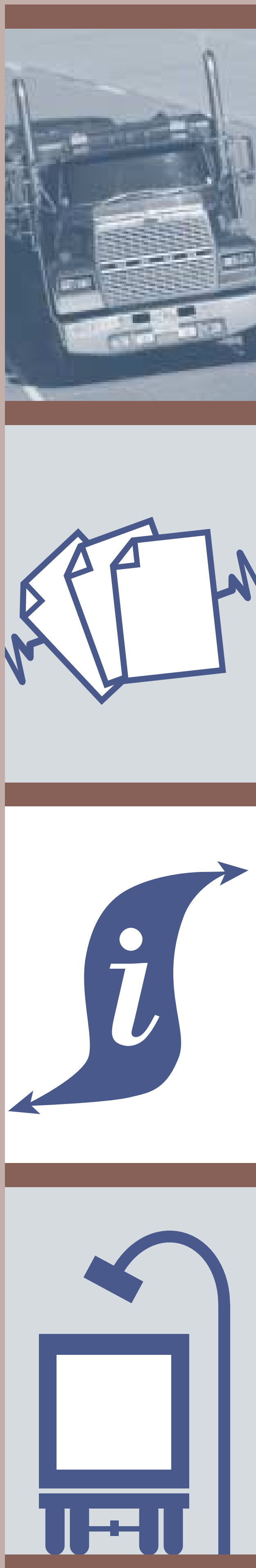


chapter 6

WHAT HAVE WE LEARNED ABOUT ITS FOR COMMERCIAL VEHICLE OPERATIONS? STATUS, CHALLENGES, AND BENEFITS OF CVISN LEVEL 1 DEPLOYMENT

Author:
John E. Orban, Ph.D.
Battelle

EXECUTIVE SUMMARY

Intelligent transportation systems (ITS) offer significant benefits to state motor carrier agencies, the motor carrier industry, and the traveling public. New and emerging technologies, information systems, and communications networks provide the framework for states, the Federal Government, and private stakeholders to electronically collect and exchange motor carrier safety and interstate registration and tax payment information. Use of these technologies supports initiatives by state and Federal agencies, in partnership with the motor carrier industry, to improve highway safety, simplify government administrative credentialing operations, enhance productivity, and reduce delays for safe and legal carriers.

The Federal Motor Carrier Safety Administration (FMCSA) established goals to reduce commercial vehicle fatalities 50 percent by 2010, with a baseline of 5,374 fatalities in 1998, and to reduce the number of persons injured in commercial vehicle crashes 20 percent by 2008, with a baseline of 127,000 injuries in 1998. An overriding objective of the ITS technologies designed for roadside operations is to reduce the number of crashes involving large trucks and the resulting personal injury and property damage. Using ITS technologies, enforcement personnel have access to up-to-date safety and credential information for motor carriers as well as for individual vehicles. This access can improve highway safety by allowing state and federal enforcement officials to concentrate their resources on high-risk carriers and vehicles.

Three main ITS technology areas designed for commercial vehicle operations (CVO) applications are safety information exchange, electronic screening, and electronic credentialing. Since 1991, the U.S. Department of Transportation (U.S. DOT) has sponsored numerous field demonstrations of new technologies. The Commercial Vehicle Information Systems and Networks (CVISN) Model Deployment Initiative (MDI) is one such test involving a handful of states. The goal of the CVISN program is to assist states in achieving an initial, "ambitious but achievable" level of deployment in the three technology areas discussed below. According to FMCSA, 38 states have indicated they are planning to achieve this initial level of deployment, called Level 1 (see Table 6-2 below and Richeson 1999), by September 30, 2003, depending on the availability of federal ITS deployment funds and state resources.

Safety Information Exchange Technologies

Safety information exchange technologies make more up-to-date motor carrier safety information available to enforcement officers at the roadside. 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 1999, 84 percent of states were using Aspen, a software system that facilitates recording and processing of inspection data and provides historical information on the safety performance of motor carriers. Other advanced systems for exchanging safety information at the roadside are also being developed.

Electronic Screening Systems

Electronic screening systems allow certain commercial vehicles (e.g., those with good safety and legal status) to bypass roadside inspection and weigh stations. Such systems are technically feasible and offer tangible, time-saving benefits. Dedicated Short-Range Communications (DSRC) technologies provide reliable communication between moving vehicles and roadside enforcement operations. Much growth in electronic screening has occurred since the emergence of three programs: HELP (Heavy Vehicle Electronic License Plate) PrePass, NORPASS (North American Pre-clearance and Safety System), and Oregon's Green Light. Currently nearly half the states in the United States and nearly 7,000 motor carrier fleets are participating in such electronic screening programs.

