' CVISN systems on the ground. Prior to visiting each state, the research team reviewed each state's cost data provided through the self-evaluation report and created a customized interview protocol (Appendix B.1) that was distributed to the state prior to the site visit. Preparation of the interview protocol along with the analysis of the state's cost data began the process of updating, verifying, and expanding the data collected through the self-evaluation templates in a manner that assisted the research team in conducting the initial cost analysis. Further, the pre-visit analysis identified data gaps related to start-up and operational costs and avoided costs (benefits).

A member of the research team visited each of the four states, interviewing state transportation, law enforcement, and credentials administration officials as appropriate to:

- Learn more about the costs of deployment and operation for the states
- Observe and document changes in costs (increases or decreases) brought about by CVISN deployment

- Clarify any questions and evaluate the quality of the data provided by the state in its self-evaluation report
- Determine the applicability or comparability of cost data from one state to other states
- Learn what states have observed regarding costs or savings for motor carriers participating in CVISN.

As noted previously, the objective of the site visits was to verify the deployment information and cost data at the state level and close data gaps. Site visit reports were prepared for each state and are highlighted in the remainder of this section of the report.

Montana. Historically, Montana has been very progressive with respect to CVISN development, initiating its program in 1991 in response to a legislative mandate to automate its credentialing system. Montana selected Martin Marietta (now ACS) to develop the EC system and by 1999 had automated its oversize/overweight permitting process. Today, the automated program can be used to obtain trip, term, custom combine, and oversize/overweight permits, and to pay gross vehicle weight fees. In calendar year 2005, Montana's automated program was used to issue nearly 60,000 permits: 3,408 permits were issued without assistance from Montana Department of Transportation (MDT) staff and the remainder required MDT staff to enter data provided by motor carriers. Since 1994, the number of commercial vehicle permits issued by the State of Montana has doubled and the state is now issuing nine more kinds of permits; however, development of the automated system has allowed Montana to become more productive while meeting customer service expectation without adding more staff. Montana has developed IRP and IFTA credentialing systems but to date these systems are not used to issue credentials to motor carriers. The costs associated with these systems are not presented in this document because the system was developed in cooperation with ACS and the cost data are considered by Montana to be proprietary. Montana's costs were, however, included in national aggregate and average data reporting.

Montana has developed an extensive ES program at little cost to the state through its partnership with Help, Inc. Montana is participating in the PrePass program, and MDT staff contend that the PrePass system was the only one available to the state at the time the program was under development due to cost constraints. Montana staff noted that PrePass has served the state very well by electronically screening a large volume of vehicles at Montana weigh stations and inspection sites without compromising MDT's core enforcement functions. Montana now operates five permanent sites that offer ES and has deployed 30 high-speed mainline weigh-in-motion (WIM) devices.[10] These systems, however, are multi-functional and perform both ES and other non-CVISN functions. Montana staff noted during the interview that all ES services were provided by Help Inc., and that with the exception of one mainline WIM scale, Montana did not own or maintain equipment or materials relating to its ES program.

In 2003, the State of Montana performed 112,424 electronic screenings of commercial motor vehicles (CMVs). Of the screened vehicles, 79,721, or 70.9% of screened CMVs, were given a green light transponder signal and allowed to bypass the weigh station. Of the screened CMVs,

[10] Montana's self-evaluation report (Appendix H) indicates that the state plans to operate seven ES sites and will have installed 34 high-speed WIMS within the next 12 months.

32,703, or approximately 29.1%, were given a red light transponder signal and required to enter the weigh station or inspection site.

When inspections are not required, MDT staff estimate that it takes roughly 1 minute of state employee time per vehicle when processing motor carriers at weigh stations. Further, MDT staff estimate that bypassing each weigh station saves motor carriers an average of 6 minutes, though this number may be smaller relative to other states due to the lack of significant congestion at Montana weigh stations. As cited in a 2006 article by the Oregon Department of Transportation, the American Trucking Associations (ATA) estimated the average motor carrier cost per mile in 2003 at $2.80 (ATA 2004) and the average speed from point of origin to delivery at 42 miles per hour (Green Light 2006). Thus, the average operating cost to motor carriers can be computed at $1.96 per minute. After accounting for inflation and inflating the ATA's cost estimates to real 2006 dollars, the average cost per mile is estimated at $2.17 per minute. Thus, the ES system in Montana saved the motor carrier industry more than 7,972 operating hours in 2003 at a total cost savings of $1,037,967.

Montana has deployed CVISN SIE equipment across its system and at all 23 of its weigh stations.[11] Today, virtually all of its inspections are completed by state officers and inspectors using laptop computers equipped with Aspen. In 2003, the State of Montana conducted approximately 35,000 Level I, II, or III CMV inspections using Aspen. Montana staff noted during the interview that Aspen is a time-saving tool; however, they were unable to quantify or document associated cost savings. Because CVISN is not a stand-alone program in Montana, the state has used existing resources and integrated them into CVISN elements. As noted above, cost data related to Montana's contract with ACS in the development of PreView are viewed as proprietary; therefore no cost data related to SIE deployment are presented.

New Jersey. New Jersey represents a program that is still under development but has designs for expansion in the coming years. New Jersey's EC program for IRP was launched in 2002. It focused only on IRP renewals and has not been used for issuing new or supplemental IRP credentials. In 2003, the state processed 9,700 IRP renewal transactions for 44,000 vehicles. The state set a goal of 10% for the proportion of IRP transactions completed on-line but to date has experienced on-line transaction rates closer to 3%. Much of the shortfall was attributed by New Jersey staff to the 2.5% fee charged to carriers when applying for and paying for credentials on-line. To date, New Jersey has not deployed an IFTA credentialing program.

New Jersey plans to expand its IRP program to include the issuance of supplements electronically, which represented an opportunity to add 1,100 transactions and 5,000 vehicles in 2003. The project was expected to begin in 2007 and to be completed by June 2008. The New Jersey Department of Transportation, State Police, Office of Information Technology, and the motor carrier industry were planning to serve as partners during project development. The cost of the project, excluding state employee labor, was expected to total roughly $279,000. Project costs were expected to include a vendor contract, personal computers, and printer and scanner equipment.

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[11] Again, Montana's self-evaluation report shows a value of 28 permanent weigh/inspection sites connected to CVIEW (or equivalent) for carrier or vehicle electronic data snapshots.

The State of New Jersey is also in the process of determining the best approach for removing the 2.5% fee requirement. Once the fee is removed, staff interviewed for this project estimated that the percentage of filers who may exercise the option of on-line credentialing could expand to 15 to 20%. There are currently 14 full time equivalent (FTE) positions dedicated to processing credentials. New Jersey DOT staff indicate that the number of FTEs could be reduced proportionally to the percentage of motor carriers filing electronically. Thus, a 12 to 17% increase in electronic filing could result in the elimination or reassignment of approximately 1.7 to 2.3 FTEs, saving the state between $130,866 and $171,665 annually based on U.S. Bureau of Labor Statistics data regarding the average cost to employers for employee compensation for all state and local employees.

New Jersey, as of 2003, had expended approximately $4.5 million deploying a mainline WIM network. In 2003, New Jersey had 40 WIM devices deployed around the state. That number has since then expanded to 67. The network, however, has not been used for the purposes of ES. Instead, the WIM devices are used for traffic monitoring, data collection, and overweight enforcement efforts.

New Jersey has outlined a program to enable ES operations by September 2008. The project includes the deployment of additional weigh scales, communications retrofit of WIM sites, an upgrade to computers located at existing WIM sites, and completion of a study of ES requirements and alternatives. The study will consider the high-level ES requirements and technology applications, and will recommend preferred deployment sites. Excluding state labor costs, New Jersey has budgeted $362,000 for these projects in FY 2006 and $131,000 in both FYs 2007 and 2008 to support implementation of the ES program on a limited basis.

New Jersey determined that there was a significant need for automated inspection programs prior to the development of CVISN. Prior to the deployment of laptops with Aspen to all 106 inspectors and officers involved in CVO and enforcement, it took a minimum of 1 to 2 weeks to enter in data following inspections. As the number of inspections grew to exceed 40,000 annually by 2003, the backlog for entering inspections data grew to over 8 months. Due to the safety consideration resulting from the lack of timely inspection data, the State of New Jersey dedicated three FTEs, including overtime, to reducing the backlog. The deployment of laptop computers with Aspen eliminated the backlog and enabled real-time acquisition of relevant safety data. The initial start-up costs associated with these SIE elements totaled $698,558, with the majority of the costs tied to the purchase of 140 laptop computers, portable printers, and wireless modems.

New York. New York has developed an extensive EC program that has issued more than 400,000 credentials in three years. In the past three years, the number of electronic credentials issued through New York's One-Stop-Credentialing and Registration (OSCAR) program has grown significantly from 8,984 to 268,973 (Table 6-1). The fees transmitted electronically have also grown significantly during this time, expanding from $227,794 to $797,607. This increase was due to a significantly higher volume of credentials being filed on-line, and is not due to rate increases. OSCAR enables motor carriers to obtain credentials and transmit payments to the state electronically through a web-based application. At present, the system can be used to obtain IRP, IFTA, Highway Use Tax (HUT), and Single State Registration System (SSRS) credentials. OSCAR replaced a system that required motor carriers to obtain these credentials from up to four different agencies. Further, OSCAR represents a single data entry point, removing the need for carriers to file multiple forms.

The cost data collected through the self-evaluation survey indicate that New York incurred roughly $1.6 million in one-time start-up costs associated with development of its EC system and incurs $497,938 in annual recurring costs. These estimates, however, were questioned by a representative of the New York Department of Taxation during the on-site interview and it was noted that labor costs may have been underestimated. He estimated the one-time start-up costs in the $2 to $3 million range.

Table 6-1. Annual Credentials Issued and Fees Collected through OSCAR System in New York State

	FY 2003-2004		FY 2004-2005		FY 2005-2006	
	Credentials	Fees Collected	Credentials	Fees Collected	Credentials	Fees Collected
HUT	8,473	$126,935	25,916	$388,230	266,226	$613,665
IFTA	182	$1,456	911	$7,288	1,430	$5,752
IRP	299	$96,956	595	$218,618	899	$163,056
SSRS	30	$2,447	258	$12,913	418	$15,134
Total	8,984	$227,794	27,680	$627,049	268,973	$797,607

The benefits associated with OSCAR are significant. Prior to OSCAR, motor carriers were required to either travel to Albany, New York, to obtain credentials, a round trip that could take up to 12 hours, or mail in their forms and wait several days or weeks for their credentials. OSCAR enables the motor carrier to obtain credentials within 10 minutes. Prior to OSCAR, the time required to process each credential could take carriers up to 1 hour per transaction.

The State of New York also recently experienced a significant benefit associated with the HUT permitting process. Every three years, the state goes through the process of renewing every HUT permit in the state. In 2002, this process took 75 staff members 6 months to complete. Because the staff hired to support the project were largely temporary, the salaries plus limited fringe benefits associated with each staff member cost the state only $25,000 to $30,000 per person on an annualized basis. Thus, the HUT renewal process cost the state roughly $0.9 to $1.1 million in 2002. In 2005, the number of staff participating in the project was reduced to 45 and the process was completed in approximately 4.5 months at a total cost to the state of $0.4 to $0.5 million. Thus, the use of OSCAR during the HUT renewal process resulted in $0.5 to $0.6 million in cost savings to the state, an amount equal to a 55% reduction in labor costs.

New York has not yet fully developed its ES program. Rather, it is in the process of developing a mobile screening process that will not rely on fixed-site devices. However, agency representatives noted that the state is considering adding ES at a single fixed facility near the Canadian border at Champlain, New York. There are no permanent weigh stations in the State of New York. Thus, the $399,528 spent to date was used to purchase wireless mobile AVI platforms and to cover state and contractor labor costs for software and hardware configuration activities related to ES program development.

With respect to SIE, the State of New York has purchased 210 laptop computers with portable printers for mobile enforcement. Each is equipped with Aspen, enabling the 150 officers and inspectors involved in commercial vehicle operations and enforcement to acquire real-time information regarding safety performance, with the exception of systems that require nighttime data uploading. For these systems, information is available within 24 hours. New York currently processes more than 91,000 inspections annually. Prior to CVISN, there was a 9-month backlog in filing inspection forms, and two full-time employees were hired to reduce the backlog. Within 6 months after implementing the CVISN SIE components, the backlog was eliminated. Today, there is no backlog associated with the processing of inspection data.

South Dakota. To date, the focus of the South Dakota CVISN program has been the development of an extensive automated permitting program called the South Dakota Automated Permit System (SDAPS). SDAPS enables motor carriers to apply for 26 different permits on-line, thus expediting the permit application process for motor carriers and state issuing agencies. SDAPS can also be used to request a transponder to support ES. SDAPS can be used to request permits, conduct route analysis, and store and recall permit information. The system enables users to obtain single trip permits, books of 10 permits, and extended period permits (Table 6-2). Users can also submit transponder requests with SDAPS.

Table 6-2. Permits Issued through the South Dakota Automated Permit System (SDAPS)

Single Trip Permit Requests	**Extended Period Permit Requests**
Temporary Licensing	Haystack Mover
Oversize/Overweight	Booster Axle
Move to Scales	Baled Livestock Feed
Over 80,000 Pounds on Interstate	Farm Implement
Haystack Mover	Non-Divisible Loads
Bales Livestock Feed	Life Axle/Variable Load
Farm Implement	Manufactured Home
Manufactured Home	Oversize Trailer – Permit Power Unit
Electric Utility	Oversize Trailer – Permit Trailer
	Harvest Fleet
Book of 10 Permits	Harvest Permit – Permit Power Unit
	Harvest Permit – Permit Trailer
Transponder Request	Self-Propelled Equipment
	Electric Utility
	Over-Length Semi-Trailer
	Slow on Interstate

South Dakota spent approximately $720,278 in one-time start-up costs associated with SDAPS deployment and incurs approximately $518,660 in annual recurrent program costs associated with e-credentialing.

The average processing time associated with the issuance of the permits presently processed through SDAPS has fallen sharply from approximately 5 minutes under the legacy system to roughly 1 to 2 minutes under SDAPS. During South Dakota Fiscal Year (FY) 2006 ending June

30, 2006, roughly 50,384 permits were issued through the SDAPS program. Assuming 3.5 minutes in cost savings to the state per permit issued, annual cost savings associated with the reduced time required to issue permits due to SDAPS deployment totaled $65,306 for FY 2006.[12]

The SDAPS program has generated other benefits associated with reduced fees to motor carriers, time savings associated with route analysis, enhanced understanding of the road network, and a reduction of bridge strikes due to incomplete information regarding vehicle and bridge heights. Prior to deploying SDAPS, motor carriers were charged an $8 transaction fee with each application. SDAPS has removed that cost element. During FY 2006, removal of this transaction fee resulted in $402,672 in cost savings to motor carriers.

Prior to SDAPS, a bridge engineer spent 3 to 4 hours per day reviewing routes in support of the oversize/overweight permitting program. Today, the Geographic Information System (GIS) designed to support SDAPS conducts the analysis in an automated manner, and manual route analysis requests to South Dakota DOT engineers have declined to roughly one per week. Finally, enforcement personnel noted in the interview that as a direct result of SDAPS, the number of bridge strikes has declined in South Dakota by one to two annually. The reduction in bridge strikes translates into fewer fatalities associated with these major crashes and fewer bridge closures.

South Dakota has not yet developed an IRP and IFTA EC process but does exchange IRP and IFTA information with other jurisdictions through existing clearinghouses. However, as part of its recent application for participation in the FY 2006 CVISN deployment grant program it did outline a plan for establishing EC operations for IRP and IFTA.

ES in South Dakota has been established at one site: the Jefferson Port of Entry. The cost of the Jefferson Port of Entry project has totaled roughly $6.9 million and included costs associated with:

- State employee labor and other costs for ES development and activities associated with design and construction;
- Contracted construction of buildings, pavement, scales, signs, wiring, as well as other construction activities, labor and software; and
- Sorter lane WIM scales.

The potential benefits associated with ES at the Jefferson Port of Entry are significant. South Dakota agents interviewed for this study estimate that the ability to bypass the Jefferson Port of Entry could save motor carriers an average of 5 to 10 minutes per bypass. These benefits, however, have largely not been realized yet due to the inability of South Dakota, operating as a Norpass state, to recognize the vast majority of the vehicles traversing the state's roadways. From June 28, 2006 through September 28, 2006, approximately 72,855 heavy trucks traveled through the Jefferson Port of Entry. Of those trucks, 4,542 or 6.2% of all truck traffic received a

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[12] The average hourly labor cost used in the calculation is $24.60 based on the South Dakota response to Question 12 regarding the annual labor cost under the legacy system for IFTA credentialing in the CVISN self-evaluation survey. The response, which estimated hourly costs at $22.22, was inflated to 2006 dollars to generate the $24.60 estimate.

green light to bypass the weigh station while the vast majority (68,313 or 93.8%) was not allowed to bypass the weigh station.

To date, South Dakota has incurred roughly $2.1 million in labor, software and hardware costs associated with deployment of numerous SIE packages, including the VINA (Vehicle Identification Number Analysis) software program, the South Dakota Accident Reporting System, Commercial Vehicle Information Exchange Window (CVIEW), and Performance and Registration Information Systems Management (PRISM). Today, 100% of the state's officers and inspectors involved in commercial vehicle operations and enforcement use laptop computers with Aspen. South Dakota reported that due to the efficiency savings associated with deploying CVISN SIE components, over the past 5 years the number of inspections the state could perform annually has increased by 25 to 30% to 26,564 in 2004 without expanding the number of enforcement staff.

6.4 Analysis of Deployment, Costs and Benefits Data

Data Completeness and Currency. Beginning in October of 2003, states were requested to complete self-evaluation reports that evaluated the CVISN infrastructure deployments within their state. These surveys consisted of three templates: costs, deployment, and benefits and lessons learned. Significant progress has been made in collecting self-evaluation data. Table 6-3 provides the completion status of the CVISN state self-evaluation forms as of April 2006.

Table 6-3. Status Report of Sent, Incomplete, Complete, and Verified CVISN Templates

CVISN Self-Evaluation Template	Sent - Not Started		Incomplete		Complete		Verified		Total
Deployment	0	-	18	35%	10	20%	23	45%	51
Cost	6	12%	17	33%	6	12%	22	43%	51
Benefits & Lessons Learned	7	14%	16	31%	5	10%	23	45%	51
Total	13	8%	51	33%	21	14%	68	44%	153

Treatment of Sensitive State-Identifiable Cost Data. One of the most frequently asked questions among states setting out to deploy CVISN technologies—and one of the most persistently difficult to answer—is, "How much will a system like this cost our state to install and operate?" As part of the CVISN self-evaluation, states were asked to provide specific unit costs for equipment, materials, software, hardware, labor, and vendor costs among others.

In the course of developing the self-evaluation templates, and in rolling out the password-protected web site used for data collection and reporting among state CVISN program managers and their teams, some states occasionally raised concerns about the privileged or proprietary nature of cost data, particularly where vendor and contractor costs were involved. While some state CVISN program managers held to the view that all CVISN funds expended by state transportation and public safety agencies were by their nature public and subject to no proprietary restrictions, other states claimed certain cost elements as proprietary, or declined to provide FMCSA with state-identifiable cost data for viewing by other states.

To respect the interests of states that are concerned about the release of state-identifiable data, such links between exact dollar values and specific states have not been released to the public as part of the CVISN program. The cost data that have been released to the public, for example, on the ITS JPO unit cost database web site, have been aggregated or otherwise masked to prevent the release of proprietary data. State self-evaluation cost data were used as a starting point in determining, inferring, or estimating baseline start-up, annual operating, and life-cycle costs for use in the national benefit-cost analysis, as described in Section 8.0. In this Cost Analysis section of the National Evaluation Report, however, to protect the proprietary interests expressed by some participating CVISN states, all state identities have been masked. Specific cost values provided by the four focus states identified above, where field site visits were conducted, are included, so that readers can get a clearer picture of how the fuller deployment context relates to actual dollar values invested for at least these four states.

The following method was used to mask the identity of specific state data, while still offering the user the ability to trace from table to table and obtain a realistic picture of prevailing costs for deploying and operating CVISN technologies in comparable states.

1. The information in Tables 6-4 through 6-12 is listed in terms of ***anonymous numeric identifiers,*** each of which represents the data of a given single CVISN state across all records where that state provided deployment or cost data. Thus, readers can use the deployment data presented in the early tables to locate a state whose scale of operation roughly matches the scale of interest, and then track the state ID numbers across subsequent tables (see text box example on page 6-15). Some state deployment information is repeated on later tables for ease of cross-referencing from deployment to cost data.

2. The states have been arranged into ***three strata*** reflecting their relative level of CVISN deployment and the volume of activity, following the same stratification method applied in the Motor Carrier Survey (Section 5.0). In Tables 6-5 through 6-12, the relatively highest activity states are presented first, followed by the medium- and lower-activity states. Within each of the three strata, no attempt was made to assign the numeric identifiers in descending or ascending order.

3. It is acknowledged that these assignments are somewhat subjective and debatable. Some states that are highly active in some areas of CVISN may appear in the medium or low category, and vice versa. The group assignments are intended give readers a convenient, approximate way to recognize states comparable to their own in terms of the overall CVO business environment and the relative degree of CVISN activity.

4. Because the state-identifiable deployment data, which are regarded as less sensitive, are listed elsewhere in this report (Section 4 and Appendix H), the per-state deployment data in this cost analysis section (for example, numbers of IRP

carrier accounts, number of FTE inspectors, or number of weigh station sites) have been expressed as ranges, again to prevent the release of state-identifiable cost data by cross-tabulation or inference.

5. The descriptive statistics presented at the bottom of the tables were prepared based on the actual per-state deployment and cost values, prior to the conversion of deployment data from discrete values into ranges.

6. The cost data are expressed in actual dollar values as reported by each state and have not been modified, except for having been changed to constant year 2006 dollars for purposes of equivalent comparisons, as described in Section 6.4.2 below.

7. State officials and others who wish to learn the exact expenditures of other specific, comparable CVISN states are invited to contact the respective state CVISN program managers to request this kind of information.

The listing below shows which states belong to each stratum for purposes of the cost analysis tables.

HIGH	MEDIUM		LOW	
Arizona	Georgia	New York	Alaska	New Jersey
Arkansas	Idaho	North Dakota	Connecticut	Rhode Island
California	Illinois	Ohio	Maine	South Carolina
Colorado	Indiana	Oklahoma	Massachusetts	South Dakota
Florida	Kansas	Utah	Minnesota	Texas
Kentucky	Maryland	Virginia	Nebraska	Wyoming
Tennessee	Michigan	Washington		
	Missouri	West Virginia		
	Montana	Wisconsin		
	New Mexico			

Some CVISN states provided data for only part of the questions on the self-evaluation cost template. Therefore, the sets of states represented numerically will vary across Tables 6-4 through 6-12.

Most if not all of the following jurisdictions are participating in some aspects of CVISN deployment, but these jurisdictions do not have any cost data presented in this section:

Alabama	Louisiana	Oregon
Delaware	Mississippi	Pennsylvania
District of Columbia	Nevada	Vermont
Hawaii	New Hampshire	
Iowa	North Carolina	

Example of Navigating Across the Cost Tables

To find a state that is comparable to yours, you can begin with credentialing deployment data (e.g., number of IRP or IFTA accounts per state), or with screening/weigh/inspection data (e.g., number of permanent weigh scale sites, number of full-time equivalent inspection staff, or number of electronic screening sites).

For example, imagine that your state has between 4,001 and 6,000 IRP carrier accounts. Table 6-4, which is the only table in this set that is not sorted numerically by State ID number, is arranged in ascending order of IRP carrier accounts and IFTA carrier accounts per state. The State ID numbers are shown in the first column. Table 6-4 shows that four states reported being in the range of interest: one HI (ID=6), one MED (ID=20), and two LO (ID=31, 37). Now imagine that your state also has between 4,001 and 5,000 IFTA carrier accounts, and about 8% of your state's carrier accounts are applying for IRP credentials electronically. State ID 20 is the only one with data included in this analysis that matches this three-part combination exactly (Table 6-4).

Reading across the deployment data, which are listed in Tables 6-5 through 6-12 in numerical order by State ID number, for State ID 20 you can see that this state has between 10 and 20 permanent scale sites, and weighs between 1 million and 3 million vehicles per year at those permanent sites (Table 6-5). The state also has fewer than five high-speed mainline weigh-in-motion scales (Table 6-6), and between 101 and 150 FTEs assigned to perform CV inspections (Table 6-9).

State ID 20 reported start-up costs of $529,442 for CVISN electronic credentialing (Table 6-7), and it reported annual legacy (pre-CVISN) credentialing costs of $401,559, but no current values for CVISN electronic credentialing costs (Table 6-8).

This state also reported start-up costs of $1,741,838 and annual operating costs of $168,968 for CVISN safety information exchange (Tables 6-9 and 6-10). Likewise, State ID 20 reported start-up costs of $1,213,586 for deploying CVISN electronic screening, but no annual operating costs for e-screening (Tables 6-11 and 6-12).

By putting together these actual reported costs, and comparing values across similar states, you can begin to form a picture of what costs your state may incur to deploy and operate CVISN technologies similar to those in your state of interest.

6.4.1 CVISN Deployment Data

Respondent Information. Information about the respondents includes: name of the person completing the template form, contact information, name of the agency/department/division completing the form, names of other persons who provided supporting information, and the date when the form was completed. Such information was used to identify the respondents and determine an approximate timeframe for the costs included in the report.

Credential Administration (IRP, IFTA, and Other). Information obtained in this section includes: number of IRP carriers and commercial vehicle accounts; number of annual IRP transactions; percentage of commercial motor carrier accounts that apply for IRP and IFTA credentials electronically; ownership of front-end user interface systems and related central office hardware; type of third-party vendor (when applicable) that provides state IRP and IFTA credential services; possible payment methods that could be adopted by carriers to pay IRP and IFTA fees and costs; current and expected level of state participation on IRP and IFTA clearinghouses; type of computer connection the states use to connect to the IRP and IFTA electronic credential systems; frequency of state updates and transformations of IRP and IFTA data to the CVIEW or other centralized systems such as PrePass; and information about credentials other than IRP and IFTA such as registrations permits, oversize and overweight permits, and highway use tax. Table 6-4 provides a descriptive statistical summary of selected EC deployment data. As with all Tables 6-4 through 6-12, the ID column represents the identity of each single state, and the Deployment Stratum column represents the relative level of CVISN deployment and the volume of CVO activity.

Roadside Safety Information Exchange. The roadside SIE section of the deployment template includes detailed information about the types of highway weigh and scale sites in each state (e.g., permanent versus plug-and-run, if they are used for vehicle safety and/or credentials and compliance functions). This section classifies the weight and scale sites by their location. This section also includes information about the number of commercial vehicles weighed annually. The roadside SIE section further includes data on commercial vehicle inspections such as number of FTE inspectors and the number of laptop computers they are using to support their inspection process. CVISN technology used in the inspection selection process is also included in roadside SIE. Data on state weigh station usage and wireless connectivity to central database management systems such as the CVIEW system and SAFER are also included in this section.

CVISN resources are optimized when integrated with other relevant central database management systems such as CVIEW and SAFER.

Roadside Electronic Screening. Roadside ES data sets include information concerning ES and the current status and future plans of states offering CVISN for ES to increase safety, registration, and vehicle enrollment. Respondents also provided data concerning their participation in the ES program or partnership (e.g., Help/PrePass and Norpass). The roadside ES data count the number of permanent static scale and remote weigh stations that offer ES to identify both permanent and temporary ES capabilities and technology deployment at the state level. The roadside ES data also counted the number of high-speed mainline WIM devices the states installed or are planning to install, as well as the reduced-speed ramp or sorter-lane WIM devices that states installed or are planning to install.

Significant effort concerning roadside ES deployment was devoted to counting the number of commercial vehicles screened electronically by the state's system in the 12 months prior to template completion. The number of commercial vehicles given green and red light transponder signals in the cab to bypass were counted. The state's prevailing random pull-in percentage rates (number of red lights/number of station encounters) were approximated. Finally, this section includes data on the method by which in-vehicle transponders were purchased and distributed to motor carriers and vehicles (e.g., purchased and distributed by the state government versus third party). Tables 6-5 and 6-6 summarize key data—number of mobile and permanent sites, number of vehicles weighed per year at mobile and permanent sites, number of high-speed WIM devices, number of CMV screening per year—relating to ES by states.

Table 6-4. Summary of Selected Electronic Credentialing Deployment Variables

ID	Deployment Stratum	Number of IRP Accounts	Number of IFTA Accounts	Percent of Carrier Accounts Applying IRP Credentials Electronically	Number of IRP Transactions/Yr
38	LO		1,000-2,000		
22	MED	1,000-2,000	1,000-2,000		
28	LO	1,000-2,000	1,000-2,000		2,000-4,000
30	LO	2,001-3,000			2,000-4,000
1	HI	2,001-3,000	1,000-2,000	11-20	2,000-4,000
16	MED	2,001-3,000	1,000-2,000	6-10	6,001-8,000
7	HI	2,001-3,000	2,001-3,000	>20	8,001-10,000
23	MED	2,001-3,000	2,001-3,000		6,001-8,000
24	MED	2,001-3,000	2,001-3,000	6-10	8,001-10,000
34	LO	2,001-3,000	2,001-3,000		4,001-6,000
36	LO	2,001-3,000	2,001-3,000	6-10	4,001-6,000
10	MED	2,001-3,000	3,001-4,000		6,001-8,000
19	MED	3,001-4,000	2,001-3,000		
21	MED	3,001-4,000	2,001-3,000		2,000-4,000
3	HI	3,001-4,000	3,001-4,000		2,000-4,000
14	MED	3,001-4,000	3,001-4,000	11-20	8,001-10,000
6	HI	4,001-6,000	3,001-4,000	6-10	6,001-8,000
20	MED	4,001-6,000	4,001-5,000	6-10	10,001-20,000
31	LO	4,001-6,000	4,001-5,000	11-20	8,001-10,000
37	LO	4,001-6,000	4,001-5,000		
11	MED	6,001-8,000	5,001-7,000	6-10	>30,001
18	MED	6,001-8,000	5,001-7,000		20,001-30,000
25	MED	6,001-8,000	5,001-7,000		10,001-20,000
29	LO	6,001-8,000	5,001-7,000		4,001-6,000
35	LO	6,001-8,000	5,001-7,000		10,001-20,000
4	HI	8,001-10,000	4,001-5,000	11-20	20,001-30,000
12	MED	8,001-10,000	5,001-7,000		10,001-20,000
13	MED	8,001-10,000	5,001-7,000	>20	>30,001
17	MED	8,001-10,000	>7,001	1-5	10,001-20,000
9	MED	>10,001	4,001-5,000	6-10	20,001-30,000
2	HI	>10,001	>7,001		20,001-30,000
5	HI	>10,001	>7,001		10,001-20,000
15	MED	>10,001	>7,001	1-5	>30,001
26	MED	>10,001	>7,001		20,001-30,000
32	LO	>10,001	>7,001	1-5	10,001-20,000
33	LO	>10,001	>7,001		>30,001
Statistical Summary					
State Mean		6,395	5,030	15	15,213
State Median		5,025	4,200	10	10,550
Maximum		16,000	13,000	53	46,000
Minimum		1,100	1,200	5	2,400
Range (Max -Min)		14,900	11,800	48	43,600
Standard Deviation		4,456	3,347	13	12,061

Table 6-5. Summary of Selected Weigh and Inspection Site Variables

ID	Deployment Stratum	Number of Permanent Sites	Number of Vehicles Weighed/Yr. at Permanent Sites	Number of Mobile Scale Systems	Number of Vehicles Weighed/Yr. Using Mobile Systems
1	HI	21-30	3M-5M	<20	5,001-10,000
2	HI	>31	>10M	81-160	<1,000
3	HI	10-20			
4	HI	<10	>10M	81-160	<1,000
5	HI	21-30	5M-10M	201-400	20,001-40,000
6	HI	10-20	<100,000	>400	10,001-20,000
7	HI	10-20	5M-10M	<20	>40,001
8	MED	21-30	5M-10M	41-80	>40,001
9	MED	<10	1M-3M	20-40	10,001-20,000
10	MED	10-20	1M-3M	161-200	10,001-20,000
11	MED	21-30	>10M	201-400	<1,000
12	MED	10-20	1M-3M	20-40	5,001-10,000
13	MED	10-20	1M-3M	41-80	1,000-5,000
14	MED	<10	1M-3M	20-40	5,001-10,000
15	MED	21-30		201-400	>40,001
16	MED	10-20	1M-3M	20-40	20,001-40,000
17	MED			41-80	
18	MED	21-30	3M-5M	20-40	1,000-5,000
19	MED	<10			
20	MED	10-20	1M-3M	161-200	1,000-5,000
21	MED	<10	5M-10M	41-80	1,000-5,000
22	MED	21-30	100,000-500,000	<20	5,001-10,000
23	MED	10-20	500,001-1M	161-200	<1,000
24	MED	>31	5M-10M	>400	>40,001
25	MED	10-20	100,000-500,000	201-400	5,001-10,000
26	MED	10-20	5M-10M	<20	5,001-10,000
27	LO	<10	100,000-500,000	41-80	5,001-10,000
28	LO	21-30	1M-3M	20-40	<1,000
29	LO	<10	3M-5M	<20	1,000-5,000
30	LO	<10		<20	
31	LO	10-20	500,001-1M	<20	20,001-40,000
32	LO	<10	<100,000	81-160	20,001-40,000
33	LO	>31	100,000-500,000	>400	>40,001
34	LO	10-20	100,000-500,000	41-80	5,001-10,000
35	LO	<10	100,000-500,000	20-40	10,001-20,000
37	LO			<20	20,001-40,000
Statistical Summary					
State Mean		18	3,704,979	159	20,628
State Median		14	1,570,808	56	6,963
Maximum		54	20,000,000	1,675	176,286
Minimum		3	5,700	3	9
Range (Max -Min)		51	19,994,300	1,672	176,277
Standard Deviation		12.84	4779675.78	303.30	32984.11

Table 6-6. Summary of Selected Electronic Screening Variables

ID	Deployment Stratum	Program	Number of High-Speed WIMs	Number of Reduced-Speed WIMs	Number of Comm. Vehicle Screenings/Yr.
1	HI	HELP Inc./PrePass	5-10	<5	>1M
2	HI	HELP Inc./PrePass	>21	5-10	>1M
3	HI	HELP Inc./PrePass		5-10	
4	HI	HELP Inc./PrePass		5-10	100,001-500,000
5	HI	HELP Inc./PrePass		>11	>1M
6	HI	Norpass	<5	5-10	500,001-1M
7	HI	HELP Inc./PrePass	5-10		>1M
8	MED	Norpass		>11	
9	MED	HELP Inc./PrePass			100,001-500,000
10	MED	Norpass	<5		<100,000
11	MED	HELP Inc./PrePass	5-10	5-10	
12	MED	NorPass	<5	<5	<100,000
13	MED	HELP Inc./PrePass	>21	5-10	500,001-1M
14	MED	HELP Inc./PrePass	<5		<100,000
15	MED	HELP Inc./PrePass	11-20	>11	>1M
16	MED	HELP Inc./PrePass	<5	<5	>1M
18	MED	HELP Inc./PrePass	11-20	<5	>1M
19	MED	HELP Inc./PrePass	5-10		
20	MED	HELP Inc./PrePass	<5	<5	100,001-500,000
21	MED	HELP Inc./PrePass	5-10	<5	
22	MED	HELP Inc./PrePass	>21		100,001-500,000
23	MED		5-10		
24	MED	Norpass	5-10	<5	500,001-1M
27	LO	Norpass	5-10		
28	LO	HELP Inc./PrePass		<5	100,001-500,000
29	LO	HELP Inc./PrePass		<5	
30	LO	Norpass	<5	<5	
31	LO	HELP Inc./PrePass	<5		500,001-1M
32	LO		>21	<5	
33	LO			<5	
34	LO	Norpass	11-20		
35	LO	Norpass		<5	
Statistical Summary					
State Mean			16	7	1,204,389
State Median			6	4	728,000
Maximum			136	38	5,666,150
Minimum			1	1	900
Range (Max -Min)			135	37	5,665,250
Standard Deviation			28	8	1,482,011

6.4.2 CVISN Cost Data

All costs in this report are presented in 2006 dollars. This was accomplished by adjusting the raw data, reported from 2003 to the present, for the annual inflation rates described by the Consumer Price Index (CPI). This was carried out assuming that the form date, as supplied by the respondent or as determined through database administrative records, was roughly consistent with the relevant time period for the costs.

Some minor adjustments to the data were necessary due to the idiosyncrasies of the individual states filling out the templates. For instance, because much of Connecticut's cost information is proprietary, they chose to list aggregated costs rather than unit costs and number of units. As a result, in handling the data, no unit costs for Connecticut were included in the analysis, although the information was retained to be reflected in the total costs.

Florida also required some careful handling. Four different agencies completed templates and there was some apparent overlap between the answers. This was also true for the Florida deployment data. This was handled by using only the data provided at the state level (rather than by individual agencies), to avoid double-counting.

States made considerable use of the options in the template to specify cost elements that fell outside the prescribed categories on the template. Responses like these, which were extensive and unique, are included in Appendix B.3, which presents a complete listing of cost elements.

While statistical estimates are provided in the data, they should be interpreted with care. Because not all surveys are complete and verified, and because states did not necessarily fill out the forms the same way, the state figures and overall averages presented may not represent the entirety of the data.

Electronic Credentials Costs. The cost of electronic credentials is paid by the states to provide systems that enable motor carriers to apply, pay for, and receive various operating credentials using transportation data management information systems, such as central IRP and IFTA credentials systems.

Start-up Costs. EC start-up costs include the costs of computer network servers for EC, personal computers (desktop or laptop) for state employees to use in electronic credentials administration, consumable supplies and materials for outreach, internal and external publicity, training or supporting the initial CVISN deployment of electronic credentials (only cost items related to one time start-up), network infrastructure, and other central office or branch office network hardware and peripherals for EC. EC start-up costs also include the one-time start-up costs for software package purchases. The software packages include both purchases of back-end database management and data processing or reporting and front-end user interface and data entry. Column 4 in Table 6-7 summarizes the state-by-state total EC nonlabor costs. Labor start-up costs include the state employee labor for new EC software development and new hardware configuration. Labor start-up costs include the cost of contractor or third party labor for new software development and hardware configuration. Care should be taken in interpreting these costs as differences in state reporting could influence the numbers.

Table 6-7. Electronic Credentialing One-Time Start-up Costs ($2006)

ID	Deployment Stratum	Number of IRP Accounts	Number of IFTA Accounts	Total Non-Labor Costs, $	Total Labor Costs, $	Total Start-Up Costs, $
1	HI	2,001-3,000	1,000-2,000	$55,991	$439,283	$495,274
2	HI	>10,001	>7,001	$102,926	$6,549,398	$6,652,324
3	HI	3,001-4,000	3,001-4,000			
4	HI	8,001-10,000	4,001-5,000	$153,194	$40,076	$193,270
5	HI	>10,001	>7,001		$781,699	$781,699
6	HI	4,001-6,000	3,001-4,000			
7	HI	2,001-3,000	2,001-3,000	$23,316	$1,051,478	$1,074,795
9	MED	>10,001	4,001-5,000	$255,569		$255,569
10	MED	2,001-3,000	3,001-4,000	$59,309		$59,309
11	MED	6,001-8,000	5,001-7,000	$1,671,440	$1,671,440	$3,342,880
12	MED	8,001-10,000	5,001-7,000	$362,864	$217,595	$580,459
13	MED	8,001-10,000	5,001-7,000			
14	MED	3,001-4,000	3,001-4,000			
15	MED	>10,001	>7,001			
16	MED	2,001-3,000	1,000-2,000	$241,373		$241,373
17	MED	8,001-10,000	>7,001	$160,135	$1,397,701	$1,557,836
18	MED	6,001-8,000	5,001-7,000	$123,471	$268,509	$391,980
19	MED	3,001-4,000	2,001-3,000			
20	MED	4,001-6,000	4,001-5,000	$342,629	$186,813	$529,442
21	MED	3,001-4,000	2,001-3,000	$513,996	$75,097	$589,093
22	MED	1,000-2,000	1,000-2,000	$44,283		$44,283
23	MED	2,001-3,000	2,001-3,000	$19,922	$1,361,520	$1,381,442
24	MED	2,001-3,000	2,001-3,000	$492,518		$492,518
25	MED	6,001-8,000	5,001-7,000			
26	MED	>10,001	>7,001		$782,258	$782,258
27	LO			$28,037		$28,037
28	LO	1,000-2,000	1,000-2,000	$188,201	$184,658	$372,860
29	LO	6,001-8,000	5,001-7,000	$714,233		$714,233
30	LO	2,001-3,000		$76,400	$3,603,500	$3,679,900
31	LO	3,001-4,000	4,001-5,000			
32	LO	>10,001	>7,001	$226,948	$1,218	$228,166
33	LO	>10,001	>7,001			
34	LO	2,001-3,000	2,001-3,000	$5,535	$714,742	$720,278
35	LO	6,001-8,000	5,001-7,000	$794,595	$7,778,530	$8,573,125
36	LO	2,001-3,000	2,001-3,000			
37	LO	4,001-6,000	4,001-5,000			
38	LO		1,000-2,000			
Statistical Summary						
State Mean		6,395	5,030	$289,430	$1,505,862	$1,350,496
State Median		5,025	4,200	$160,135	$748,221	$580,459
Maximum		16,000	13,000	$1,671,440	$7,778,530	$8,573,125
Minimum		1100	1200	$5,535	$1,218	$28,037
Range (Max –Min)		14,900	11,800	$1,665,905	$7,777,312	$8,545,088
Standard Deviation		4,456	3,347	373,315	2,241,288	2,107,317

EC start-up cost also includes the cost of labor for interface modification for existing systems (state employee labor plus contractor or vendor labor costs) and labor costs for training associated with CVISN credentialing system deployment. The initial descriptive statistical analysis shows that the average start-up cost of EC is about $1.35 million. However, this start-up cost ranges widely between nearly $8.5 million in State ID 35 to $28,037 in State ID 27. This excludes the states that showed $0 investment. The next lowest start-up cost is for State ID 22, at $44,238.

Annual Costs. Annual credentialing costs are divided into labor costs and nonlabor costs. Annual nonlabor costs include membership fees the states pay to IRP and IFTA clearinghouses, fees paid to third-party IRP and IFTA credential administrators (e.g., VISTA or Polk) for operating both back-end database management and data processing system and front-end user interface data entry system. Annual IRP and IFTA and other credentialing nonlabor costs also include lease payments for computer equipment, and recurring costs for marketing, outreach, and publicity.

Annual labor credentialing cost data include the costs of state employees, contractors, and third party labor costs (pre-deployment and post-deployment) used for both IRP and IFTA credentialing. Annual credentialing labor costs include a comparison between existing (legacy) labor costs (pre-deployment) and the CVISN labor after deployment of the system. The data contained in this section represent one of the most important data elements because the marginal impact of CVISN deployment in terms of costs before and after deployment (incremental cost) is critical. The incremental costs include both labor and nonlabor costs. The nonlabor incremental cost includes the hardware, software, fees and training that would not be paid otherwise. For example, the first row of the initial descriptive statistical analysis presented in the last column of Table 6-8 shows that of the states that provided values for both legacy costs and CVISN (post-deployment) costs, several reported identical values. Of those that did not report identical costs, State ID 1 appears to be saving approximately $16,000 per year overall and State ID 10 appears to be saving $4,000 per year on IFTA costs.

Table 6-8. Electronic Credentialing Annual Costs ($2006)

ID	Deployment Stratum	IRP Legacy Annual Costs	IRP CVISN Annual Costs	IFTA Legacy Annual Costs	IFTA CVISN Costs	Total Legacy Annual Costs (IRP+IFTA)	Total CVISN Annual Costs (IRP+IFTA)
1	HI	$26,570	$18,599	$26,570	$18,599	$53,139	$37,197
2	HI	$2,562,635		$4,118,283		$6,680,917	
5	HI		$100,079				$100,079
7	HI	$253,114		$285,574		$538,688	
9	MED	$64,701		$64,701		$129,402	
10	MED	$600,209		$26,167	$22,645	$626,376	$22,645
12	MED	$537,544				$537,544	
15	MED	$1,186,183		$625,442		$1,811,625	
17	MED			$147,195	$147,195	$147,195	$147,195
20	MED	$240,935		$160,624		$401,559	
23	MED	$625,806				$625,806	
28	LO	$13,838		$13,838		$27,677	
31	LO	$545,984	$545,984	$545,984	$545,984	$1,091,968	$1,091,968
32	LO	$132,848	$132,848			$132,848	$132,848
34	LO	$221,413		$110,707		$332,120	
Statistical Summary							
State Mean		$539,368	$199,377	$556,826	$183,606	$938,347	$255,322
State Median		$253,114	$116,463	$147,195	$84,920	$469,551	$116,463
Maximum		$2,562,635	$545,984	$4,118,283	$545,984	$6,680,917	$1,091,968
Minimum		$13,838	$18,599	$13,838	$18,599	$27,677	$22,645
Range (Max- Min)		$2,548,796	$527,385	$4,104,444	$527,385	$6,653,241	$1,069,323
Standard Deviation		690,713	236,011	1,199,415	248,850	1,720,385	412,913

Safety Information Exchange Costs. The SIE costs include the costs the states pay to deploy and support roadside activities and systems that improve the safety of commercial vehicle operations. Similar to the EC costs, SIE cost components include start-up and on-going annual costs.