The benefits of electronic screening, which are widely acknowledged, vary by carrier type and operating practice. Early field operational tests estimated an average time savings to participating motor carriers of between 1.5 and 4.5 minutes per bypass. States benefit from electronic screening in reduced inspection queues, which reduce the need and costs to build bigger weigh stations. Electronic screening also helps states focus more of their inspection resources on high-risk carriers. Most in the CVO industry agree that interoperability, or the ability for a vehicle to operate with the same equipment and under similar rules as it travels from state to state, is critical to the success of electronic screening at the roadside.

Electronic Credentialing Systems

Electronic credentialing systems provide for electronic administration of interstate registration, fuel tax payment, and other credentials. Preliminary estimates from systems deployed in Kentucky suggest that states and motor carriers using them can save up to 75 percent of the current costs for credentials administration. The integration of legacy credentialing systems with new applications requires careful planning. Sound technical leadership from state personnel familiar with the business application is also important. Two issues that concern the future direction of electronic credentialing are (1) determining data communications standards and protocols and (2) determining which software system (specialized computer programs or Web applications) motor carriers most prefer and accept. In cooperation with states and other stakeholders, FMCSA has taken a survey to evaluate its policy for electronic credentialing to determine needed changes. Results from this survey are expected in early 2001.

The Future

Some advanced roadside technologies, such as weigh-in-motion equipment and Aspen software, are already widely deployed. However, the type and amount of safety information for use during roadside inspections, or for selecting vehicles for inspection, is likely to change dramatically as faster and less costly wireless communication technologies become available. Systems such as SAFER (Safety and Fitness Electronic Record) data mailbox will permit greater use of vehicle-specific safety data (e.g., prior inspection results) during vehicle inspections. Thus, continued development and refinement of systems such as Aspen and CVIEW (Commercial Vehicle Information Exchange Window) are needed.

The growth in electronic screening is also expected to continue. However, carrier enrollment is heavily dependent on solving interoperability issues among the states. Furthermore, as states determine the type of bypass criteria to use, they must communicate these criteria to the carriers and, to the degree possible, establish some level of uniformity within key corridors.

Recent deployment successes, along with the desire to reduce credentialing costs, will help promote further deployment of electronic credentialing. It now appears that multiple solutions, including personal computer- (PC) and Web-based systems, as well as current "paper" systems, will be needed to satisfy the various needs of a diverse industry.

Table 6-1 presents the deployment status of the CVISN technologies that are part of Level 1 deployment, and identifies limiting factors for systems that are not widely deployed. Deployment levels, determined from surveys of states (Radin 2000, PTI 2000), are divided into three categories: Limited (less than 10 percent of states), Moderate (between 10 and 30 percent of states), and Widespread (more than 30 percent of states).

Table 6-1. CVISN Summary Table

Technology	Deployment Level	Limiting Factors	Comments
Safety Information Exchange			
Laptop computers with Aspen or equivalent	Widespread Deployment	N/A	**Successful**
Wireless connection to SAFER at roadside	Moderate Deployment	Technical challenges with communications among systems	**Holds promise**—for identifying frequent violators of safety laws
CVIEW or equivalent	Limited Deployment	Connections to legacy state system	**Jury is still out**—being tested in three or four states
Electronic Screening			
One or more sites equipped with DSRC	Widespread Deployment (no. of states); Limited Deployment (no. of carriers)	Interoperability	**Holds promise**—deployment trend is positive
Electronic Credentialing			
End-to-end IRP & IFTA processing	Limited Deployment	Challenges and costs of connecting legacy systems	**Holds promise**—potential for significant cost savings to states and carriers
Connection to IRP & IFTA clearinghouses	Limited Deployment	Institutional issues	**Jury is still out**—cost savings can only be realized with widespread deployment

Most of the major CVISN technologies have achieved some degree of success. Thus far, the most successful component, demonstrated by widespread deployment, is the use of laptop computers for safety information exchange. Wireless connection to SAFER, electronic screening with DSRC, and end-to-end electronic processing of international registration plan (IRP) credentials have been successfully deployed in some states and will likely enjoy widespread deployment as technical and institutional issues become resolved. The use of license plate readers for automated vehicle identification has not been successful because of low reliability. Most states are relying on voluntary participation of motor carriers in electronic screening programs, which use more reliable DSRC for vehicle identification and communication with the driver. The other components—CVIEW and participation in clearinghouses—show promise, but technical and institutional issues still need to be resolved.

One of the key lessons learned over the past few years is that collaboration among states in cooperation with the Federal Government is key to success. Through the ITS/CVO Mainstreaming program and other state organizations, states have been working together to identify and solve technology problems. The ITS/CVO Mainstreaming program is an FMCSA initiative designed to foster and support ITS deployment and to communicate ITS program information to all stakeholders (U.S. DOT 2000).

Many of the issues presented in this paper were identified and discussed extensively in forums with state officials, who are key stakeholders in future CVISN deployment. Their views on what works and what needs improvement must be considered when charting the future direction of this technology deployment.