Start-up Costs. SIE start-up costs consist of nonlabor and labor costs. Start-up nonlabor cost data include the costs of purchasing hardware for information exchange such as computer network servers, personal computers (including laptops and desktops used at roadside check stations), printers, wireless modems used for SIE deployment. Start-up costs include all hardware in areas other than the state main offices, such as roadside or mobile telecommunication stations. This hardware includes routers, T1 lines and network equipment. The start-up costs also include material used for outreach, publicity, training, and supporting the deployment of the SIE. Start-up labor costs are those incurred for interface modification with existing systems and training costs.

Table 6-9 summarizes the SIE start-up costs. For example, the initial statistical summary shows that on average, the states paid roughly $680,000 dollars in SIE start-up costs. However, this average hides a large variation in costs ranging from a high of almost $2.7 million in State ID 30 to a low of almost $31,000 in State ID 22.

Annual Costs. Annual SIE cost data includes both labor and nonlabor costs. The states' annual nonlabor costs are those related to the lease payments for computer equipment, telephone and internet charges, wireless communication charges, and charges for linking central data services – e.g., the American Association of Motor Vehicle Administrators Network. The annual labor costs for SIE include the costs of labor services provided by states, contractors, and third party employees.

Table 6-10 provides summarized annual recurrent state cost data relating to the CVISN SIE. Column 5 shows the total annual costs associated with the safety data information exchange. On average, the annual SIE costs states roughly $74,000. However, these costs range from a high of $239,393 in State ID 27 to a low of $65 in State ID 29. This low illustrates potential inconsistencies in reporting across the states.

Electronic Screening Costs. ES costs are state costs associated with supporting activities and programs that increase the usage of ES to maintain safety data and enable trucks to bypass roadside inspection and weigh stations legally.

Start-Up Costs. ES start-up costs include those relating to hardware and equipment dedicated to ES, such as the costs associated with network servers, desktop personal computers, laptops, WIM scales, in-vehicle transponders purchased by the states for distribution, in-vehicle transponders purchased by the states for resale (cost recovery or other basis) to motor carriers enrolling vehicles in ES, AVI equipment and systems, telecommunication equipment between upstream sites and weigh stations, electronic signs for weigh stations and loop detectors for weigh stations.

ES start-up costs include the cost of existing system upgrades as well as those costs related to one-time start-up fees paid for ES to third-party vendors. This equipment may include mainline compliance tracking systems, over height detectors and remote cameras with video transceivers. The start-up costs, similar to start-up costs of the other CVISN functions, include data on consumable supplies and material for outreach, internal and external publicity or training, or other activities to support CVISN deployment of ES.

Table 6-11 summarizes the ES start-up costs at the state level. The initial statistical descriptive analysis shows that on average, the states invested between $1 million and $2.8 million each in ES as a one-time start-up cost. As noted above, depending on the business model, some states have very low start-up costs for screening.

Table 6-9. Safety Information Exchange Start-up Costs ($2006)

ID	Deployment Stratum	Number of FTE Officers	Total Non-Labor Costs, $	Total Labor Costs, $	Total Start-Up Costs, $
1	HI	31-60	$3,709	$208,793	$212,501
2	HI	>201			
3	HI		$1,272,451		$1,272,451
4	HI	151-200	$592,280		$592,280
5	HI	>201		$61,664	$61,664
6	HI	151-200			
7	HI	31-60		$146,133	$146,133
8	MED	61-100			
9	MED	<30	$395,215		$395,215
10	MED	<30	$14,019	$61,617	$75,635
12	MED	>201	$710,092		$710,092
13	MED	61-100			
14	MED	>201			
15	MED	>201			
16	MED	151-200			
17	MED	101-150	$671,218		$671,218
18	MED	>201			
20	MED	101-150	$148,733	$1,593,105	$1,741,838
21	MED	31-60	$303,099	$75,097	$378,196
22	MED	61-100	$31,828		$31,828
23	MED	<30	$33,422	$52,151	$85,573
24	MED	151-200	$45,767	$107,831	$153,598
25	MED	151-200			
26	MED	101-150			
27	LO	31-60	$391,333	$419,478	$810,810
28	LO	<30	$58,121	$209,457	$267,578
29	LO	101-150			
30	LO	<30	$155,900	$2,524,900	$2,680,800
31	LO	<30			
32	LO	101-150	$690,558		$690,558
33	LO	>201			
34	LO	61-100	$208,017	$1,868,450	$2,076,467
35	LO	101-150	$572,353	$83,030	$655,383
37	LO	<30			
Statistical Summary					
State Mean		195	$349,895	$570,131	$685,491
Maximum		1,126	$1,272,451	$2,524,900	$2,680,800
Minimum		10	$3,709	$52,151	$31,828
Range (Max -Min)		1,116	$1,268,742	$2,472,749	$2,648,972
Standard Deviation		266	345,065	841,518	729,157

Table 6-10. Safety Information Exchange Annual Costs ($2006)

ID	Deployment Stratum	Annual Non-Labor Costs, $	State Annual Labor Costs, $	Other Annual Labor Costs, $	Total Annual Costs, $
1	HI			$5,535	$5,535
5	HI		$60,003	$45,611	$105,614
7	HI	$1,222			$1,222
9	MED	$120,745		$70,093	$190,837
10	MED			$7,548	$7,548
12	MED	$33,860			$33,860
17	MED	$66,944	$67,790		$134,734
20	MED	$132,462	$36,505		$168,968
23	MED	$522	$4,172		$4,694
24	MED	$10,870	$26,466		$37,336
27	LO	$45,291	$150,969	$43,134	$239,393
28	LO		$21,256	$15,499	$36,755
29	LO	$65			$65
Statistical Summary					
State Mean		$45,776	$52,452	$31,237	$74,351
Maximum		$132,462	$150,969	$70,093	$239,393
Minimum		$65	$4,172	$5,535	$65
Range (Max -Min)		$132,398	$146,797	$64,557	$239,329
Standard Deviation		51,315	48,702	25,797	83,528

Table 6-11. Electronic Screening One-Time Start-up Costs ($2006)

ID	Deployment Stratum	Program	Number of Screening Sites	Total Start-Up Non-Labor Costs, $	Total Start-Up Labor Costs, $	Total Start-Up Costs, $
1	HI	HELP Inc./PrePass	5-10		$13,617	$13,617
2	HI	HELP Inc./PrePass	>15	$7,749,457		$7,749,457
3	HI	HELP Inc./PrePass	5-10			
4	HI	HELP Inc./PrePass	5-10			
5	HI	HELP Inc./PrePass	>15			
6	HI	Norpass	11-15			
7	HI	HELP Inc./PrePass	5-10			
8	MED	Norpass	>15			
9	MED	HELP Inc./PrePass		$43,134		$43,134
10	MED	Norpass	<5	$444,819	$1,078	$445,897
11	MED	HELP Inc./PrePass	11-15	$16,175	$270,665	$286,840
12	MED	Norpass	<5	$755,383	$1,002,864	$1,758,247
13	MED	HELP Inc./PrePass	>15			
14	MED	HELP Inc./PrePass	<5			
15	MED	HELP Inc./PrePass	>15			
16	MED	HELP Inc./PrePass	<5	$1,020,118		$1,020,118
17	MED			$113,766	$339,680	$453,445
18	MED	HELP Inc./PrePass	>15			
19	MED	HELP Inc./PrePass	5-10			
20	MED	HELP Inc./PrePass	<5	$1,181,731	$31,855	$1,213,586
21	MED	HELP Inc./PrePass	5-10	$9,507,043		$9,507,043
22	MED	HELP Inc./PrePass	>15	$501,547		$501,547
23	MED		5-10			
24	MED	Norpass	5-10	$5,647,569	$4,376,335	$10,023,904
27	LO	Norpass	5-10	$57,152	$37,742	$94,895
28	LO	HELP Inc./PrePass	<5	$1,107,065		$1,107,065
29	LO	HELP Inc./PrePass	<5			
30	LO	Norpass	<5	$895,800	$775,400	$1,671,200
31	LO	HELP Inc./PrePass	<5			
32	LO		>15	$4,547,381		$4,547,381
33	LO		<5			
34	LO	Norpass	11-15	$756,126	$6,188,737	$6,944,863
35	LO	Norpass	<5			
Statistical Summary						
State Mean			16	$2,146,517	$1,303,797	$2,787,190
State Median			8	$825,963	$305,173	$1,107,065
Maximum			144	$9,507,043	$6,188,737	$10,023,904
Minimum			2	$16,175	$1,078	$13,617
Range (Max -Min)			142	$9,490,868	$6,187,659	$10,010,288
Standard Deviation			26	3,004,068	2,166,722	3,519,018

Annual Costs. Similar to the EC and safety information annual cost, the ES annual costs consist of both annual nonlabor and labor costs. The ES nonlabor costs include the lease payments of computer equipment for ES, annual payments made to ES administrators, vendors, and or partnerships (e.g. PrePass and Norpass). The annual screening costs include annual maintenance costs for mainline WIM scales, sorter-lane WIM scales as well as the annual maintenance costs for other roadside equipment (e.g. AVI, transponder readers). Nonlabor annual costs for ES include all recurrent costs for activities such as marketing, outreach and publicity.

ES annual labor costs are estimated based on the states, contractors, and vendor employee annual labor costs. Table 6-12 shows the state by state costs of ES. The average state spent almost $160,000 annually. However, the range is significant from a high of $902,258 annually in State ID 2 to a low of $11,071 in State ID 4.

Unit Costs. All unit costs are summarized in Appendix B.3. States that provided blank or zero responses for a given cost element were disregarded. For all three of the CVISN components, unit costs were drawn directly from the forms in some cases, such as for equipment and materials, but calculated in other cases, such as labor. Where calculated, the total amount spent was divided by the number of units reported. Most of the cases where the unit costs were calculated related to labor where a number of hours and total labor costs were solicited by the self-evaluation template. The unit costs are provided primarily for one-time start-up costs, where explicit pieces of equipment or software are purchased. They are not provided for annual operation and maintenance costs, as units in this area are often not defined. Labor unit costs (hourly), where reported with cost and hours, were calculated for both the one-time start-up costs and the annual recurring costs. These are the incremental cost amounts for the costs described in the tables above and the remainder of the data reported in the self-evaluation template.

For ease of interpretation, the unit costs are presented in a format that follows the self-evaluation template. It separates EC, SIE, and ES, as they were in the template, and provides brief explanations of the data requested in the template. The smallest nonzero value reported, the mean, the median, the highest value reported, the standard deviation, and a count of the number of states that responded to the question are all presented for each question. The response count is particularly useful in evaluating the generalizability and reliability of the responses. Where few states have responded, the results may or may not have broad applicability.

Frequently, there was not enough information to present unit costs. In some cases, such as for any operating and maintenance cost, the template was not designed to solicit unit costs. Any place where there were insufficient data to calculate a unit cost, “NA,” for “not applicable,” appears in the table. These categories were left in the final table so that it could follow the template format in its entirety.

Table 6-12. Electronic Screening Annual Costs ($2006)

ID	Deployment Stratum	Program	Number of Screening Sites	Total Annual Non-Labor Costs, $	Total Annual Labor Costs, $	Total Annual Costs, $
1	HI	HELP Inc./PrePass	5-10			
2	HI	HELP Inc./PrePass	>15	$902,258		$902,258
3	HI	HELP Inc./PrePass	5-10			
4	HI	HELP Inc./PrePass	5-10	$11,071		$11,071
5	HI	HELP Inc./PrePass	>15	$9,897	$219,279	$229,176
6	HI	Norpass	11-15			
7	HI	HELP Inc./PrePass	5-10			
8	MED	Norpass	>15			
9	MED	HELP Inc./PrePass				
10	MED	Norpass	<5	$107,296	$6,470	$113,766
11	MED	HELP Inc./PrePass	11-15	$154,204		$154,204
12	MED	Norpass	<5	$16,175	$53,917	$70,093
13	MED	HELP Inc./PrePass	>15			
14	MED	HELP Inc./PrePass	<5			
15	MED	HELP Inc./PrePass	>15			
16	MED	HELP Inc./PrePass	<5	$72,249		$72,249
17	MED			$32,350		$32,350
18	MED	HELP Inc./PrePass	>15			
19	MED	HELP Inc./PrePass	5-10			
20	MED	HELP Inc./PrePass	<5			
21	MED	HELP Inc./PrePass	5-10	$276,398		$276,398
22	MED	HELP Inc./PrePass	>15	$18,820		$18,820
23	MED		5-10			
24	MED	Norpass	5-10	$232,384	$63,157	$295,541
27	LO	Norpass	5-10			
28	LO	HELP Inc./PrePass	<5	$53,139	$5,314	$58,453
29	LO	HELP Inc./PrePass	<5			
30	LO	Norpass	<5	$15,000		$15,000
31	LO	HELP Inc./PrePass	<5	$102,443		$102,443
32	LO		>15			
33	LO		<5			
34	LO	Norpass	11-15	$16,606		$16,606
35	LO	Norpass	<5			
Statistical Summary						
State Mean			16	$134,686	$69,627	$157,895
State Median			8	$53,139	$53,917	$72,249
Maximum			144	$902,258	$219,279	$902,258
Minimum			2	$9,897	$5,314	$11,071
Range (Max -Min)			142	$892,361	$213,965	$891,188
Standard Deviation			26	228,125	87,763	226,646

6.4.3 CVISN Economic Benefits Data

In addition to assessing the costs incurred through CVISN deployment, this report also considers the potential benefits or avoided costs realized by states when using CVISN technology. The data contained within the CVISN Benefits/Lessons Learned Template were largely qualitative in nature, and the data supplied by states were quite limited in scope. Thus, this report does not rely on the data presented in the Benefits/Lessons Learned Template (see Appendix F). Instead, it relies on three primary data sources for CVISN benefits information:

- Site Visit Data. Site-visit data were collected through the survey distributed to the States of Montana, New Jersey, New York and South Dakota (Appendix B.1) and the follow-on interviews conducted on-site in September 2006.

- Apogee Research's *Budgetary Implications of ITS / CVO for State Agencies,* completed for the National Governors Association in October 1997.[13]

- The *Evaluation of the CVISN Model Deployment Initiatives,* completed by USDOT in March 2002.[14]

Because the benefits analysis relies on published data, no attempt has been made to mask the identity of specific states. CVISN benefits estimates are presented in Tables 6-13 and 6-14. In both tables, estimates are presented in 2006 dollars and are state-specific. Benefits estimates were normalized on a per-account (Table 6-13) and per-transaction (Table 6-14) basis.

Table 6-13 presents CVISN benefits estimates on an annual, per-account basis for two states participating in the CVISN Model Deployment Initiative (Kentucky and Maryland). These estimates represent cost savings to states differentiated based on CVISN system type. The original cost values were as reported by the states between 1995 and 1999.

The first system examined in Table 6-13 was implemented in the State of Kentucky for IRP credentialing. Kentucky used an in-house IRP credentialing system, with total annual operating costs measuring $75.68 (after conversion into dollar values for the year 2006). At the time of the CVISN MDI, Kentucky had approximately 4,400 IRP accounts, and it was administering new, supplemental and renewal applications through its IRP system. The $75.68 estimate included those costs associated with labor (including fringe benefits), mailing and communication costs, and other operations and maintenance (O&M) costs associated with the electronic system.[15] Following deployment, these costs dropped approximately $49.77 per account, representing a savings to the state of $25.91 per account.

Pre-CVISN, Maryland used a third-party system called the Vehicle Information System for Tax Apportionment (VISTA) for its credentialing activities. Maryland reported 6,500 IRP accounts, with annual per-account costs of $167.23. Cost elements in Maryland were similar to those

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[13] Apogee Research, Inc. Budgetary Implications of ITS / CVO for State Agencies. Report prepared for the National Governors Association. October 1997.
[14] Evaluation of the CVISN MDI – Volume I: Final Report. Prepared for the U.S. Department of Transportation ITS Joint Program Office. (USDOT March 2002).
[15] Ibid.

reported in Kentucky, though much more of the costs were tied directly to payments made to the third-party system operator. Following full system deployment, IRP credentialing costs were expected to drop to $113.72, representing a $53.51 reduction per account.

The final administrative process considered in the CVISN MDI report was an end-to-end system for administering, processing, and issuing IFTA credentials. The baseline system costs presented in Table 6-13 ($201.01) represent the average costs reported in Kentucky and Maryland in the CVISN MDI final report. Cost elements considered for the IFTA process were similar to those reported previously for the IRP systems. Post-CVISN annual operating costs were reported at $121.01 per account, representing per-account savings to states of $79.83.

Table 6-13. Electronic Credentialing Benefits to States in the CVISN MDI (Per Account)

		Baseline per Account		Post-CVISN Recurring Cost (Per Account)			
State	Administrative Process	Annual Capital Cost	Annual Operating Costs	Annual Capital Costs	Annual Operating Costs	Total	Savings per Account
Kentucky	End-to-End IRP		$75.68	$1.79	$47.98	$49.77	$25.91
Maryland	IRP with VISTA		$167.23	$2.46	$111.27	$113.72	$53.51
Kentucky, Maryland	End-to-End IFTA		$201.01	$0.17	$121.01	$121.18	$79.83

Source: USDOT (2002, page 6-15, Table 6-3; values were converted from $1995-99 to $2006)

Apogee Research's *Budgetary Implications of ITS / CVO for State Agencies* considered potential cost savings associated with the deployment of CVISN for several credentialing processes:

- Oversize / overweight permits
- International Registration Plan (IRP)
- International Fuel Tax Administration (IFTA)
- Hazmat or Hazardous Material Permits
- Single State Registration Systems (SSRS).

Benefits estimates presented in the Apogee report are presented in Table 6-14. These estimated benefits were speculative, and largely based on an assessment of agency costs pre- and post-CVISN deployment. The post-CVISN cost estimate relied on data obtained from reviewed literature, interviews with transportation professionals, input from a Technical Advisory Group and the judgment of the study team.

Following CVISN deployment, New York and New Jersey reported $11.73 and $8.61 savings per transaction for IRP supplements and IRP renewals, respectively. These estimated cost savings were reported during the site visits, as detailed in Section 6.3. As reported here, cost savings are those tied to labor, material, and mailing costs avoided when sending out renewal notices and applications, processing applications, sending out invoices, processing payments, and mailing credentials to motor carriers.

Table 6-14. Electronic Credentialing Benefits to States (Per Account)

		Cost Savings (per Transaction)		
State	Administrative Process	Low	High	Mid-Point
California	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$26.0	$31.5	$28.74
Colorado	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$30.8	$48.1	$39.46
Connecticut	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$5.0	$6.2	$5.64
Delaware	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$5.4	$6.5	$5.93
Florida	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$8.7	$10.7	$9.68
Kentucky	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$7.6	$10	$8.83
Minnesota	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$10.7	$14.3	$12.51
New Jersey	Oversize/Overweight, IRP, IFTA, Hazmat, SSRS	$4.3	$5.8	$5.05
New York	IRP Supplements			$11.73
New Jersey	IRP Renewals			$8.61

Source: Apogee (1997)

7.0 SAFETY ANALYSIS

7.1 Introduction

The purpose of the CVISN National Evaluation safety analysis was to measure the effects of CVISN technologies on the safety of trucks and the general traveling public, through improved roadside enforcement and administrative processes. Further details on the approach, methods, and results of the safety analysis are presented in Appendix C.

Summary of Safety Analysis Results

The analysis assumed national deployment of various "scenarios" or suites of CVISN roadside safety information exchange and electronic screening technologies, integrated with centralized state and national safety databases to aid inspectors in focusing on the highest-risk vehicles, carriers, and drivers. Each CVISN scenario that was modeled indicated that many more large truck-related crashes, injuries, and fatalities could be avoided through the widespread deployment of CVISN technologies.

When compared with current inspection selection methods, which tend to rely solely on the professional experience and judgment of roadside inspectors and officers, CVISN technologies are estimated to prevent between 1,399 and 17,907 additional crashes per year across the nation. This represents the saving of between 6 and 215 lives (i.e., avoided fatalities from crashes) per year, and the avoidance of between 142 and 4,638 truck-related injuries per year.

In the best-case scenario, when compared to a baseline value of 3,139 crashes avoided using current methods, 21,046 crashes could be avoided if the top 5% of vehicles in terms of driver OOS violations were to be inspected in conjunction with infrared screening for potentially hazardous brake conditions. This implies that about 4.8% of the nation's 441,000 annual truck-related crashes could be avoided under this best-case CVISN safety analysis scenario.

Objectives and hypotheses for the safety analysis were as follows:

Objective 1.1 - Evaluate current and potential future inspection selection methods used (e.g., Inspection Selection System, or ISS, and Query Central)

> **Hypothesis:** Inspectors use national and state data at the roadside in different ways to help make inspection selection decisions
>
> **Hypothesis:** Various national and state data sources can be effectively integrated (consistent with the National ITS Architecture) for efficient use by roadside inspectors

Hypothesis: If inspectors could have access to real-time, updated safety information based on accurate vehicle or carrier identity, then inspectors would use that information to help make inspection selection decisions

Hypothesis: Inspectors' use of visual cues and intuition to select trucks for inspection will decline as the ready availability of more accurate, convenient, historical data increases at the roadside check station

Objective 1.2 - Determine effectiveness of CVISN at increasing the efficiency of inspections (i.e., focusing on high-risk or noncompliant carriers, vehicles, and drivers)

Hypothesis: The availability of real-time safety information at the roadside, combined with other available or developmental roadside measures (e.g., in-vehicle transponders for automatic vehicle identification, or AVI, license plate readers, weigh-in-motion (WIM) scales, remote video imagery), will help inspectors more effectively target higher-risk carriers, vehicles, and drivers

Hypothesis: The availability of real-time credentials and licensing information at the roadside will help inspectors more effectively target noncompliant carriers, vehicles, and drivers

Objective 1.3 - Determine reductions in crashes, injuries, and fatalities nationwide under various deployment scenarios

Hypothesis: If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided directly, through increased inspection efficiency

Hypothesis: If CVISN infrastructure and technologies were deployed in all states, then truck-involved crashes, injuries, and fatalities would be avoided indirectly, through increased motor carrier compliance with safety and licensing regulations

7.2 Approach to Safety Analysis

Data to address the evaluation objectives and hypotheses were collected from states through three methods: (1) Examination of existing data sources such as the CVISN self-evaluation database and the CVISN state deployment matrix; (2) Phone interviews with various state CVISN officials; and (3) Field studies conducted at inspection sites located in Colorado, New York, Ohio, and Kentucky.

First, state-supplied information contained in the CVISN state deployment matrix, maintained by Johns Hopkins University Applied Physics Laboratory (JHU/APL), and the CVISN self-evaluation database was compiled to characterize how states utilize specific types of CVISN screening and safety data exchange technologies at their inspection sites to help them make inspection selection decisions. Additional input was also solicited directly from states by the evaluation team. Finally, all CVISN states were invited to participate in this research by nominating themselves for inclusion in the evaluation.

States that responded and that looked the most promising were selected to participate in a phone interview with the evaluation team, during which a more in-depth investigation of each state's current approach to the roadside screening and inspection process was conducted. Results from the phone interviews were also used to identify those states that were the most able to contribute to the evaluation and that were interested in participating in the field studies. States that offered different perspectives on safety by having a variety of sites and techniques, or states whose roadside operations represented the operations of a large number of similar states, were considered ideal candidates for the field studies. Other factors in the selection of sites included geographic diversity (each state from the other, and compared with the states that were central to the CVISN MDI evaluation), and the variety of CVISN deployment approaches in each state. CVISN officials at the departments of transportation and law enforcement agencies from each state interviewed were very cooperative in the evaluation.

One reason for Ohio's inclusion was their relatively high level of commercial vehicle inspection activity as reported in the CVISN self-evaluations. Colorado has an active program of truck crash analysis and collects an abundance of truck data at inspection stations, allowing for a convenient way to identify high-risk carriers and trucks. Furthermore, the roadside operations of Ohio and Colorado represent the operations of a large number of similar states. New York expressed interest in linking carrier information to specific vehicles. New York performs all commercial vehicle inspections at temporary or mobile sites, having no permanent weigh/inspection facilities. This unique facet makes New York an attractive choice as it provided a different perspective on mobile inspection methods and safety enforcement. Kentucky was chosen because it was already the site of a separate, safety-related field observation study for FMCSA.[16] Figures 7-1 through 7-8 illustrate the locations and configurations of the four field observation sites. The site layout shown in Figure 7-3 (New York) is an example of one of the three field observation sites where data were collected in that state.

[16] Data from Kentucky were developed under a separate but related USDOT task order, BA34018, on the same contract as the National Evaluation, DTFH61-02-C-00134 (FMCSA 2008a,b).

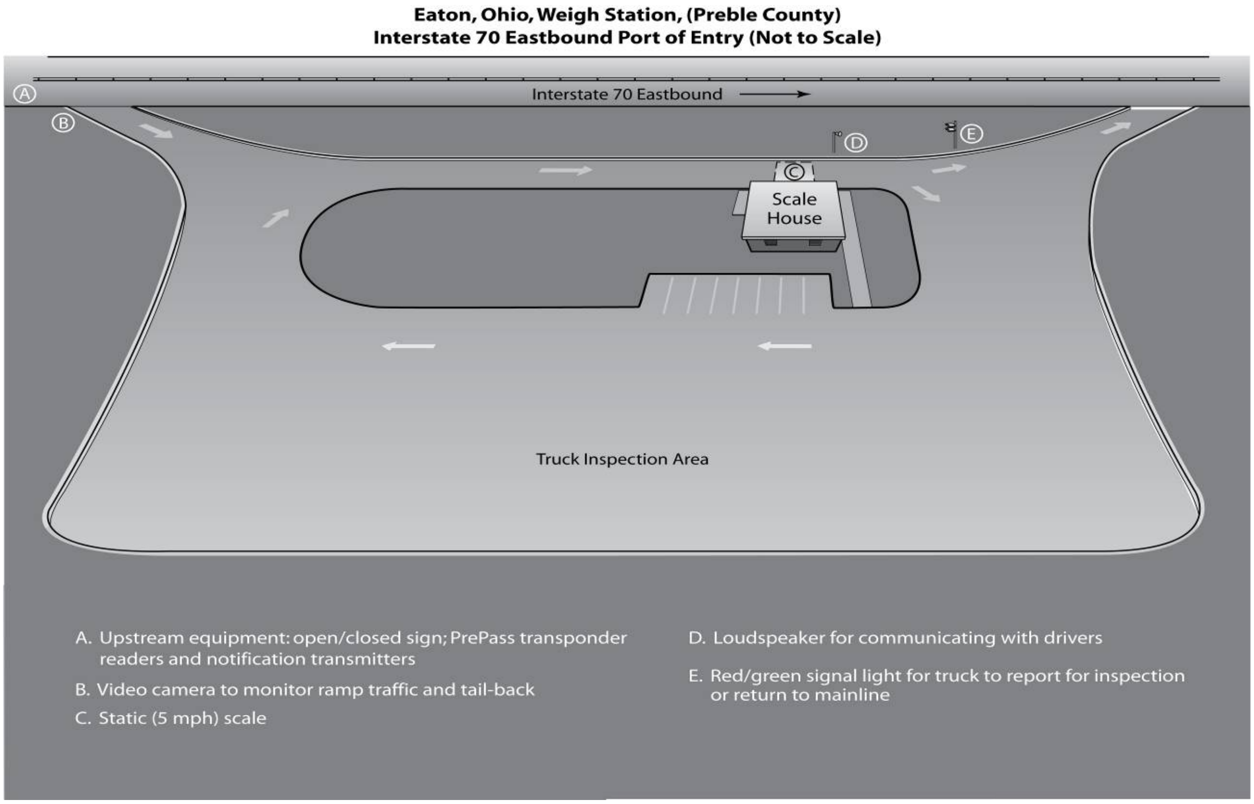

Figure 7-1. Layout of Weigh-Inspection Station and Traffic Patterns at Eaton, Ohio. Illustration is not to scale.

Figure 7-2. Preble County Scale House, Eaton, Ohio

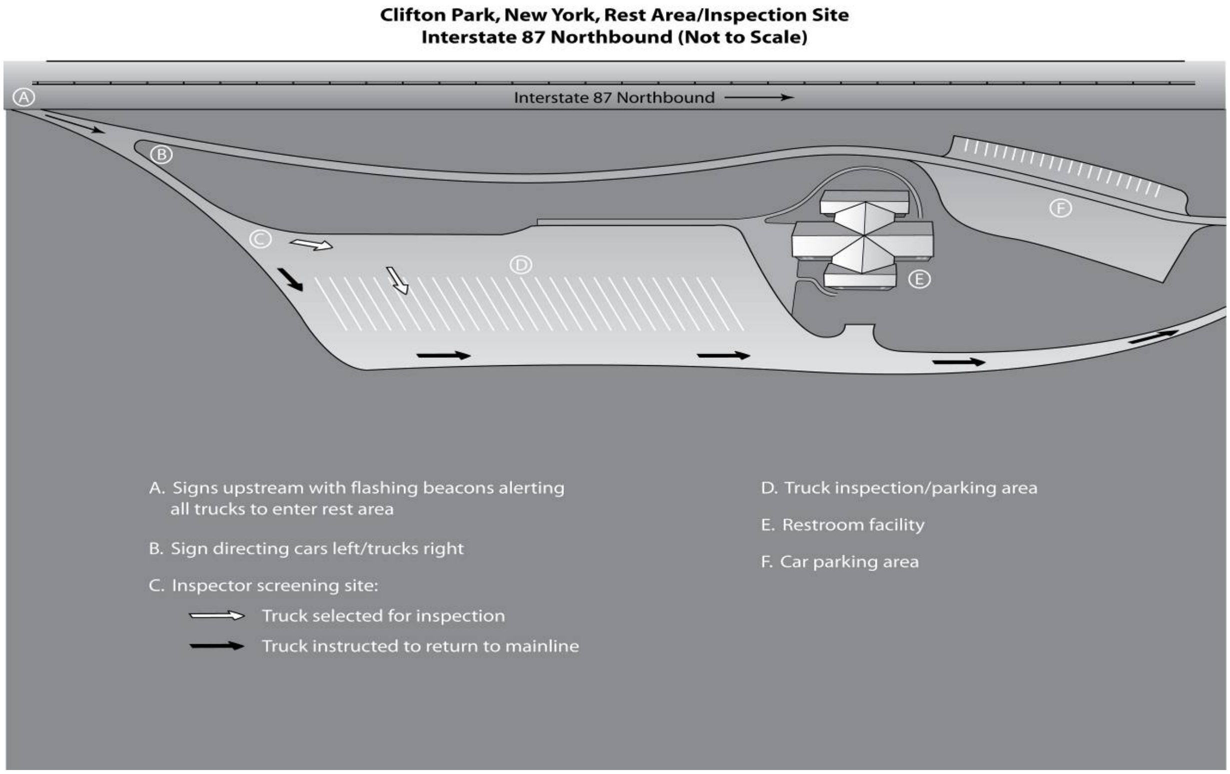

Figure 7-3. Layout of Rest Area-Inspection Site and Traffic Patterns at Clifton Park, New York. Illustration is not to scale.

Figure 7-4. Portable Truck Scales in Use at the Schodack Rest Area on Westbound I-90 in New York

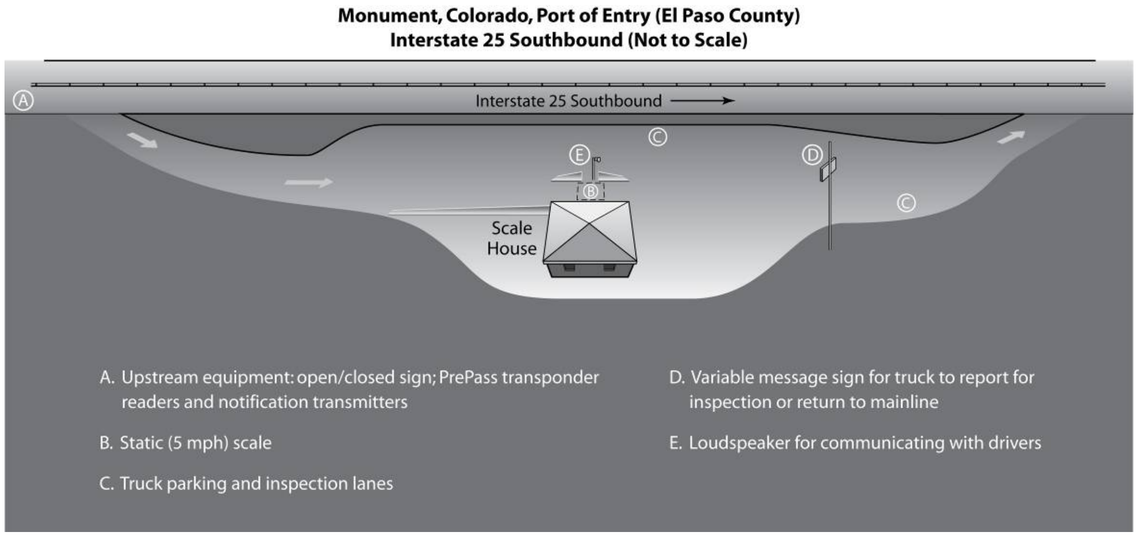

Figure 7-5. Layout of Weigh-Inspection Site and Traffic Patterns at Monument, Colorado. Illustration is not to scale.

Figure 7-6. Northbound Monument, Colorado Port of Entry Building on I-25

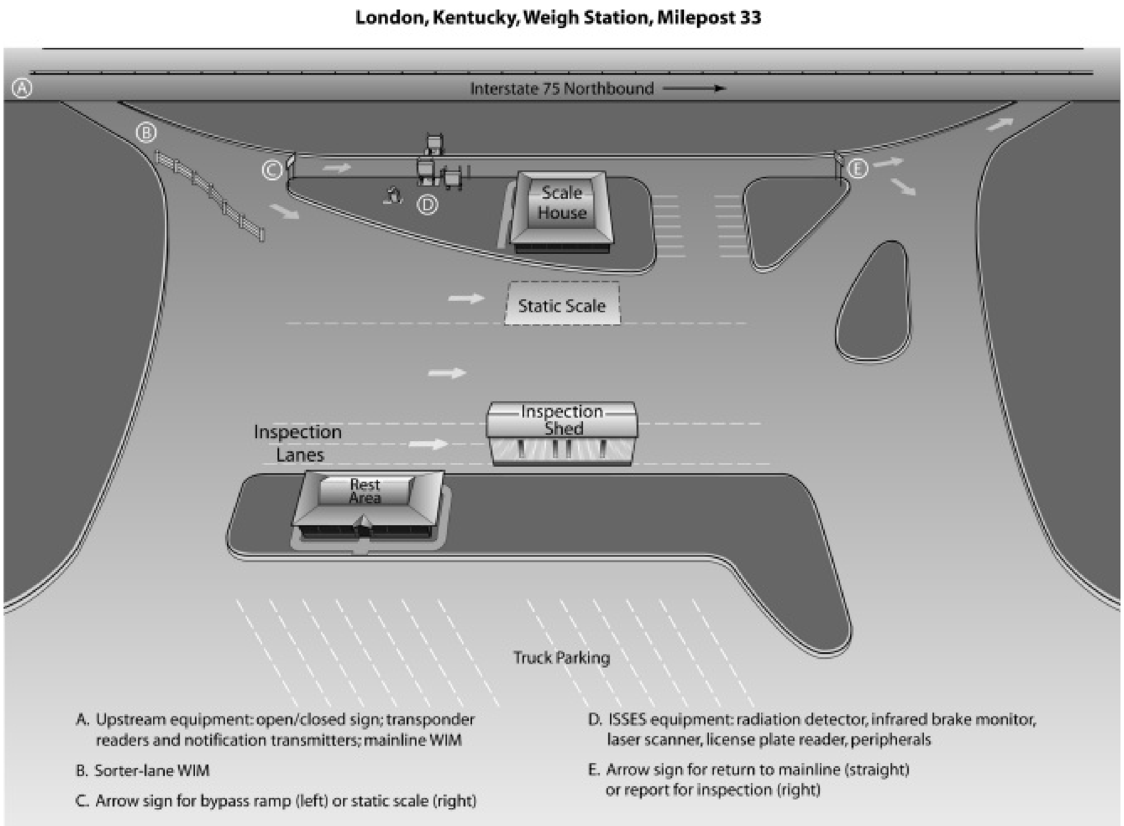

Figure 7-7. Layout of Weigh-Inspection Station and Traffic Patterns at London, Kentucky (Laurel County). Illustration is not to scale.

Figure 7-8. Laurel County, Kentucky, ISSES deployment.

Other data sources used in this evaluation included various federal and state safety data sources as well as past federal studies that relate to commercial motor vehicle crashes and safety. Listed below are the main data used in achieving the goals of the evaluation.

- CVISN self-evaluation database and state CVISN deployment matrix.
- Interviews with state CVISN program managers, specialists, and roadside inspectors.
- Interviews with CVISN experts and stakeholders (Volpe National Transportation Systems Center, Johns Hopkins University Applied Physics Laboratory, Upper Great Plains Transportation Institute, Heavy Vehicle Electronic License Plate (HELP) PrePass, North American Preclearance and Safety System (Norpass).
- USDOT numbers for all trucks that traversed an inspection station during separate field studies conducted in Colorado, New York, Ohio, and Kentucky (during normal daytime hours).
- Norpass (electronic screening/pre-clearance) bypass decisions per truck for one week during Kentucky field study.
- Electronic copies of inspections performed during field studies.
- Electronic copies of statewide inspections spanning 1 to 3 years (depending on state availability).
- Copies of the Safety and Fitness Electronic Records System (SAFER) Carrier and Inspection Tables at time of each field study.
- Large Truck Crash Causation Study (LTCCS, USDOT 2006g).
- 2003 National Truck Fleet Safety Survey (USDOT 2006f).
- Large Truck Crash Facts – 2005 (USDOT 2007b).

The goal of roadside enforcement is to avoid as many crashes as possible by putting unsafe vehicles out of service (OOS) before conditions on the vehicle contribute to a crash. A means to this end is to improve the inspection selection process in such a way that the greatest benefit can result from a fixed number of inspections. This makes the most efficient use of limited time, human resources, and facilities. The overall approach of this evaluation is to first assess the effectiveness of the current inspection selection methods at selecting high-risk trucks.

In addition, alternative methods for selecting vehicles for inspection were evaluated based on potential availability of information from the above data sources. First, the most basic selection process of selecting vehicles randomly for inspection is addressed. This is presented mainly to assess the contribution of the inspectors' knowledge and experience when examining the current vehicle selection process used in the four states. Other scenarios make use of progressively more involved selection criteria. One involves using ES to eliminate all low- and medium-risk carriers from selection consideration so that inspectors can focus on high-risk trucks or those with insufficient safety information in federal databases. There are multiple metrics to use when assigning commercial vehicles to safety risk categories. Two that were explored were the carrier's ISS score, a rating system promoted by USDOT, and the carrier's vehicle and driver OOS rates, metrics preferred for example by Kentucky in roadside enforcement. Additional scenarios examined other novel approaches that can be defined using other types of data that could be made available at the roadside. In particular, the scenarios use information on OOS violations with a high relative crash risk.

Finally, the evaluation measured the success of these new inspection selection methods by simulating what would happen if inspectors used this additional information to select various segments of the highest-risk trucks for inspection. The measures used to evaluate success were the estimated number of crashes, injuries, and fatalities avoided.

7.3 Safety Analysis Results

Results are organized into three major areas corresponding to the three objectives of the evaluation.

- First, to help evaluate how current inspection selection methods at the roadside are used by inspectors and other law enforcement personnel, the degree to which roadside enforcement personnel utilize national and state data at the roadside and the different ways it is used to help make inspection selection decisions is presented at a high level from a national perspective, followed by more specific information for the ten interviewed states (Objective 1.1).

- Secondly, a summary of the effectiveness of current CVISN deployments—in Ohio, Colorado, Kentucky, and New York—at increasing the efficiency of inspections in terms of focusing on high-risk vehicles is presented (Objective 1.2).

- Finally, safety benefits, in terms of the number of crashes, injuries, and fatalities prevented under various hypothetical roadside deployment scenarios, are estimated (Objective 1.3).

7.3.1 State CVISN Deployments - Overall

Since the time of the MDI Evaluation (USDOT 2002), many more states have adopted CVISN roadside screening and enforcement technologies. As of May 2008 there were 20 Expanded CVISN states that had completed Core (formerly known as Level 1) Deployment.[17] An additional 25 states were in the Core Deployment Phase, while the remaining 5 states along with the District of Columbia were in the Core Planning and Design Phase. Some states are well-established in their CVISN programs and are expanding by deploying some state-of-the-art technologies in SIE, ES, and EC. Other states are earlier in their CVISN development and are working hard to integrate CVISN technologies into their roadside practices.

SIE is the exchange of carrier, vehicle, and driver data to and from the roadside for use in support of enforcement and inspection decisions, such as deciding which vehicle to inspect, or

[17] To achieve Core Deployment, a state must meet certain minimum requirements set forth by FMCSA in the three main areas of CVISN: SIE, credentials administration, and electronic screening. These states are now focusing on implementing more advanced CVISN technologies. States that have met some but not all of the requirements are said to be in the Core Deployment Phase. Those states that are still in the early planning stages are said to be in the Core Planning and Design Phase. Table 4-1 above lists the states in each CVISN phase as well as a checklist showing some of the capabilities each state has demonstrated.

learning what a given carrier's past history of OOS orders has been. The use of motor carrier and vehicle-specific safety performance data by state agencies conducting roadside inspections has grown significantly in recent years. As of August 2006, 49 of the 50 states (98%) plus the District of Columbia were using Aspen or an equivalent system at inspection sites to record inspections. This is up from 84% of states in December of 1999 as reported in the CVISN MDI final report (USDOT 2002). Also, 48 of the 50 states submit interstate and intrastate reports to SAFER through SafetyNet. Because of Aspen's ability to pull data from other sources such as ISS, Past Inspection Query (PIQ), and Query Central, inspectors have more data (both historical as well as real-time) at their disposal when performing inspections. Further, Aspen's connectivity to SAFER and/or SafetyNet allows for a quicker exchange of inspection data. In addition, 23 states have implemented a Commercial Vehicle Information Exchange Window (CVIEW) or equivalent system as of May 2008 for exchanging interstate and intrastate data within the state and established a connection with SAFER to exchange interstate data through snapshots. An additional 15 states expect to have this functionality deployed by the end of 2008.

ES—or the ability to detect, identify, and weigh commercial motor vehicles at mainline or ramp speeds—is the system that can give certain transponder-equipped, enrolled vehicles a green light in the cab to bypass static weigh and inspection stations, if electronic records and vehicle weights for that carrier are in order. Most of the growth in ES has occurred due to the emergence of three programs or partnerships: HELP/PrePass, Norpass, and Oregon's Green Light. Currently 72% of the states are participating in such ES programs. This is up from about 50% in 2002. Ten of these participating states use snapshots updated by a SAFER/CVIEW description in an automated process to support screening decisions. Total truck enrollment in the three programs has grown by 181% since 2001. Enrollment as of November 2007 stands at about 562,000 trucks, which is a small fraction of the 8 million trucks in the U.S.

States have made significant progress in the past few years in the automated processing of credentials, mainly focusing on the International Registration Plan (IRP) and the International Fuel Tax Agreement (IFTA). As of May 2008, 28 states support EC for IRP and IFTA, with an additional 4 states supporting just IRP entries. All these states support the electronic submission of applications, evaluation processing, and application response. In addition, all but a few of these IRP and IFTA supporting states proactively provide updates to vehicle snapshots as needed when IRP and IFTA credentials actions are taken. The IRP and IFTA clearinghouses were developed to facilitate distribution of registration funds and tax revenues among states and provinces have also seen an increase in state participation in recent years. As of August 2006, 39 states were providing IRP credential application information to the IRP clearinghouse and supporting electronic state-to-state fee payments via the clearinghouse. For IFTA, 35 states were providing the IFTA clearinghouse with IFTA credential application information using electronic data interface standards.

7.3.2 State CVISN Deployments – Interviewed States

Among the 10 states interviewed for this evaluation, there was a wide variation in CVISN capabilities. Based on information collected from these interviews with state CVISN representatives and other sources such as the CVISN self-evaluation database and FMCSA support organizations, three settings depicting CVISN capabilities and development are presented.

1. **Setting A** – State has achieved CVISN Core Deployment and is more advanced in its vehicle screening and SIE processes. Characteristics associated with these states include:

    - State relies heavily on safety and credential related information to make inspection decisions
    - State regularly uses federal data sources and tools such as SAFER, Query Central, and Licensing and Insurance (L&I)
    - State is involved in developing or implementing new technologies to improve the data available to make inspection decisions and the manner in which data is collected.

2. **Setting B** – State has achieved CVISN Core Deployment or is very close to doing so – its operations are not as advanced as Setting A. Characteristics associated with these states include:

    - State relies on using safety and credential related information to make inspection decisions
    - State uses federal data sources and tools such as SAFER, Query Central, and L&I
    - State is active in the CVISN planning and deployment process
    - State is proactively looking for new ways to improve the exchange of safety information in their state.

3. **Setting C** – State is currently using few CVISN technologies or is in the early stages of developing them. Characteristics associated with these states include:

    - State relies on using inspector judgment and experience to make most inspection decisions
    - State infrequently uses federal data sources and tools such as SAFER, Query Central, and L&I
    - State is active in the CVISN planning process
    - State is looking for new ways to improve the exchange of safety information in their state by working toward Core CVISN Deployment.

States in Setting A demonstrate that various national and state data sources can be effectively integrated for efficient use by roadside inspectors. Inspectors in these states are more inclined to utilize real-time, updated safety information as their main source of information to help make inspection selection decisions while still relying somewhat on visual cues and intuition. States in setting B and C, however, rely more on inspector judgment and intuition as CVISN technologies are not used to the same degree (Setting B) or CVISN infrastructure is not yet fully in place to support its use (Setting C).

Based on the results of the 10 state interviews, Table 7-1 shows the states that best matched up with each setting. The states listed in Table 7-1 are representative of many more CVISN participating states.

Table 7-1. States Assigned to CVISN Capability Settings

Setting A – Advanced States	Setting B – Deploying States	Setting C – Planning States
Colorado Kentucky Tennessee Washington	Florida New York Ohio Utah	Oklahoma Texas

7.3.3 Inspection Efficiency

The carriers' ISS scores were used to assess their safety risk. ISS is a decision aid recommended by USDOT and used by some states for commercial vehicle roadside driver/vehicle safety inspections, which guides safety inspectors in selecting vehicles for inspection. The system provides FMCSA with the capability to continuously quantify and track the safety status of motor carriers, especially unsafe carriers. This allows FMCSA enforcement and education programs to effectively allocate resources to carriers that pose a high risk of involvement in crashes. The ISS provides a three-tiered recommendation as shown in Table 7-2.

Table 7-2. ISS Values and Recommendations

Recommendation	ISS Inspection Value	Risk Category
Inspect (inspection warranted)	75–100	High
Optional (may be worth a look)	50–74	Medium
Pass (inspection not warranted)	1–49	Low

The USDOT numbers for all trucks observed at each inspection site involved in the field studies were compared with a copy of the SAFER database obtained at the time of each field study to obtain the ISS score for each carrier that could be identified. Trucks were then placed into risk categories based on the values shown in Table 7-2. Carriers were placed into an "insufficient data" risk category if there was not enough information to generate an ISS score. Carriers with USDOT numbers that could not be found in SAFER were labeled as unknown. In addition, the distribution of risk categories was calculated for all inspections that were performed in each state during the last 1 to 3 years, depending on the availability of state inspection reports.

Inspection efficiency is defined as the ability of inspectors to target high-risk trucks for inspection. In this evaluation, inspection efficiency is measured as the percent increase in high-risk trucks selected for inspection under current inspection selection methods compared to a technique where trucks are selected randomly for inspection. Inspection efficiency is also measured as the percent increase in OOS orders resulting from the higher percentage of high-risk trucks inspected. Table 7-3 summarizes the inspection efficiency for the four field study inspection stations in terms of the probability of selecting high-risk trucks. For the inspected and truck traffic vehicles, the probability of a truck being high-risk is shown. The probability of a truck being in the high-risk category is calculated as the number of high-risk trucks divided by the total number of trucks.

For example, about 35% of the truck traffic at the Preble County site in Ohio was considered high-risk while 50% of the vehicles inspected at the Preble County station were high-risk. The ratio of the proportion of high-risk vehicles inspected to the proportion in the truck traffic population is 1.42 (49.56% divided by 34.93%). This ratio is statistically significantly greater than 1 (the value expected if there was no difference between random inspections and current practices). Thus, current inspection practices in Ohio such as inspector judgment, visual observation of vehicles, and use of PrePass for transpondered vehicles yields about 42% more high-risk trucks than if inspectors would simply choose trucks randomly. The ratios for Colorado and Kentucky are also statistically significantly greater than 1. Current inspection practices in Colorado and Kentucky yield 50 and 16% more high-risk trucks than random selection would, respectively. Inspection practices in New York did not result in a significant increase in high-risk trucks. Of all four states, New York's inspection practices were the closest to a random selection with no ES, WIMs, or static scales to screen vehicles.

Table 7-3. Inspection Efficiency at Field Study Inspection Stations

Vehicle Data	Percent of High-Risk Carriers			
	Colorado	**Kentucky**	**New York**	**Ohio**
Inspected[1]	40.95%	33.94%	18.72%	49.56%
Truck Traffic[2]	27.35%	29.32%	17.62%	34.93%
Inspected vs. Truck Traffic	1.50[3]	1.16[3]	1.06	1.42[3]

(1) Inspection figures based on inspections performed at the field study inspection site(s) during previous 1 to 3 years (depending on state).
(2) Truck traffic numbers based on trucks observed during the state's field study.
(3) Ratio is statistically significantly greater than 1 with 95% confidence

Table 7-4 presents the number of OOS orders that would be expected under each of the following three scenarios: (1) trucks are selected randomly for inspection; (2) trucks are selected based on current inspection practices; and (3) trucks are selected using fully deployed ES technologies. Under this last scenario, all commercial vehicles classified as low- and medium-risk are assumed to enroll in an ES program, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors then use current practices to select vehicles for inspection from the remaining trucks in the high-risk and insufficient data categories. The expected number of OOS orders per 100 inspections under each of these scenarios was calculated by multiplying the proportion of trucks in each risk category by the OOS rate for that category and then summing the OOS orders across all risk categories.

Table 7-4. Inspection Efficiency Summary Results (In Terms of Increased OOS Orders) at Field Study Inspection Stations

State	No. OOS Orders per 100 Inspections			% Increase in OOS Orders per 100 Inspections		
	Random Selection	**Inspected**	**Full ES**	**Inspected vs. Random Selection**	**Full ES vs. Random Selection**	**Full ES vs. Current Inspection Practices**
Colorado	25.59	25.86	35.84	1.1%	40.1%	38.6%
Kentucky	13.00	12.55	18.81	- 3.5%	44.7%	49.9%
New York	22.02	23.36	31.29	6.1%	42.1%	33.9%
Ohio	26.73	28.55	35.55	6.8%	33.0%	24.5%

For example, Colorado would expect about 26 OOS orders per 100 inspections when trucks are selected randomly and also when their current inspection practices are used. The number of OOS orders would increase to about 36 per 100 inspections if full ES were employed. The number of OOS orders expected under each of the three scenarios is significantly lower for Kentucky compared to the other states. This is a result of Kentucky's actual OOS rate being significantly lower than the OOS rates in the other three states (as well as the national average). The other three states show more consistent results, with Ohio having a slightly larger number of OOS orders than Colorado or New York. The last three columns of Table 7-4 show the percent increase in OOS orders per 100 inspections when comparing scenarios. For instance, the percent increase in OOS orders when full ES is used as opposed to current inspection practices ranges from about 25% (Ohio) to almost 50% (Kentucky). Kentucky's higher increase again is due to their lower than normal actual OOS rate based on their current inspection practices.

Overall, the results presented in Tables 7-3 and 7-4 demonstrate that the availability of real-time safety information at the roadside would help inspectors more effectively target higher-risk carriers, vehicles, and drivers, yielding more OOS orders.

7.3.4 Safety Benefits

In 2005[18], 5,212 people were killed and approximately 114,000 were injured in crashes involving approximately 441,000 large commercial motor vehicles (CMVs). Ultimately, safety benefits will be realized only to the extent that targeted inspections and improved compliance translate into reductions in numbers of crashes. The premise of targeted inspections is that, for the same number of inspections performed, additional drivers and vehicles operating with OOS conditions will be removed from the roadway. Furthermore, all of the conditions leading to the OOS order will be fixed and "stay fixed" for a period of time after the inspection. Therefore, crashes that would have occurred during this period are prevented because the OOS conditions that would have caused the crashes were eliminated. The safety benefit of CVISN technologies is determined by using a probability model to compare the number of crashes avoided under a baseline scenario (i.e., with pre-CVISN roadside enforcement, or RE, strategies and technology) with the number of crashes avoided under a number of deployment scenarios involving CVISN. It is assumed under each scenario that the corresponding numbers of injuries and fatalities avoided are proportional to the number of crashes avoided.

Table 7-5 provides a high-level summary of the seven scenarios examined. A more thorough description of each scenario follows the table.

[18] Although more current crash statistics are available, the safety benefits analysis is performed using a baseline year of 2005 because that was the last year for which complete data were available from all of the relevant sources.

Table 7-5. High-Level Overview of Roadside Enforcement Scenarios

Scenario Number	Screening Criteria Used in Scenario						
	Random Only	Inspector Experience and Judgment	Electronic Screening with Snapshots	Vehicle and Driver OOS Rates Using Threshold	Brake and Driver OOS Rates	Infrared Images and Driver OOS Rate	ISS Score
RE-0	X						
RE-1		X					
RE-2		X	X				
RE-3		X	X	X			
RE-4		X	X		X		
RE-5		X	X			X	
RE-6		X	X				X

RE-0: Random Selection. Enforcement officers (inspectors) select commercial vehicles for inspection in a random manner without using personal experience, judgment, or any CVISN technologies. This is not one of the roadside enforcement strategies being considered, nor is it a realistic strategy to employ. However, the calculation of safety benefits under this scenario is useful for determining the contribution of current practices, which depend on inspectors' knowledge and experience, during the vehicle selection process.

RE-1: Baseline—Pre-CVISN. Inspectors select commercial vehicles for inspection using personal experience and judgment, but without the aid of most CVISN technologies. ES is assumed to be used at its current level as of June 2007.

RE-2: Mainline Electronic Screening based on ISS Score. State deploys ES with safety snapshots at all major inspection sites. All motor carriers that are classified as low- or medium-risk based on ISS scores (comprising approximately 60% of trucks on the road) enroll in the ES program, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors use current practices to select vehicles for inspections from the remaining 40% of trucks in the high-risk and insufficient data categories. A supplemental analysis was conducted as an offshoot of Scenario RE-2. In this supplemental study, various index or threshold values of the ISS score were applied, to select different segments of the truck population. Results are presented in Appendix C.9.

RE-3: Electronic Screening based on high vehicle and driver OOS rates. State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from SAFER. In this scenario, each truck is screened based on the vehicle and driver OOS rate of the carrier. A threshold OOS rate is established for both vehicles and drivers such that all trucks with OOS rates exceeding the corresponding thresholds will be brought into the inspection station for inspection while all others will be allowed to bypass inspection sites. The threshold rates are chosen such that only trucks with the highest OOS rates are candidates for inspection. The threshold values can vary depending on both the truck traffic and the rate at which inspections can be performed at the site. As part of RE-3, three specific threshold values are considered.

RE-4: Electronic screening based on high driver OOS and brake violation rates. State utilizes ES at all major inspection sites. Each truck is screened based on its OOS or violation rate for violations that have a high relative risk for crash. In this scenario, vehicles are screened based on their brake violation and overall driver OOS rates as they appear in SAFER. A distinction is made here between violation and OOS rates. SAFER contains a *violation* rate for brakes but not a brake *OOS* rate. Thus, violation rates are used as a safety index for brake issues, while the driver OOS rate is used to screen for driver issues. Using data from the Large Truck Crash Causation Study and historical state inspection records, both brakes and driver OOS violations have been found to have a high relative risk for crashes. This scenario differs from RE-3 in that vehicles are screened on their brake violation rate as opposed to their overall vehicle violation rate in an attempt to identify those vehicles that have a violation that has a higher relative risk for crash. Similar to RE-3, all trucks with violation rates exceeding the threshold will be candidates for inspection, while all others will be allowed to bypass inspection sites. Moreover, the threshold rates are chosen such that only trucks with the highest rates are selected for inspection and the thresholds can vary depending on the amount of inspection personnel available at a given station. As part of RE-4, three specific threshold values are considered.

RE-5: Electronic screening based on infrared screening and high driver OOS violation rate. State utilizes some form of infrared screening (such as the IRISystem) at all major inspection sites. Each truck is screened via two criteria: the thermal (IR) images and the driver OOS rate of the particular carrier. In this scenario, vehicles are screened based on the presence of a brake violation as detected through the infrared image produced by the infrared system and the driver OOS rate as it appears in SAFER. This scenario is similar to RE-4 in that both brakes and driver OOS violations are used as screening criteria. RE-5 differs from RE-4 in that vehicles are screened for brake violations via infrared imaging as opposed to brake violation rates obtained from SAFER. All trucks with a potential brake violation as detected from the infrared image or trucks with driver OOS rates exceeding various thresholds will be candidates for inspection, while all others will be allowed to bypass inspection sites.

RE-6: Electronic Screening based on high ISS scores. State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from SAFER. Similar to Scenario RE-2, in Scenario RE-6 each truck is screened based on the ISS score of the carrier. However, in RE-6, higher threshold ISS scores are established for both vehicle and driver OOS violations such that all trucks with ISS scores exceeding the corresponding thresholds will be brought into the inspection station for inspection while all others will be allowed to bypass inspection sites. The threshold rates are chosen such that only trucks with the highest ISS scores are candidates for inspection. The threshold values can vary depending on both the truck traffic and the rate at which inspections can be performed at the site. As part of RE-6, three specific threshold values are considered.

RE-0 is the most basic selection process of selecting vehicles randomly and is presented mainly to assess the contribution of the inspectors' knowledge and experience during the vehicle selection process, which is represented in the baseline scenario RE-1. The remaining five scenarios all make use of progressively more involved selection criteria. ES is employed in RE-2 to eliminate all low- and medium-risk carriers from selection consideration. Although this scenario helps improve inspection selection efficiency by allowing inspectors to focus only on high-risk vehicles or those with insufficient data, there are still too many vehicles remaining in these categories for roadside enforcement officials to inspect them all. As a result, scenarios RE-3 through RE-6 provide various methods to further narrow down the number of vehicles that inspectors have to choose from. RE-3 and RE-4 select only those vehicles with the highest probability of having particular kinds of OOS violations as measured by some safety index. RE-5 examines the benefits when infrared imaging is used to screen for brake violations. RE-6 is an offshoot of RE-2, in that it utilizes the carrier's ISS score as a safety index in selecting trucks for inspection.

Table 7-6 summarizes the major results of this safety benefits analysis. The target population is the nationwide population of CMVs, assuming instantaneous deployment of CVISN technologies in the entire U.S., depending on the scenario. Benefits are expressed in numbers of events per year. Further discussion of the Scenario RE-6 supplemental analysis, involving the use of three index values applied to the ISS score, is presented in Appendix C.9.

Figure 7-9 presents the safety benefits related to the number of crashes avoided under each scenario. The numbers in the figure correspond to the number of crashes avoided presented in the third column of Table 7-6.

According to the model, current roadside enforcement strategies (RE-1) are responsible for avoiding 3,139 truck-related crashes, which represents about 0.7% of the 441,000 truck-related crashes nationwide that occur annually, based on 2005 crash statistics. Furthermore, it is estimated that current roadside enforcement activities are responsible for preventing 813 injuries and 38 deaths.

For reference, the number of crashes, injuries, and fatalities that would be avoided if vehicles were randomly selected for inspection (RE-0) were also calculated and shown in Table 7-6. The differences between these numbers and the baseline numbers can be used to estimate the benefits of current inspection selection strategies, which include the training, knowledge, and experience that the inspectors bring to the job. Specifically, the number of crashes, injuries, and fatalities that would be avoided if vehicles were selected based on current roadside enforcement strategies is 29% higher (3,139 versus 2,426) than the number that would be avoided under random selection of vehicles.

The safety benefits of CVISN are obtained by subtracting the numbers of crashes, injuries, and fatalities avoided under the baseline scenario from the corresponding numbers under scenarios RE-2 to RE-6. As shown in RE-2, if ES based on the ISS score were used to select vehicles for inspection such that all medium- and low-risk carriers are allowed to bypass the inspection site, an additional 1,004 crashes, 260 injuries, and 12 fatalities could be avoided.

Table 7-6. Estimated National Annual Safety Benefits of CVISN under Selected Deployment Scenarios and Assumptions

Scenario	Description		Numbers of Annual Safety Events Avoided[1]			Additional[2] Annual Safety Events Avoided (CVISN Benefit)		
			Crashes	Injuries	Fatalities	Crashes	Injuries	Fatalities
RE-0	Random Selection		2,426	628	29			
RE-1	Baseline – Pre CVISN		3,139	813	38			
RE-2	Mainline Electronic Screening Based on ISS Score		4,143	1,073	50	1,004	260	12
RE-3	Electronic Screening based on high vehicle and driver OOS rates[3]	5%	7,795	2,019	94	4,656	1,206	56
		10%	5,637	1,460	68	2,498	647	30
		25%	3,686	955	44	547	142	6
RE-4	Electronic screening based on high driver OOS and brake violation rates[3]	5%	15,530	4,022	186	12,391	3,209	148
		10%	11,550	2,991	139	8,411	2,178	101
		25%	7,626	1,975	92	4,487	1,162	54
RE-5	Electronic screening based on infrared screening and high driver OOS violation rate[3]	5%	21,046	5,451	253	17,907	4,638	215
		10%	18,025	4,668	216	14,886	3,855	178
		25%	15,366	3,980	184	12,227	3,167	146
RE-6	Electronic Screening based on high ISS score	5%	5,599	1,450	67	2,460	637	29
		10%	5,355	1,387	64	2,216	574	26
		25%	4,538	1,175	54	1,399	362	16

[1] The estimated number of crashes avoided is based on the assumption that crashes are avoided when vehicles and drivers with safety violations are placed OOS. For reference, in 2005, there were 441,000 truck-related crashes nationwide resulting in 114,000 injuries and 5,212 deaths (USDOT 2007b).

[2] Compared to baseline scenario (RE-1).

[3] Safety Benefits shown for strategies RE-3, RE-4, RE-5, and RE-6 are dependent on the percentage of the truck population selected for inspection (top 5%, 10%, or 25% in terms of risk).

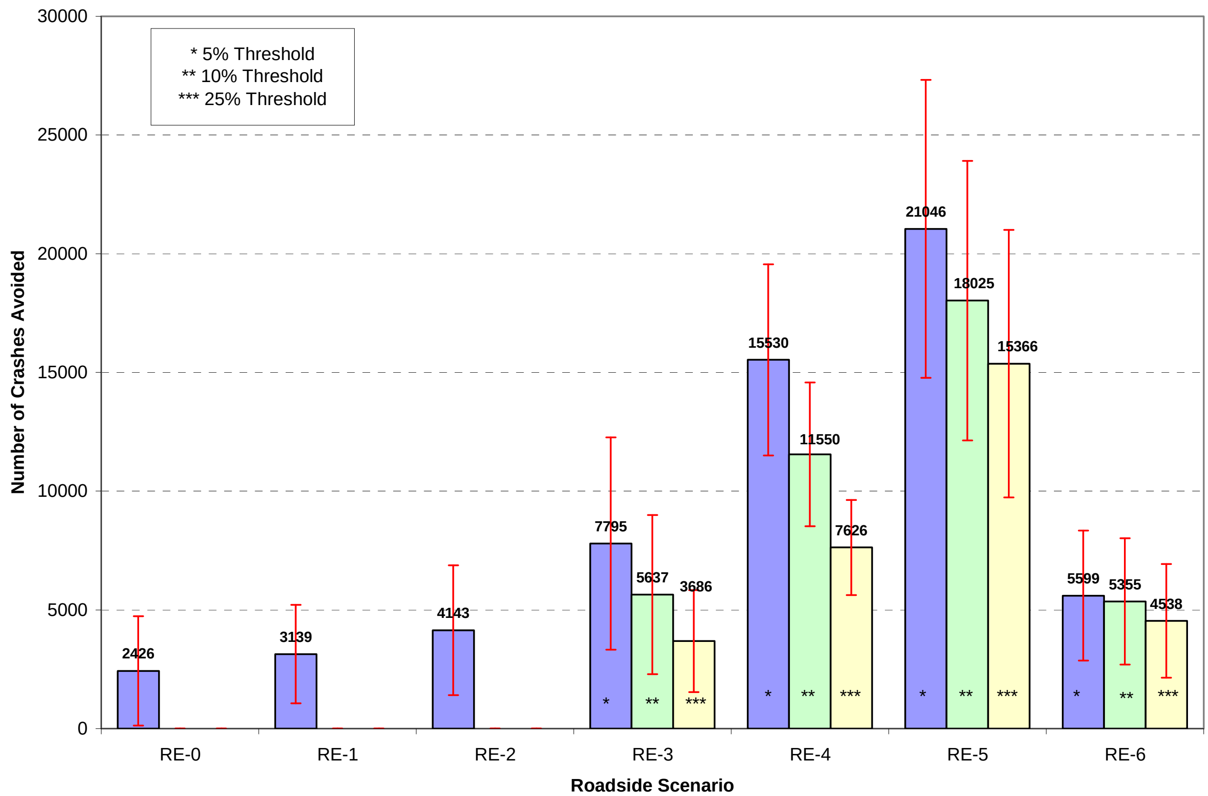

Figure 7-9. Estimated National Annual Number of Crashes Avoided under Selected Deployment Scenarios and Assumptions (Mean Number of Crashes Avoided and 95 Percent Confidence Interval)

Results for Scenarios RE-3 through RE-6 are presented at three different levels defined by the level of the threshold value of the safety index used. The value of the threshold can neither be so high that very few trucks on the road will be brought in for inspection nor can it be too low, which would result in more trucks being flagged for inspection than roadside enforcement resources can handle. Moreover, the appropriate value for the index threshold will vary from site to site and should be dependent on the number of inspectors available at a given inspection site as well as the amount of truck traffic. For each scenario, results are presented when the top 5, 10, and 25% of trucks in terms of the safety index are brought in for inspection. For instance, the 5% threshold represents the cutoff point for the 5% of trucks with the highest index value. For example, an inspection station with truck traffic of 1,000 trucks per day during normal inspection hours would expect to have about 50 trucks available for inspection if the 5% level of the index was used. Using the 90^{th} percentile would result in about 100 trucks available for inspection. For each scenario, the largest benefit is realized at the 5% threshold level, because trucks brought into the station will have the most risk associated with them. However, there must be sufficient truck traffic available at a site to use this high a level; otherwise too few trucks will be brought in for inspection, leaving available inspectors idle. As the threshold percentage increases, more trucks of lower safety risk are brought into the station, thus resulting in a smaller safety benefit given a constant number of inspections.

The safety benefits increase with each scenario RE-3 through RE-5. At the 5% threshold level, using high vehicle and driver OOS rates to electronically screen vehicles (RE-3) would avoid 7,795 crashes nationally, a savings of 4,656 crashes from the baseline scenario. Using high brake violation or driver OOS rates (RE-4) would result in having 15,530 crashes avoided, a savings of 12,391 crashes from the baseline scenario. The maximum benefit is achieved with RE-5, where 21,046 crashes are avoided if the top 5% of vehicles in terms of driver OOS violations are inspected in conjunction with infrared screening. This implies that about 4.8% of the nation's 441,000 annual truck-related crashes could be avoided under RE-5. To put this figure into perspective relative to crashes overall that are caused by OOS violations, the difference in violation rates between trucks involved in crashes and trucks not involved in crashes was examined. Examination of data from the LTCCS and the historical inspection reports from states involved in this evaluation have shown that there is a 7.2% increase in relative crash risk for driver OOS violations and a 0.6% increase in crash risk for vehicle violations. Since a vehicle could have a vehicle and driver violation, the two crash risk figures cannot be added to obtain the total increase in crash risk. However, these figures suggest that if there were no vehicle or driver OOS violations present in the population, no more than about 7.8% of the nation's 441,000 crashes involving large trucks could be avoided. This is the maximum possible benefit if all OOS violations were removed from trucks traveling on the road. This fact helps to put the crash avoidance results into context and to provide an upper bound on the number of crashes that could be avoided due to elimination of all OOS conditions.

RE-6 is most comparable with RE-3, since they both reflect the same inspection selection criteria with the exception that RE-3 uses carrier vehicle and driver OOS rates to screen vehicles while RE-6 uses ISS scores. Slightly more crashes are avoided at the 5 and 10% thresholds using a carrier's vehicle and driver OOS rates as opposed to the carrier ISS score. At the 25% threshold level, however, the benefit associated with RE-6 is higher than RE-3. Another observation is that there is not much difference in crash benefits across threshold levels for RE-6 as there is with RE-3. This implies that there may not be a large benefit to screening vehicles using the same 5, 10, and 25% threshold levels used with OOS rates. Future study is warranted that examines the effectiveness of ISS at predicting vehicle, driver or specifically brake OOS conditions in vehicles at the inspection site and, if necessary, to recommend modifications to the ISS calculation to better account for brake and driver violations.

Overall, by deploying and utilizing CVISN infrastructure and technologies as outlined in the above scenarios, the number of truck-involved crashes, injuries, and fatalities could be avoided directly through the increased inspection efficiency gained as a result of the availability and use of the real-time safety information.

Scenarios RE-0 through RE-5 are covered in more detail in Appendix C of this report while Scenario RE-6 is discussed further in Appendix C.9.

7.4 Safety Analysis Conclusions

Below are the conclusions from the safety analysis:

- **Evaluation of Current and Potential Future Inspection Selection Methods.** There is a wide variation in CVISN capabilities among states and in the extent that they use national and state data sources to access real-time, updated safety information to help make inspection selection decisions.

  Some states were well established in their CVISN programs and were expanding by deploying some state-of-the-art technologies in screening and data collection. States such as Colorado, Kentucky, Tennessee, and Washington rely heavily on computer-based safety and credential related information to make inspection decisions while regularly using federal and state data sources and tools such as SAFER, Query Central, or a CVIEW. They also are involved in developing or implementing new technologies to improve the data available to make inspection decisions and to improve the manner in which data are collected.

  Other states, such as Florida, New York, Ohio, and Utah, are very involved in CVISN capability development and have put into practice most if not all of the Core CVISN Deployment capabilities. These states are active in the CVISN planning and deployment process and are proactively looking for new ways to improve the exchange of safety information in their state.

  Still other states, such as Texas and Oklahoma, are earlier in their CVISN development and are working to integrate CVISN technologies into their roadside practices. They have started the CVISN planning process and are involved in at least one of the three main CVISN areas (SIE, ES, and EC) but have not yet achieved Core CVISN Deployment. These states rely more on inspector judgment and experience to make inspection decisions, making infrequent use of federal data sources and tools. These states are looking for new ways to improve the exchange of safety information by working toward Core CVISN Deployment.

- **Effectiveness of CVISN at Increasing the Efficiency of Inspections.** States vary in the efficiency of their current inspection practices, i.e., their ability to select high-risk trucks for inspection. Current inspection practices in Colorado, Kentucky, and Ohio yield 50, 16, and 42% more high-risk trucks than random selection would, respectively. Inspection practices in New York did not result in a significant increase in high-risk trucks over random selection. Of all four states, New York's inspection practices were the closest to a random selection with no ES, WIMs, or static scales to screen vehicles.

  Because CVISN technologies are not fully deployed or utilized in the field study states, a series of hypothetical scenarios was constructed to compare current inspection selection methods with various progressive options for integrating CVISN screening technologies at the states' weigh stations. The scenarios also explored variations in the inspection selection criteria that states could use in trying to focus their finite resources on the highest-risk carriers, vehicles, and drivers. Substantial potential reductions in crashes, injuries, and fatalities were predicted from wider deployment of CVISN. Estimates were made using statistical modeling.

- **Safety Benefits Under CVISN Roadside Deployment Scenarios.** Current roadside enforcement strategies are responsible for avoiding 3,139 truck-related crashes, which represents about 0.7% of the 441,000 crashes in the nation that occur annually, based on 2005 crash statistics. Furthermore, it is estimated that current roadside enforcement activities are responsible for preventing 813 injuries and 38 deaths. For reference, the numbers of crashes, injuries, and fatalities that are avoided using current roadside enforcement strategies is 29% higher (3,139 versus 2,426) than the number that would be avoided under random selection of vehicles.

  Utilization of ES based on the carrier's ISS score to select vehicles for inspection such that all medium- and low-risk carriers are allowed to bypass the inspection site would result in 4,143 crashes avoided, a 32% increase over the baseline scenario of current CVISN practices. Under this scenario, an additional 260 injuries and 12 fatalities could be avoided.

  Examination of data from the LTCCS and the historical inspection reports from four states selected for this evaluation showed that both driver and brake OOS conditions have a very high relative crash risk. Specifically, there is about a 7% increase in relative crash risk for driver OOS violations and a 5% increase in crash risk for brake violations. As such, inspection selection scenarios where only those vehicles with the highest probability of having driver or brake OOS violations are inspected resulted in the largest safety benefits. Selecting the highest 5% of carriers (i.e., those carriers posing the highest risk to safety) for inspection using either their driver OOS or the brake violation rate of the carrier results in 15,530 crashes avoided. The number of injuries and fatalities avoided under this scenario are 4,022 and 186, respectively. Using the same scenario but screening brake violations via infrared technology at the inspection site rather than the carrier's brake violation rate, the maximum benefit is achieved with 21,046 crashes avoided. This implies that about 4.8% of the nation's 441,000 annual truck-related crashes could be avoided under this scenario. The numbers of injuries and fatalities prevented under this scenario are 5,451 and 253, respectively.

7.5 Implications of Findings

The following summarizes some implications based on the results and provides recommendations for potential research:

- **Technology Deployment Issues.** The findings from this safety analysis suggest that a significant number of crashes, injuries, and fatalities could be avoided by utilizing more advanced inspection selection algorithms when choosing vehicles for inspection. Use of these advanced selection methods requires that technology be deployed to all inspection sites so that (1) inspectors could electronically identify every commercial vehicle that

Since the number of trucks that have transponders used for ES is low relative to the total number of trucks on the road, FMCSA may consider incentives or regulatory requirements such that all commercial vehicles would have a transponder, or else some alternative means of truck identification will need to be adopted. Some current alternatives include optical character recognition-based USDOT number or license plate readers such as those utilized in an advanced safety enforcement system in Kentucky. However, these technologies have not yet proven that they can identify a high percentage of commercial vehicles accurately.

Other technologies, such as passive radio frequency identification (RFID) tags or chips imbedded in or affixed to a license plate or window sticker, may be technically feasible, but likely face high regulatory or institutional hurdles before they can be mandated or widely adopted by voluntary means. Also, passive RFID chips do not offer an easy means of communicating a stop/go signal to the vehicle cab, as current transponders do. These kinds of issues and concepts are currently being addressed by the CVISN Roadside Identification ad hoc team, the FMCSA "Smart Roadside" initiative, and others.

- **Inspector Training.** A majority of the inspectors encountered during this evaluation relied predominantly on visual cues, inspector judgment, and experience in deciding which vehicles to inspect. Although some states use safety data to support those decisions, most states do not. The scenarios presented in this report represent a departure from the current approach and rely on giving inspectors greater access to real-time safety data to select trucks with a high relative risk for crashes. Inspectors would need extensive training to acclimate them both to the new technologies and to the benefits that can be achieved through more focused inspection selection algorithms.

- **Selection of Safety Indices.** One overall finding of this evaluation was that using an indexed safety measure will better help select vehicles with OOS violations. More research should be conducted to determine the most appropriate safety measure. From an inspection efficiency standpoint, the best choice for a safety index is one that correlates well with the probability of finding an OOS violation on a vehicle chosen for inspection. Analysis of the LTCCS showed that driver and brake OOS violations have a high relative risk for crash. As such, OOS rates were used in this analysis as safety indices when trying to identify vehicles with a probability of having a driver or brake OOS condition. This does not necessarily mean that OOS rates are more effective as safety indices than ISS scores or other measures, merely that OOS rates were chosen as a safety index in this analysis because they represented the quickest way to identify carriers with a history of driver or brake OOS conditions. This is because the OOS rate is a simple calculation

Because the ISS score is recommended by FMCSA and is used by some states, future study is warranted to examine the effectiveness of ISS at predicting driver or brake OOS conditions in vehicles at the inspection site. Modifications to the ISS calculation may eventually be recommended to better account for brake and driver violations. To this end, a scenario where the ISS score is used with safety index thresholds to screen vehicles, in a manner similar to RE-3, is presented in Appendix C.9.

- **Limitations of Findings.** The safety analysis uses a probability model to predict the number of truck-related crashes that would be avoided nationwide as CVISN deployment expands. Due to the variations in the pace and scope of CVISN deployment in different states, the relative rarity of large-truck crashes, and the wide variety of factors that contribute to truck crashes, it is not practical to perform longitudinal observational studies of CVISN safety benefits by simply comparing the number of motor vehicle crashes before and after CVISN deployment. The model used in this study is justified by basic principles of probability; however, its application relies on a variety of input parameters used to estimate impacts and benefits of CVISN. Some of the parameters were estimated using results from the open literature on crashes and highway statistics, and others were estimated with data collected in special studies involving participating CVISN states. Both types of estimates are subject to errors of unknown magnitude.

  The probability model used in this report to obtain crash avoidance estimates contains an implicit assumption that, conditioned on the presence or absence of a violation, the likelihood of a crash does not depend on whether the truck was selected for inspection. Certainly this is true if inspections are performed at random; but this assumption may not be true under other inspection selection criteria. The model is used for the benefits estimation because it greatly simplifies the calculations and it can make use of available data. Appendix C.10 presents an alternative, more complete model, provides some justification for making the simplifying assumption, and suggests potential sources of data for further investigation.

  Although additional data are needed, the safety analysis presented in this report helps to illustrate how the deployment of CVISN can affect highway safety in the future. The analysis can be easily modified as new data become available.

8.0 BENEFIT-COST ANALYSIS

8.1 Introduction

This report describes a comprehensive benefit/cost analysis (BCA) that has been carried out for the National CVISN Deployment Program. It updates a similar analysis conducted in 2002 as part of the evaluation of the CVISN Model Deployment Initiative (MDI), taking account of the progress that has been made since then toward more widespread deployment of CVISN technologies, and the additional data made possible by this current evaluation.

8.1.1 Purpose

Benefit/cost analysis is a public sector evaluation tool that compares all of a project's benefits to society to all of the project's costs to society. The question to be answered in a BCA is: Do these benefits exceed the costs? If the answer is yes, the benefit/cost ratio (BCR) is greater than one, and the project is said to be *economically* "feasible" or economically "justified." *Commercial* feasibility, the analogous private sector criterion, is much narrower in the benefits and costs it compares. Benefits are restricted to commercial *revenue*, and costs are limited only to those paid directly by the project developer.

This BCA evaluates two distinct CVISN components:

- Roadside Enforcement (RE)
- Electronic Credentialing (EC).

This BCA evaluates separately the deployment of RE according to each of the four scenarios defined in the Safety Analysis report (Section 7.0) that include CVISN deployment beyond the baseline level (RE-2 through RE-5), as well as the full-scale deployment of EC throughout the United States. These scenarios are described in more detail below.

8.1.2 Scenarios Studied

The RE scenarios reflect different assumptions about the nature and extent of the specific safety data used in the screening process to identify the trucks that are selected as candidates for inspection vs. being allowed to bypass the weigh station. The definitions of these scenarios, as taken directly from the Safety Analysis report, are as follows:

- **RE-2: Mainline Electronic Screening (ES) based on ISS Score**. State deploys ES with safety snapshots at all major inspection sites. All motor carriers that are classified as low- and medium-risk based on ISS scores (comprising approximately 60% of trucks on the road) enroll in the ES program, are equipped with transponders, and are allowed to bypass inspection sites. Inspectors use current practices to select vehicles for inspections from the remaining 40% of trucks in the high-risk and insufficient data categories.

- **RE-3: Electronic Screening based on high vehicle and driver OOS rates**. State utilizes ES at all major inspection sites. Safety information for each carrier is obtained from SAFER.

- **RE-4: Electronic screening based on high driver OOS and brake violation rates**. State utilizes ES at all major inspection sites. Each truck is screened based on its OOS or violation rate for violations that have a high relative risk for crash. In this scenario, vehicles are screened based on their brake violation and overall driver OOS rates as they appear in SAFER. A distinction is made here between violation and OOS rates. SAFER contains a violation rate for brakes but not a brake OOS rate. Thus, violation rates are used as a safety index for brake issues, while the driver OOS rate is used to screen for driver issues. Using data from the Large Truck Crash Causation Study and historical state inspection records, both brakes and driver OOS violations have been found to have a high relative risk for crashes. This scenario differs from RE-3 in that vehicles are screened on their brake violation rate as opposed to their overall vehicle violation rate in an attempt to identify those vehicles that have a violation that has a higher relative risk for crash. Similar to RE-3, all trucks with violation rates exceeding the threshold will be candidates for inspection, while all others will be allowed to bypass inspection sites. Moreover, the threshold rates are chosen such that only trucks with the highest rates are selected for inspection and the thresholds can vary depending on the amount of inspection personnel available at a given station. As part of RE-4, three specific threshold values are considered.

- **RE-5: Electronic screening based on infrared screening and high driver OOS violation rate**. State utilizes some form of infrared screening (such as the IRISystem) at all major inspection sites. Each truck is screened via two criteria: the thermal (IR) images and the driver OOS rate of the particular carrier. In this scenario, vehicles are screened based on the presence of a brake violation as detected through the infrared image produced by the infrared system and the driver OOS rate as it appears in SAFER. This scenario is similar to RE-4 in that both brakes and driver OOS violations are used as screening criteria. RE-5 differs from RE-4 in that vehicles are screened for brake violations via infrared imaging as opposed to brake violation rates obtained from SAFER. All trucks with a potential brake violation as detected from the infrared image or trucks with driver OOS rates exceeding various thresholds will be candidates for inspection, while all others will be allowed to bypass inspection sites.

A sixth, supplemental RE scenario included in the Safety Analysis, RE-6, which evaluated the effects of varying the thresholds for the ISS score (as a modification of Scenario RE-2 above, described in Appendix C.9), was generated after the completion of the BCA, and is not included in the economic analysis.

For scenarios RE-3, RE-4, and RE-5, we examine three variants, each representing one of three alternative assumptions about threshold values of the safety criteria used to determine which trucks are selected as candidates for inspection vs. being allowed to bypass. These three variants are as follows:

- RE-3/4/5A: top 5% of trucks in terms of risk, according to the scenario-specific criteria
- RE-3/4/5B: top 10% of trucks in terns of risk, according to the scenario-specific criteria
- RE-3/4/5C: top 25% of trucks in terms of risk, according to the scenario-specific criteria.

In the BCA for the CVISN MDI conducted in 2002, two scenarios were evaluated for EC that distinguished between states using VISTA and states not using VISTA. Given the development of CVISN deployment since then, this distinction is no longer meaningful, and therefore only a single scenario is evaluated for EC in the current BCA. For the purposes of this analysis, it is assumed that EC is fully deployed in all states, and is used for all necessary credentialing of all the trucks owned and operated by US motor carriers.

8.1.3 Outline of Section 8.0

The remainder of this BCA report section and the accompanying appendices are organized as follows:

- *Section 8.2* provides a summary of the BCA results, showing the computed benefit/cost ratios for each of the scenarios described above.

- *Section 8.3* provides a description of the methodology used in the BCA, including an overview of the guiding principles used in this type of analysis, the specific costs and benefits included in the analysis, and the data sources used for each of them.

- *Section 8.4* presents more detailed results of the analysis, including the total computed costs and benefits for each scenario, and includes a discussion of our findings.

- *Appendix D.1* contains the detailed results of an updated literature review that formed the basis of many of the numbers used in the calculation of CVISN benefits.

- *Appendix D.2* contains a detailed discussion of the times and costs associated with truck inspection activities, and describes the calculation of time savings benefits associated with the ES aspects of CVISN RE used in this BCA

- *Appendix D.3* contains detailed tables showing state-level total cost and benefit figures (to all stakeholders) for each scenario.

- *Appendix D.4* contains detailed tables showing yearly cost and benefit figures for each scenario.

8.2 Summary of Results

Table 8-1 summarizes the results of the BCA for each of the five scenarios (four RE scenarios plus one EC scenario).[19] The results in the table reflect the present value of the stream of benefits and costs that was calculated to occur over lifetime of the project, expressed in 2006 U.S. dollars[20] and discounted at 7%. The more detailed results presented later in the report also show the values using a 4% discount rate.

For the five RE scenarios, the table shows that the benefit/cost ratios range from 1.9 to 7.5, indicating that this CVISN component produces positive net benefits over the full range of assumptions contemplated in this study. The table also shows that the total benefits of EC are expected to exceed its total costs by more than a two-to-one margin, having a benefit/cost ratio of 2.6. Taken together, these results indicate that all aspects of the National CVISN Deployment Program examined in this BCA are expected to produce significant net benefits to society and are economically justified. The methodology by which these results were derived is described in the following section.

Table 8-1. Summary of CVISN Benefit/Costs Analysis Results ($2006)

CVISN Program	Scenario	Total Benefits	Total Costs	Net Present Value	Benefit/Cost Ratio
Roadside Enforcement	RE-2	$8,906,875,937	$4,110,657,662	$4,796,218,275	2.2
	RE-3A	$14,422,099,019	$6,838,922,219	$7,583,176,800	2.1
	RE-3B	$11,715,250,483	$5,774,709,138	$5,940,541,345	2.0
	RE-3C	$8,899,068,198	$4,626,101,527	$4,272,966,671	1.9
	RE-4A	$23,493,346,042	$5,544,961,109	$17,948,384,933	4.2
	RE-4B	$18,649,740,936	$4,804,238,306	$13,845,502,630	3.9
	RE-4C	$13,519,716,327	$4,158,837,793	$9,360,878,533	3.3
	RE-5A	$26,617,363,372	$3,607,051,636	$23,010,311,736	7.4
	RE-5B	$23,074,475,556	$3,081,989,018	$19,992,486,538	7.5
	RE-5C	$19,956,124,446	$2,688,192,054	$17,267,932,392	7.4
Electronic Credentialing		$8,220,221,144	$3,116,829,485	$5,103,391,660	2.6

8.3 Methodology

The EC and RE elements of CVISN are expected to make commercial vehicle credentialing less costly, and safety inspections more effective. The electronic screening of commercial vehicles is

[19] Ten rows for the Roadside Enforcement economic models are shown in the table, because scenarios RE-3 through RE-5 have three different modeled threshold values each, designated A, B, and C. With reference to the safety analysis, Scenario 0 (random selection) and Scenario 1 (existing or pre-CVISN selection methods) are not included in the BCA, because they do not entail any incremental deployment of CVISN infrastructure, and therefore, no incremental costs compared to the baseline. Safety Scenario RE-6 was developed after this BCA was completed.
[20] 2006 dollars are used throughout this report for consistency with the Cost Data Analysis (Section 6.0), which reports all cost figures in $2006.

also expected to save transit time for trucks with good safety compliance records by enabling them to bypass inspection stations at highway speeds in most cases. It is also hoped that this benefit will motivate carriers to improve their safety compliance behavior.

Trucks bypassing inspection stations will not only experience time savings for themselves and their cargo, but also they provide energy savings and air and noise pollution benefits for the public. Of most importance to the public, however, are the cost savings and productivity increases of EC to the states and carriers, and the improved targeting for inspection of unsafe vehicles enabled by the new information systems that make up the RE element of CVISN. The benefits of crashes avoided by removing unsafe trucks from highways include the value of lives saved, injuries avoided, reduced property damage to trucks, their cargo, and to other vehicles, and reduced delay to all vehicles from congestion due to crashes. These public benefits from CVISN are obviously important in justifying the expenditures needed to implement and operate these systems.

The question to be answered in this BCA is whether all the benefits exceed all the costs. This means that all the benefits and costs input to a BCA must have some inherent value to society. It is important for government to consider all such impacts, even if the private sector does not. And, while the actual summing of the benefits and costs in a BCA is straightforward, identifying the right inputs and observing or estimating their values is not.

In particular, for a benefit or cost to be included in a BCA, it must be:

- Quantifiable
- Monetizable
- Not duplicative
- Not a transfer.

Benefits must be quantifiable in order to attach a monetary value to them. However, not all quantifiable benefits have economic value to society. Not duplicative means that we cannot double count the same benefits and costs, even though they may appear to some not to be duplicative. And, finally, transfers between affected groups are not net changes in benefits to society, and, therefore, cannot be included in a BCA.

Each of the benefits and costs in a BCA is discounted to a present value over the economic life of a project. For the National CVISN Deployment Program, benefits are assumed to begin immediately with the one-time start-up costs in the year 2006, and extend for a 25-year period through 2030. This allows 25 years of economic returns for the project, which will include one or more replacement cycles for equipment and software at appropriate intervals.[21]

[21] For the purposes of this analysis, it is assumed that the size of the truck fleet remains constant throughout the 25 year life of the project. This simplifying assumption is necessary due to the uncertainties associated with projecting changes in costs and benefits that would result from changes in the size of the truck fleet.

8.3.1 Benefits and Costs Included in this BCA

The benefits quantified for inclusion in this BCA do not include every conceivable public benefit of CVISN, but they do include the major categories of benefits. The specific benefits and costs that will be included in the BCA for each CVISN component are summarized in Table 8-2.

Table 8-2. Benefits and Costs Included in the BCA

CVISN Component	Benefits	Costs
Roadside Enforcement	• Value of crashes avoided[1] • Value of transit-time savings, including operating and maintenance (O & M) and air and noise pollution	• One-time start-up costs to states • Replacement capital costs to states in future years • Increased operating costs to states • Increased operating costs to carriers • Increased out-of-service (OOS) costs to carriers
Electronic Credentialing[2]	• Operating cost savings to states • Operating cost savings to carriers • Truck inventory cost savings to carriers	• One-time start-up costs to states • Replacement capital costs to states in future years • One-time start-up costs to carriers • Operating costs to carriers

Notes:

1. Value of crashes avoided includes reduced delays to all vehicles from congestion due to crashes.

2. Start-up and replacement capital costs to carriers for Electronic Credentialing are assumed to be small or zero since only a personal computer (PC) is required, which essentially all carriers have.

The CVISN project may alter the administration of commercial vehicle enforcement and regulatory processes in various ways, but the net economic benefits cannot be assessed until the impacts are translated into the measures described above. These impacts are the result of changes in accidents, administrative and compliance costs, motor carrier behavior, and other changes in commercial vehicle regulatory administration and transportation activities. These evaluation measures determine the type of data that need to be collected and analyzed in the CVISN evaluation. The process of identifying the benefit measures listed above is described below for each of the five traditional ITS goal areas (safety, efficiency, productivity, mobility, and energy/environment).

8.3.2 Benefit Measures

Table 8-3 summarizes the evaluation benefit measures for input to the CVISN BCA arranged by the three major categories of stakeholders to whom benefits will accrue. States and motor carriers are the primary beneficiaries of the most important productivity (cost saving) and safety benefits. Shippers/receivers and the public also benefit from these impacts of CVISN. However, the BCA values these benefits in the aggregate to assess the total net worth of a project. This minimizes any tendency to double count these benefits.

Table 8-3. Classification of Benefits and Their Incidence

		Benefit Description	Stakeholder Impacted: State	Stakeholder Impacted: Carriers (and Shippers)	Stakeholder Impacted: Public
Roadside Enforcement:	Safety	Crashes avoided		✓	✓
	Productivity/Mobility	Cost savings: Transit-time savings (including O&M)		✓	✓
		Increased output (included in safety benefit)		✓	✓
	Energy/Environment	Fuel use (included in transit-time savings)		✓	
		Air/noise pollution (included in transit-time savings)			✓
Electronic Credentialing:	Productivity	Cost savings: Faster credentialing	✓	✓	
		Cost savings: new truck inventory		✓	

The benefits of CVISN's *roadside enforcement* noted in Table 8-3 are:

- **Safety:** Crashes avoided through improved inspection, plus reduced accident costs, including delays to the motoring public from fewer truck accidents.

- **Productivity/Mobility:** Cost savings to motor carriers from ES transit-time savings, including O&M. Reduced delays to the motoring public from accidents (mobility goal area benefit included in accident cost savings). Increased output from more productive inspections measured by crashes avoided with benefits (again) to motor carriers and the public.

- **Energy/Environment:** Energy/fuel savings to motor carriers included in value of transit-time savings. Air and noise pollution savings from transit-time savings calculated separately, but included in the value of transit-time savings.

Some of the above benefit measures are in natural units other than dollars. They are converted to dollar values ("monetized") for input to the BCA as described in more detail in Appendices D.1 and D.2.

Table 8-3 shows a relatively simpler set of benefits of CVISN's *electronic credentialing,* namely, cost savings to both the state and to motor carriers, and improved carrier fleet utilization from faster credentialing of new trucks. Each of the benefit measures are described in more detail below.

Safety Benefits. The anticipated safety benefits of CVISN from increased motor carrier compliance with state safety regulations are extremely important. The benefits consist primarily of reductions in truck-related crashes caused by violations of vehicle or driver safety regulations. The crashes are avoided either because additional trucks or drivers are placed out of service due to more efficient enforcement practices or the number of violations is reduced in response to enhanced enforcement (the indirect effect). The safety benefit will take the form of decreased fatalities and personal injuries, and decreased property damage costs from accidents. Note that in quantifying this benefit, we include the total cost to society of crashes, including the losses and delays to other motorists due to these accidents.[22] We do not subtract the costs covered by insurance from the cost savings since the cost savings will lower insurance costs for everyone and all the accident cost savings should be included in this benefit.

Efficiency Benefits. A major source of confusion on the proper inputs to an ITS BCA stems from the fact that economists and engineers sometimes use the same term to mean different things. Most importantly, in economics, efficiency means maximizing total net benefits from an investment or policy. This means that the economic efficiency goal includes all the ITS goals that have (a dollar) value to society. However, engineers use the term efficiency much more narrowly to mean more output per unit of input ("engineering efficiency").

The efficiency goal that is well accepted as one of the five major ITS goals is the engineering efficiency goal, not the economic efficiency goal. Measures of achievement of the engineering efficiency goal do not enter into a BCA. This is because increased output per unit of input is best measured in transportation as increased throughput or capacity (e.g., vehicles per hour, inspections per hour, inspections per person-hour). Converting this benefit to a dollar value to society falls under the productivity goal in the form of cost savings.

Productivity Benefits. Productivity means *lower costs to produce a given level of output*. Cost savings are an important measure of achievement of the CVISN productivity goal (e.g., cost per vehicle registration, reduced truck transit time, etc.). This benefit includes the savings to motor carriers and government agencies that result from CVISN. These cost savings certainly have value to society and enter into a BCA to calculate the net worth of CVISN investments.

With regard to RE, the productivity-related cost savings to compliant motor carriers results from saving time by bypassing inspection sites at highway speeds. We do not assume any shortening of the time to inspect each truck selected for inspection, nor is it assumed that the number of truck inspections will change. Rather, CVISN may be expected to result in a better targeting of truck inspections since more of these trucks will have been prescreened for violations using the real-time access to timely and accurate data for targeting high-risk carriers provided by CVISN. Therefore, rather than a cost savings to states, the benefit to the states is increased numbers of out-of-service (OOS) violations and improved compliance resulting in fewer crashes. Cost savings to states are foregone for the benefit of *increased output* from the inspection process in the form of *increased safety* as measured by fewer crashes. This increased output provided by

[22] See Appendix D.1.

CVISN is an important benefit. Government officials, including law enforcement officials, would like to be evaluated not only by the costs they cut, but by what they do. On the other hand, there will be a cost to some motor carriers to improve their compliance and/or deal with increased numbers of OOS violations.

With regard to EC, the benefits of CVISN to both states and motor carriers are limited to cost savings (possibly substantial). States can change their credentialing output only with legislative changes in the number of transactions required. Such changes are exogenous to the CVISN program and do not enter this BCA. Similarly, motor carriers can benefit from the cost savings that EC's speed and increased operating flexibility provides them. The benefits include both direct operating cost savings and increased fleet utilization from the increased speed with which carriers can get their trucks on the road due to faster credentialing.

With regard to the latter, this BCA assumes carriers can register new trucks faster and, thus, save on truck inventory costs. Registration renewals are assumed to be scheduled, with or without EC, to keep existing truck fleets in service. Finally, significant or measurable levels of increased revenue to motor carriers from goods shipped are not anticipated as a result of the CVISN program. This is discussed in the mobility section below.

Another potential productivity cost savings to states is pavement cost savings (increased pavement life or productivity) from fewer un-permitted overweight trucks on the road. This is a savings that can be expected to materialize over the long term, and for these reasons, we exclude it from the quantitative results of this BCA.

Other productivity-related outcome measures may have economic value to some, but should be excluded from a BCA because they represent transfers of benefits. For example, CVISN may increase the fee revenue "production" from more effective regulatory enforcement and compliance with CVISN. However, this should not be treated as a net benefit that enters into a BCA, since it is really a transfer from the carriers to state government.

Finally, certain benefits that fall under other goal areas are included in the calculation of productivity benefits due to the way unit costs are calculated in the available literature. Examples of these are:

- Reduced delay to the motoring public from CV accidents (mobility goal area benefit included in accident cost saving)

- Gallons of fuel saved by motor carriers (energy goal area cost included in the truck transit-time operating cost saving).

Mobility Benefits. Mobility is measured by the net benefits to travelers or other transportation consumers from a transportation improvement. To avoid double counting, the most important measure of achievement of the mobility goal is purposely omitted as an input to our BCA. This is the portion of the CVISN motor carrier productivity cost savings benefit (if any) that is passed on to the shipper/receiver (e.g., a value-added manufacturer, wholesaler, retail store), or to the final consumer. We can avoid the very difficult problem of collecting data on some elusive cost savings passed on to customers by including in the BCA the entire direct CVISN productivity benefit (the cost savings to motor carriers). Whether these cost savings are passed on to customers is immaterial for the BCA since the total benefit to society is the same.

Three non-motor carrier cost saving mobility measures are valid inputs to a CVISN BCA:

- Reduced highway delays to the public due to reduced motor carrier (truck) crashes.
- Reduced time in transit that reduces shipper/receiver inventory costs.
- Increased shipper/receiver satisfaction with carriers (e.g., use of safety rating data).

The first measure impacts the public in a different way than the CVISN productivity measure, (i.e., it impacts public benefits differently from the costs of the shipped goods). It is included in the accident cost saving benefit since the literature includes this in the cost of accidents. Similarly, the value to shippers/receivers of decreasing time in transit to reduce inventory costs is included in the motor carrier value of truck travel time. With regard to the third measure, to the extent that shippers are willing to pay separately for (i.e., that they value) the safety rating data, this benefit is additive to the carrier cost savings from reduced accidents. However, we have not been able to measure it in this evaluation. Also, the third measure can affect the volume of carrier business and, therefore, revenues. However, additional revenues are presumably mostly transfers, not increases in output or total goods shipped. Therefore, they do not provide net benefits for input to a BCA.[23]

Energy and Environmental Benefits. Energy savings in the form of decreased fuel use are included in the value of transit-time-related operating cost savings to motor carriers. Similarly, the values of air and noise pollution reductions from CVISN are separately calculated, but included in the transit-time-related benefits input to the BCA.

8.3.3 Cost Measures

The five ITS goal areas deal only with benefits (including cost savings). The cost of CVISN for the purpose of this BCA consists of the one-time start-up costs and the ongoing costs of CVISN programs, including equipment replacement at appropriate intervals. More specifically, these CVISN costs include the incremental capital and operating costs of the hardware and software, including computers and electronic data communications, and labor and administrative overhead costs for performing the functions associated with CVISN. In contrast to defining the cost saving benefits of CVISN, defining the incremental expenditures of resources on CVISN is relatively straightforward. Section 8.6 of this report provides our detailed findings on CVISN costs.

Table 8-4 shows the classification of costs used in this BCA and indicates their incidence among the major categories of stakeholders.

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[23] To the extent that additional revenues accrue to more efficient, profitable (and compliant) carriers, there is a net benefit to society. However, evaluating the relative profitability of different carriers is well beyond the scope of this evaluation.

Table 8-4. Classification of Costs and Their Incidence

	Cost Description	Stakeholder Impacted: State	Carriers (and Shippers)	Public
Roadside Enforcement:	Start-up costs: Equipment/housing/training	✓	✓	
	Replacement capital costs	✓		
	Operating costs	✓	✓	
	(Increased) costs of compliance: Out-of-service (OOS)		✓	
Electronic Credentialing:	Start-up costs: Equipment/housing/training	✓	✓	
	Replacement capital costs	✓		
	Operating costs		✓	

For both RE and EC, there are start-up and replacement capital costs in future years to both the states and carriers. States need to install equipment at inspection stations such as Weigh-in-Motion scales, transponder readers and other Automatic Vehicle Identification (AVI) equipment, as well as the associated computer hardware and software. The principal cost to carriers for RE is the expense associated with the in-vehicle transponder required for a truck to receive a signal giving it permission to bypass a station. Given current deployment patterns we have assumed a mix of transponder purchases under the Norpass program for some trucks and monthly subscription fees paid for enrollment in the PrePass program. A certain fraction of trucks are assumed to incur both expenses, as described in more detail below.

For EC, while it is assumed that all carriers have PCs, we have included in the analysis costs for additional hardware, technical support, and training based on interviews with motor carriers conducted as part of the FMCSA-sponsored CVISN Business Case analysis (2007a,b). States likewise need to install the equipment and software to enable EC to take place. Finally, there are costs to the carriers from improved RE. These will take the form of increasing OOS violations for high-risk carriers, and possible indirect costs of changing their behavior to improve their compliance rates (such as increased maintenance costs or increased hiring costs due to higher driver turnover). The latter cost has not been possible to estimate in this evaluation. However, since less compliant carriers are more likely to incur increased OOS costs, this cost is likely to be included at least partly in their increased OOS cost.

8.3.4 Data Sources and Estimation Procedures

Data was collected separately for the estimated projected benefits of the CVISN systems and the projected costs associated with deploying and operating these systems. The sources of these data are described in more detail below.

Benefits Data. Tables 8-5 and 8-6 summarize the data sources and procedures used in the estimation of the benefits of CVISN for the use in this BCA for RE and EC, respectively.

Table 8-5. Data Sources and Estimation Procedures for Roadside Enforcement Benefits

Benefit Measure	Stakeholders Impacted	Data Source(s)	Estimation Procedure
Crashes avoided	Carriers, public	Safety Analysis Table 7-6, Literature review	Multiply additional annual safety events avoided from safety analysis by the cost of the average large truck crash from literature review.
Transit time savings (including O&M and air and noise pollution)	Carriers	Literature review	Subtract the total time spent on weight checks from the total time spent on weight checks in the base scenario. To calculate total time spent on weight checks, multiply static weight checks by time savings for bypassing a static weight check and add to the product of WIM weights checks and time savings for bypassing a WIM weight check. For base case assume all weight checks use static scales. Otherwise, after subtracting bypassing trucks and inspected trucks from total trucks, allocate 85% of weight checks to WIM scales and 15% to static scales.

Table 8-6. Data Sources and Estimation Procedures for Electronic Credentialing Benefits

Benefit Measure	Stakeholders Impacted	Data Source(s)	Estimation Procedure
Operating cost savings to states	State	EC benefit data	Multiply total transactions for each state by the cost savings per transaction for that state, then total across all states. For states with no cost savings values, use weighted average savings per transaction.
Operating cost savings to carriers	Carriers	Econ. Analysis and Bus. Case Table 8	Multiply total transactions across all states by the $5.13 average electronic credentialing cost savings to carriers from the economic analysis and business case.
Inventory cost savings to carriers	Carriers	Econ. Analysis and Bus. Case Table 8	Multiply total trucks across all states by the $106 average truck inventory cost per day, the 3.5 day average truck delivery acceleration brought by electronic credentialing, and by the 15% average new truck share of fleet.

The primary benefits of RE will be the avoidance of truck crashes and truck transit time savings. The number of truck crashes avoided was separately estimated as part of the safety analysis.

Data on the value of crashes avoided was obtained from the 2007 update to the large study conducted by Pacific Institute for FMCSA and published in 2000. This source was selected based on our review of the most recent literature on the subject, described in more detail in Appendix D.1. This study provided crash cost estimates by severity for several vehicle types, and included medically related costs, emergency services costs, property damage costs, lost productivity, legal costs, and the monetized value of the pain, suffering and lost quality of life caused by truck crashes.

Data for the value of time savings to motor carriers was derived based on published values in the literature, as described in more detail in Appendices D.1 and D.2.

The primary benefits of the EC component will be operating cost savings to states, operating cost savings to carriers, and truck inventory cost savings to carriers.[24] Data used to measure these benefits was collected as part of the cost analysis and the economic analysis and business case for motor carrier industry support of CVISN study (FMCSA 207a,b).

Cost Data. Tables 8-7 and 8-8 summarize the data sources and procedures used in the estimation of the costs of CVISN for the use in this BCA for RE and EC, respectively. Data for all one-time deployment and recurring (annual) operating and maintenance costs experienced by the states was obtained from the results of the cost analysis, which compiled data from the self-evaluation templates completed by the states. Data on costs and cost savings experienced by motor carriers was obtained from a set of interviews conducted for the business case analysis, the literature review described in Appendix D.2, and publicly available information on the Norpass and PrePass programs. Appendix D.5 describes the assumptions used in estimating the economics of deploying ES on a nationwide basis.

Some states did not supply any data to the self evaluation, and for some states data was not supplied for certain data fields (survey questions). Where data was missing we used the median value from among those states that did supply data. For data items that are site specific (such as WIM scales), we used the median unit cost from among the states supplying data, and scaled it up to a total cost value based on the total number of permanent stations in the state for which data was missing. Where the data item was not site specific (such as software used at a headquarters location) we used the median total cost value from among the states supplying data.

[24] Truck inventory cost savings represent the benefits of increased fleet utilization, made possible by the increased speed with which carriers can get their trucks into revenue service on the road, due to faster credentialing. Specifically, this BCA assumes that EC will enable carriers to register new trucks more quickly.

Table 8-7. Data Sources and Estimation Procedures for Roadside Enforcement Costs

Cost Measure	Stakeholders Impacted	Data Source(s)	Estimation Procedure
One time start-up cost to states	State	Cost Data Analysis Tables 6-9 and 6-11	Total CVISN RE start-up costs from cost data analysis across all states, filling missing values with median state values. Where unit costs are available and units are dependent upon RE equipped stations, scale costs to reflect full deployment.
Replacement capital costs to states	State	Cost Data Analysis Tables 6-9 and 6-11	Use the portion of CVISN RE start-up costs from cost data analysis allocated to equipment. Assume computers and software have a life of five years and that WIM scales and most other heavy equipment has a useful life of ten years.
Increased operating costs to states	State	Cost Data Analysis Tables 6-10 and 6-12	Total annual CVISN RE costs from cost data analysis across all states, filling missing values with median state values. Where unit costs are available and units are dependent upon RE equipped stations, scale costs to reflect full deployment.
Increased operating costs to carriers	Carriers	PrePass, Norpass, MCMIS census data	A one-time Norpass transponder purchase fee applied to all carriers with fewer than 3,000 trucks operating in PrePass states and carriers operating exclusively in Norpass states; weighted average 2006 PrePass monthly rate of $8.55 per transponder applied to remaining carriers.[25]
Increased OOS costs to carriers	Carriers	Safety Analysis Chapter 6, Literature review	Multiply driver OOS cost from literature review by probability of driver OOS placement given driver inspection from safety study by annual driver inspections from safety analysis. Add to vehicle OOS cost from literature review times probability of vehicle OOS placement given vehicle inspection from safety analysis times annual vehicle inspections from safety analysis.

[25] See Appendix D.5 for a discussion of the assumptions used in calculating the costs and benefits of a national deployment of ES technologies.

Table 8-8. Data Sources and Estimation Procedures for Electronic Credentialing Costs

Cost Measure	Stakeholders Impacted	Data Source(s)	Estimation Procedure
One time start-up cost to states	State	Cost Data Analysis Table 6-7	Total CVISN EC start-up costs from cost data analysis across all states, filling missing values with median state values.
Replacement capital costs to states	State	Cost Data Analysis Table 6-7	Use the portion of CVISN EC start-up costs from cost data analysis allocated to equipment. Assume computers and software have a life of five years.
One time start-up cost to carriers	Carriers	Econ. Analysis and Bus. Case Table 7	Multiply $275 average EC start-up cost per carrier from economic analysis and business case by total carriers.
Operating costs to carriers	Carriers	Econ. Analysis and Bus. Case Table 7	Multiply $125 average annual EC operating cost per carrier from economic analysis and business case by total carriers.

8.3.5 Calculation of Benefit-Cost Ratios

To test the hypothesis that an investment in CVISN will have net benefits to society, all present and future discounted costs were subtracted from their properly discounted present and future benefits to society. Each of the benefits and costs occurring each year between 2006 and 2030 was discounted back to 2006 using both a 4% and 7% real discount rate to calculate the present values of the benefits and costs in 2006 dollars. The use of a 4% real discount rate in these kinds of benefit-cost calculations has been recommended by economists in both the public and private sector.[26] The use of a 7% real discount rate is a more stringent test and has been required for two decades for use in BCAs of federal programs by the U.S. Office of Management and Budget (OMB).[27]

The discounted stream of benefits can be compared directly to the discounted stream of costs, and the quotient of the two was computed to obtain the benefit-cost ratio (BCR). The difference between the two is the net present value (NPV) of the (net) benefits. BCRs and NPVs were computed for each of the scenarios described above. The results are described in the following section.

8.4 Benefit-Cost Analysis Results

This section describes the detailed results of the BCA for each of the scenarios described above in Section 8.1.

[26] See for example, U.S. Environmental Protection Agency, "Guidelines for Preparing Economic Analyses," September 2000, Chapter 6, which recommends a real rate of 2 to 3 percent for some public projects.
[27] See U.S. OMB. "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," U.S. Office of Management and Budget Circular A-94, October 29, 1992 and U.S. OMB. "Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements," U.S. Office of Management and Budget, Report M-00-08, March 22, 2000.

8.4.1 Roadside Enforcement

Tables 8-9 through 8-18 show the results of the BCA for the RE scenarios. The tables show the present values of all the benefits for RE that we have included in the BCA and compare these to the total system costs. Listing the benefits and costs in the format in these tables show how they are aggregated in their common dollar units to calculate the net benefits and the benefit/cost ratio (BCR) for each investment alternative or scenario. In each case, the benefits and costs that are received and paid at different times over the course of the next 25 years have been discounted back to 2006 dollars using both four (4) and seven (7) percent real discount rates. Discounting future values to calculate a present value in 2006 dollars is necessary to be able to compare these future streams of costs and benefits.

Table 8-9. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-2 ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$1,534,155,303	$1,177,444,345
	Transit time savings (incl. O&M and air and noise pollution)	$10,071,090,417	$7,729,431,591
	Total benefits	$11,605,245,720	$8,906,875,937
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$2,184,682,658	$1,717,354,342
	Increased OOS costs to carriers	$742,787,900	$570,080,103
	Total costs	$5,206,427,706	$4,110,657,662
Total (Net Present Value)		$6,398,818,015	$4,796,218,275
Benefit/Cost Ratio		2.2	2.2

Table 8-10. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-3A ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$7,114,568,815	$5,460,339,514
	Transit time savings (incl. O&M and air and noise pollution)	$11,676,756,460	$8,961,759,504
	Total benefits	$18,791,325,275	$14,422,099,019
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$3,641,137,764	$2,862,257,237
	Increased OOS costs to carriers	$2,805,834,617	$2,153,441,765
	Total costs	$8,725,929,528	$6,838,922,219
Total (Net Present Value)		$10,065,395,748	$7,583,176,800
Benefit/Cost Ratio		2.2	2.1

Table 8-11. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-3B ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$3,817,051,740	$2,929,537,824
	Transit time savings (incl. O&M and air and noise pollution)	$11,447,375,597	$8,785,712,660
	Total benefits	$15,264,427,337	$11,715,250,483
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$3,641,137,764	$2,862,257,237
	Increased OOS costs to carriers	$1,419,214,394	$1,089,228,685
	Total costs	$7,339,309,305	$5,774,709,138
Total (Net Present Value)		$7,925,118,032	$5,940,541,345
Benefit/Cost Ratio		2.1	2.0

Table 8-12. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-3C ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$835,839,592	$641,496,073
	Transit time savings (incl. O&M and air and noise pollution)	$10,759,233,007	$8,257,572,125
	Total benefits	$11,595,072,600	$8,899,068,198
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$3,641,137,764	$2,862,257,237
	Increased OOS costs to carriers	-$77,367,983	-$59,378,926
	Total costs	$5,842,726,928	$4,626,101,527
Total (Net Present Value)		$5,752,345,672	$4,272,966,671
Benefit/Cost Ratio		2.0	1.9

Table 8-13. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-4A ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$18,933,982,429	$14,531,586,538
	Transit time savings (incl. O&M and air and noise pollution)	$11,676,756,460	$8,961,759,504
	Total benefits	$30,610,738,889	$23,493,346,042
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$3,641,137,764	$2,862,257,237
	Increased OOS costs to carriers	$1,119,863,381	$859,480,656
	Total costs	$7,039,958,292	$5,544,961,109
Total (Net Present Value)		$23,570,780,597	$17,948,384,933
Benefit/Cost Ratio		4.3	4.2

Table 8-14. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-4B ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$12,852,370,770	$9,864,028,276
	Transit time savings (incl. O&M and air and noise pollution)	$11,447,375,597	$8,785,712,660
	Total benefits	$24,299,746,367	$18,649,740,936
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$3,641,137,764	$2,862,257,237
	Increased OOS costs to carriers	$154,735,967	$118,757,852
	Total costs	$6,074,830,878	$4,804,238,306
Total (Net Present Value)		$18,224,915,489	$13,845,502,630
Benefit/Cost Ratio		4.0	3.9

Table 8-15. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-4C ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$6,856,329,526	$5,262,144,201
	Transit time savings (incl. O&M and air and noise pollution)	$10,759,233,007	$8,257,572,125
	Total benefits	$17,615,562,533	$13,519,716,327
Costs	One time start-up cost to states	$543,368,309	$543,368,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,081,007,602	$829,659,348
	Increased operating costs to carriers	$3,641,137,764	$2,862,257,237
	Increased OOS costs to carriers	-$686,190,930	-$526,642,660
	Total costs	$5,233,903,981	$4,158,837,793
Total (Net Present Value)		$12,381,658,552	$9,360,878,533
Benefit/Cost Ratio		3.4	3.3

Table 8-16. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-5A ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$27,362,668,336	$21,000,493,918
	Transit time savings (incl. O&M and air and noise pollution)	$7,318,520,058	$5,616,869,454
	Total benefits	$34,681,188,394	$26,617,363,372
Costs	One time start-up cost to states	$694,918,309	$694,918,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,095,077,472	$840,457,791
	Increased operating costs to carriers	$0	$0
	Increased OOS costs to carriers	$2,112,713,109	$1,621,479,976
	Total costs	$4,557,290,126	$3,607,051,636
Total (Net Present Value)		$30,123,898,268	$23,010,311,736
Benefit/Cost Ratio		7.6	7.4

Table 8-17. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-5B ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$22,746,450,039	$17,457,606,102
	Transit time savings (incl. O&M and air and noise pollution)	$7,318,520,058	$5,616,869,454
	Total benefits	$30,064,970,097	$23,074,475,556
Costs	One time start-up cost to states	$694,918,309	$694,918,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,095,077,472	$840,457,791
	Increased operating costs to carriers	$0	$0
	Increased OOS costs to carriers	$1,428,580,901	$1,096,417,358
	Total costs	$3,873,157,918	$3,081,989,018
Total (Net Present Value)		$26,191,812,179	$19,992,486,538
Benefit/Cost Ratio		7.8	7.5

Table 8-18. Benefit/Cost Comparison for Roadside Enforcement Scenario RE-5C ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Crashes avoided	$18,683,383,356	$14,339,254,992
	Transit time savings (incl. O&M and air and noise pollution)	$7,318,520,058	$5,616,869,454
	Total benefits	$26,001,903,414	$19,956,124,446
Costs	One time start-up cost to states	$694,918,309	$694,918,309
	Replacement capital costs to states	$654,581,236	$450,195,560
	Increased operating costs to states	$1,095,077,472	$840,457,791
	Increased operating costs to carriers	$0	$0
	Increased OOS costs to carriers	$915,481,745	$702,620,394
	Total costs	$3,360,058,762	$2,688,192,054
Total (Net Present Value)		$22,641,844,652	$17,267,932,392
Benefit/Cost Ratio		7.7	7.4

The discount rates of 4 and 7% are applied to the future benefits and costs estimated in real (constant 2006) dollars, not inflated dollars. If the future benefits and costs were estimated in inflated (current) dollars, the "nominal" discount rate would have to be 4% or 7% *plus* the rate of inflation. If we assume today's modest 2.5% annual inflation rate going forward, the 4% and 7% real discount rates are equivalent to 6.5% and 9.5% nominal discount rates, respectively.

The tables show that in fact the choice of discount rate makes little difference to the fundamental results, with the BCRs being identical for scenario RE-2 and only slightly lower using the 7% rate for the other RE scenarios. Using the more stringent 7% discount rate, the BCRs range from 1.9 in scenario RE-3C to 7.5 in scenario RE-5B. The results for scenario RE-5 show the highest BCRs, as expected, as in these scenarios the number of crashes avoided is by far the highest, owing to the fact that this scenario uses infrared screening of the actual individual vehicles in addition to the statistical screening using safety data for the carrier operating the vehicle. Scenario RE-4 has the next highest BCRs, ranging from 3.3 to 4.2 (using the 7% discount rate), consistent with the fact that the statistical screening in this scenario makes use of data on brake violation rates, which we would be expect to be closely related to crashes. By contrast, scenario RE-3, which uses data only on vehicle and driver OOS rates, has lower BCRs of 1.9 to 2.1. Scenario 2, which uses ISS scores as the basis for screening, has a similar BCR at 2.2.

The tables also show the in addition to having much higher BCRs, the net present values for scenario RE-5 are significantly higher than the other scenarios, ranging from $17.3 to $23.0 billion. By comparison, scenario RE-4 has NPVs ranging from $9.4 to $17.9 billion.

For scenarios RE-3 and RE-4, the "A" variants have the highest NPVs and BCRs, followed by the "B" variants and then the "C" variants. This is consistent with the fact that the in the "A" variants trucks are selected for inspection from among the riskiest 5% of carriers, whereas in the

"B" and "C" variants they are selected from among the riskiest 10% and the riskiest 25%, respectively.

The make up of the benefits and costs also varies depending on the RE scenario. For example, in scenarios RE-2, RE-3, and RE-4C, the benefits from time savings outweigh the benefits from crashes avoided. By contrast, the benefits from crashes avoided are significantly higher than those of time savings for scenarios RE-4A, RE-4B, and all three variants of RE-5. Scenario RE-5 has no increased operating costs to carriers, because in this scenario carriers are not required to use transponders (all screening is done in the station rather than the mainline because infrared screening of the individual vehicles is included[28]).

In addition, scenarios RE-3C and RE-4C have negative OOS costs to carriers because in these scenarios fewer trucks and/or drivers are being taken out of service.[29] Finally, the definition of scenario RE-4 is such that the results likely understate both the benefits from crashed avoided and the costs associated with increased OOS costs to carriers. As described in the safety analysis report, the out of service placements are calculated based only on the probability of brake violations, rather taking into account all possible violations that may cause a truck to be taken out of service. Crashes avoided are based on these out of service placement estimates and to the extent that trucks might be taken out of service for other than brake violations, the resulting number of crashes avoided and OOS costs may be higher.

Detailed tables showing state-by-state estimates of the total costs and benefits (to all stakeholders) for each scenario over the 25 year life of the project (discounted at 7%) are provided in Appendix D.3. Tables listing the total year-by-year benefits and costs and their discounted values using the 4 and 7% real discount rates are provided in Appendix D.4.

8.4.2 Electronic Credentialing

Table 8-19 shows the results of the BCA for EC. The table shows that at both the 4% and 7% discount rate, this CVISN component, like RE, exhibits significant net benefits.

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[28] It would not be feasible to conduct the infrared screening at mainline speeds, and in any case, the nature of the infrared screening is such that it is designed to detect brake problems that would only manifest themselves to the infrared device upon the braking required to decelerate when entering the station.

[29] In scenario RE-3C the truck OOS rate is higher than the baseline level but the driver OOS rate is lower. In scenario RE-4C both the driver OOS rate and truck OOS rate are lower than the baseline level, but this scenario still has benefits from crashes avoided because although fewer trucks/drivers are taken out of service, the trucks/drivers that are taken out are riskier than those taken out of service in the baseline and are therefore most likely to cause a crash.

Table 8-19. Benefit/Cost Comparison for Electronic Credentialing ($2006)

		Discounted at 4%	Discounted at 7%
Benefits	Operating cost savings to states	$2,217,117,163	$1,701,608,736
	Operating cost savings to carriers	$824,504,998	$632,796,918
	Inventory cost savings to carriers	$7,668,944,253	$5,885,815,490
	Total benefits	$10,710,566,413	$8,220,221,144
Costs	One time start-up cost to states	$47,336,356	$47,336,356
	Replacement capital costs to states	$112,232,135	$82,400,292
	One time start-up cost to carriers	$447,982,454	$447,982,454
	Operating costs to carriers	$3,308,342,914	$2,539,110,382
	Total costs	$3,915,893,859	$3,116,829,485
Total (Net Present Value)		$6,794,672,554	$5,103,391,660
Benefit/Cost Ratio		2.7	2.6

Even at the more stringent 7% discount rate, total benefits are more than double the total costs, and the NPV is $5.1 billion. At the 4% discount rate the NPV is nearly $6.8 billion and the BCR is 2.7. The EC element of CVISN therefore easily passes the important BCR and positive NPV criteria for determining whether such systems are economically justified.

The table shows that most of the costs are borne by the carriers, but these costs are far outweighed by the benefits to the carriers, particularly in inventory costs savings made possible by the ability to get trucks on the road faster. The states likewise would incur both one time start-up and replacement capital costs, but these costs are offset many times over by the annual operating cost savings the states would realize from deploying EC.

A table showing the state-by-state estimates of costs and benefits for EC is provided in Appendix D.3. Tables listing total year-by-year benefits and costs and their discounted values are provided in Appendix D.4.

8.5 State Return-on-Investment Spreadsheet Tool

When CVISN states were asked their priorities for outcomes from a National Evaluation, one of the highly rated products was a "tool for states to estimate their return on investment" (see Table 3-1 above). As part of the BCA for the National Evaluation, a spreadsheet tool, known as the ***CVISN Return-on-Investment (ROI) Calculator,*** was developed to enable states to estimate their costs and benefits of deploying a CVISN electronic credentialing program. The tool was prepared in early 2008 and is currently in review at FMCSA. It is expected to be distributed to all CVISN state program managers for their use. This tool takes into account costs and benefits incurred by state government agencies only, and does not consider costs or benefits incurred by others, including carriers. As a result, outputs of the ROI Calculator should not be interpreted as global or societal benefits and costs of CVISN implementation.

The tool, in Microsoft Excel format, prompts the user to enter a number of general parameters regarding their credentials administration operation and actual or estimated costs and benefits related to their program. Based on the information entered, the calculator provides an annual breakdown of the total costs and benefits over the life of the EC program, as well as the EC program's net present value, benefit/cost ratio, and internal rate of return. All parameters contained in the ROI Calculator can be modified by the user.

States provide the following general or global parameters:

- State
- Base Year
- Project Life (duration in years)
- Discount Rate
- Credentials to be processed (IRP, IFTA, other).

The following state-specific input parameters are also needed:

- Number of motor carrier companies registered in the state in the base year
- Annual carrier growth rate
- Initial enrollment % of carriers in CVISN EC in the base year
- Annual enrollment growth rate %
- Maximum enrollment %
- Number of average annual transactions per carrier.

The inputs for one-time start-up costs and annual operating/maintenance/labor costs basically match those from the CVISN cost self-evaluation template (Appendix G). Inputs for estimated dollar-value benefits are as follows:

- Benefits per IRP transaction
- Benefits per IFTA transaction
- Benefits per other credentialing transaction.

Default values are customized for each state, based on state-supplied self-evaluation data, on the National Evaluation Cost Analysis (Section 6.0), or on default (generally median) national-scale values per state—with a scale factor applied to account for differences in fleet sizes across states—are prepopulated in the ROI Calculator, so that states have the option of using the default values or overwriting the defaults with more current or accurate values. According to the software documentation, states are encouraged to manually input state-specific values wherever possible, and use default values only if no other information is available. The ROI Calculator also allows the user to model a national scenario, combining cost and benefit data from all 50 states.

Results or outputs are shown in summary and annual table format, similar to the BCA tables in Section 8.4 above, as well as graphical chart format. To recap, the benefits and costs calculated by the tool are restricted to those incurred or accrued by state government only, and are not societal in their scope.

9.0 CONCLUSIONS, DISCUSSION, AND DIRECTIONS FOR THE FUTURE

Changing circumstances in transportation funding, and continuing growth in the volume of commercial vehicle traffic in the U.S., have required state and federal transportation and public safety officials to learn to do more with less. Public-sector managers have been faced with the pressure to maintain consistent levels of service and performance while budgets have remained flat or declined, and the numbers of heavy trucks on the road have increased. Among other factors, these trends have hastened the deployment of computer-based technologies to automate many functions that had formerly been performed manually.

The CVISN program, which sprang up to attempt to unify a series of state- and regional-based initiatives, has been and continues to be a successful mechanism for interstate cooperation and information sharing, not only in terms of real-time and historical carrier, vehicle, and driver-based data being applied today in roadside decision-making, but also in terms of programmatic, institutional, and procedural information that is readily passed from one jurisdiction to another. CVISN deployments are constantly evolving as states see and hear about cost-effective approaches in similar states, or develop unique solutions to their local problems. These approaches and solutions are then diffused across the CVISN community and applied case-by-case.

In the 10-plus years that the CVISN program has been advancing, what has been accomplished? And what remains to be done?

- As of fall 2008, 20 states have achieved a basic (Core) level of CVISN deployment, and 25 other states plus DC are on track to achieve this Core Deployment status.

- More than 20% of IRP and IFTA carrier accounts in approximately 30 states providing self-evaluation data are now or soon will be applying for their credentials electronically.

- About half of the states reporting said that 100% of their permanent roadside weigh/inspection stations were connected to CVIEW for purposes of providing carrier data snapshots to inspectors.

- Among 34 states reporting, an average of 54% of each state's permanent weigh/inspection sites are now or soon will be offering ES for transponder-equipped trucks.

- For EC, the most frequently cited qualitative benefits reported by state government officials participating in CVISN included time savings, convenience, improved data quality, and reduced labor or workload. Likewise, for SIE, the key benefits reported were improved screening and enforcement and time savings in inspections. Respondents noted that the deployment of ES led to increased bypass efficiency and reduced backups on approach lanes to weigh/inspection stations.

- State government respondents also noted several lessons learned from CVISN deployment, and areas for continued improvement, such as a need for data quality improvements in some areas, institutional difficulties in arranging credit card payment for credentials in some jurisdictions, difficulties presented by evolving, changing technologies, and a general lack of available, trained information technology or computer networking staff to support CVISN deployment and operation.

- As a general rule, states perceive institutional and interorganizational barriers to be more challenging than the technical barriers they face day-to-day when deploying CVISN technologies.

- Among the 848 motor carrier companies responding to a national survey, most were aware of both ES and EC. When looking at the proportion of commercial trucks (power units) represented in this survey, only about 15% were taking part in ES, while more than 46% were taking part in e-credentialing. Cost to the carrier, which is negligible for e-credentialing, may be a factor in this difference, and may discourage some carriers, especially smaller carriers, from joining e-screening.

- Carriers classed as "giant" or "large" (i.e., operating >100 power units) are much more likely than smaller carriers to be aware of CVISN EC (71% giant/large vs. 32% small).

- There is a positive attitude toward ES among those carriers who participate. Nearly 100% of these carriers report savings in shipping time plus increases in convenience and efficiency.

- When looking at which companies are most likely to participate in ES, giant and large motor carrier companies are much more likely to take part in ES than smaller carriers (23% giant/large vs. 5% small).

- Among the approximately 10 to 25 states supplying some dollar cost data to the CVISN self-evaluation database, the average per-state start-up cost for EC was about $1.35 million (n=25). Average annual operating cost per state was about $250,000 (n=6).

- For SIE systems, the average per-state start-up cost was roughly $680,000 (n=20), with an annual operating cost of roughly $74,000 (n=13).

- ES systems, although varying greatly from state to state in terms of start-up costs depending on the program or partnership, cost an average of between $1 million and $2.8 million per state to deploy (n=17), and approximately $160,000 per state per year top operate and maintain (n=15).

- The CVISN national safety analysis used statistical modeling based on current inspection practices, forthcoming CVISN technologies, field data, historical safety records, and large truck crash causation data to estimate decreases in truck-related fatalities. Possible CVISN roadside inspection selection technologies and methods, if deployed nationally and used to augment the professional experience and judgment of the inspector, could

- For the five RE scenarios modeled in the safety analysis, a 25-year societal benefit-cost analysis (BCA) shows that the benefit/cost ratios range from 1.9 to 7.5, indicating that this CVISN deployment produces positive net benefits over the full range of assumptions contemplated in this study. The total benefits of EC are expected to exceed its total costs by more than a two to one margin, having a benefit/cost ratio of 2.6. Taken together, these results indicate that all aspects of the National CVISN Deployment Program examined in this BCA are expected to produce significant net benefits to society and are economically justified.

- States have a unified CVISN national architecture. Specific terms and procedures of the architecture are subject to open debate, adaptation, and revision over time. Nonetheless, the architecture provides a baseline that brings a level of logic, consistency, and interoperability to what would otherwise be a patchwork of single-state systems.

- States have federal grants and other funding available, within limits and guidelines, to foster the deployment of hardware, software, other infrastructure, and personnel to increase the safety and efficiency of CVO.

- States have a supportive network of direct communication to help them solve problems in CVISN deployment. This network includes monthly state program manager conference calls, support for state CVISN system architects, ad hoc team conference calls, periodic workshops and technology showcases, online training opportunities, peer-to-peer site visit support, and other FMCSA-sponsored mechanisms to disseminate best practices and lessons learned.

Challenges for the future of CVISN are many. One constant barrier to widespread deployment has been funding, from both the state and federal levels. Many states that are otherwise qualified for federal CVISN matching fund grants cannot obtain them because the required nonfederal matching funds are not available. Some states made great strides in deploying their CVISN systems, only to see them decline or fall into disuse because of budgetary pressures that restricted ongoing operations and maintenance resources.

Another challenge is engaging the support and participation of a larger number of motor carrier companies. For a variety of reasons, many carriers—and especially medium to small-sized motor carriers—choose not to take part in the EC and ES opportunities provided through CVISN and related technologies. Some carriers report that they are not aware of the services being offered in the states where they operate. Others may lack the resources to investigate and decide whether the service would be cost-effective for their business environment. Other reasons might include a cultural apprehensiveness toward any changes in operations, especially changes involving advanced technology and data. The motor carrier industry has traditionally prided itself on its independence, and has an inherent sensitivity toward moves that are perceived to be overly restrictive toward law-abiding carriers, infringing on privacy, or verging on "big-brotherism." Even voluntary changes that promise to level the playing field by removing more unsafe vehicles and drivers from the roadways may be viewed with suspicion until their benefits, both in terms of safety and economics, are proven in practice and widely acknowledged within the carrier community.

The future of CVISN, despite these challenges, is bright. States are making solid progress in deploying CVISN technologies, and advances in technology tend to make the deployment process itself more efficient. Automated roadside identification of carriers, vehicles, and eventually drivers promises to afford great benefits in allowing safe, compliant vehicles to deliver their freight more quickly and efficiently, while encouraging chronically unsafe carriers to improve their safety practices. The systems that states have been deploying and continuously operating since the mid-1990s will provide a positive return on investment, when measured in terms of increased efficiency of operations and in terms of estimated reductions in truck-related crashes, injuries, and fatalities over the deployment life cycle of the CVISN systems. The national benefit-cost analysis demonstrates that substantial net benefits will accrue to the states, the carrier industry, and society in general as the levels of CVISN technology deployment and operation increase nationally.

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