INTRODUCTION

ITS is significantly changing the way Federal and state motor carrier agencies conduct business with the motor carrier industry. New technologies are helping to streamline credentialing operations, reduce delays for safe carriers, and improve highway safety by focusing enforcement resources on high-risk carriers. ITS designed for commercial vehicle operations includes the following:

- Safety information exchange technologies to facilitate the collection, distribution, and retrieval of motor carrier safety information at the roadside. These data help enforcement staff focus scarce resources on high-risk carriers and drivers, which, in turn, helps to reduce the number of crashes involving commercial vehicles.
- Electronic screening systems, which allow commercial vehicles that maintain good safety and legal status to bypass roadside inspection and weigh stations. This technology saves time and money for participating carriers and allows states to devote more resources toward removing unsafe and noncompliant carriers.
- Electronic credentialing systems for electronic submission, processing, approval, invoicing, payment, and issuance of credentials; electronic tax filing and auditing; and participation in clearinghouses for electronic accounting and distribution of registration fee payments among states.

Other ITS topics of current interest in the area of CVO include fleet and freight management systems, which are private sector ITS/CVO initiatives, and electronic commerce (e-commerce), which promises to have a great effect on CVO in the years ahead. However, the focus of this paper is on roadside and credentialing systems, deployed by the public sector.

Since 1991, U.S. DOT has sponsored numerous field operational tests to demonstrate new technologies and encourage their deployment. At the same time, it developed some of the key technology components, such as the SAFER database, containing current motor carrier safety data, and the Aspen software that allows state enforcement officers to access the data from computers at roadside. Aspen is a data management software system for collecting and disseminating information on commercial vehicles and drivers. It is interconnected with the SafetyNet and Motor Carrier Management Information System (MCMIS) services, and acts as a front-end interface or umbrella for several functions, including an inspection selection system (ISS), past inspection queries (PIQs), and software for conducting and reporting on individual vehicle inspections.

CVIEW is a related application that provides an interface between state legacy systems and SAFER. CVIEW is a state-owned and state-operated version of the SAFER system. It provides a state with a single point of access to its intrastate safety and credential information and provides SAFER with information about the interstate carriers, vehicles, and drivers based in the state (SAFER 1998).

In 1996, U.S. DOT sponsored the CVISN Model Deployment Initiative involving two “prototype” states—Maryland and Virginia—and eight “pilot” states: California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington. FMCSA developed a three-step strategy of planning, design, and deployment for states embarking on CVISN deployment. In the planning step, a state attends two ITS/CVO training courses and develops an ITS/CVO business plan. For design, a state attends a third training course and participates in a series of three CVISN deployment workshops to complete a CVISN program plan and top-level system design. Once the plan is accepted by FMCSA, a state can proceed with deployment, based upon the availability of Federal and state resources. The goal of the CVISN initiative is to have each state achieve an “ambitious but achievable” level of deployment, called Level 1, in each of the three technology areas shown in Table 6-2. To achieve Level 1 deployment, states must:

- Establish an organizational framework among state agencies and motor carriers for cooperative system development.
- Create a state CVISN system design that conforms to the CVISN architecture and can evolve to include new technology and capabilities.
- Implement all the elements of three capability areas, as described in Table 6-2 (Richeson 1999). These systems must be implemented using applicable architectural guidelines, operational concepts, and standards.

Table 6-2. CVISN Level 1 Deployment

Safety Information Exchange
■ Use of Aspen (or equivalent software for access to safety data) at all major inspection sites ■ Connection to the SAFER system so that states can exchange "snapshots" of information on interstate carriers and individual vehicles ■ Implementation of the 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
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 carrier registration, and hazardous material] ■ Connection to IRP and IFTA Clearinghouses ■ At least 10 percent of transaction volume handled electronically; readiness to sign up more carriers; readiness to extend to branch offices where applicable

Source: Richeson, K.E., Introductory Guide to CVISN (May 1999).

At least three states—Maryland, Virginia, and Kentucky—have demonstrated Level 1 capabilities in all three areas, and many others have made significant progress in one or two areas. The CVISN initiative is now being expanded to other states. According to the FMCSA, 8 of the 48 contiguous states have been fully funded to achieve Level 1 deployment by September 30, 2003. An additional 30 states have indicated that they expect to complete Level 1 deployment by September 30, 2003, depending on receipt of FY 2001 Federal ITS deployment or state resources to support CVISN deployment. CVISN deployment Levels 2 and 3 are currently being defined; it is assumed that states will pursue these levels of deployment without Federal support.

Expected costs and benefits of CVISN technologies have been analyzed in several studies. For reference, a pilot project to deploy CVISN roadside and credentialing technologies in the State of Washington in 1997 through 1999 was estimated to incur incremental costs of $2.7 million, with support expenses estimated to average approximately $600,000 per year for 10 years (Washington State 1998). A benefits study by Mitretek Systems, citing an earlier study by the American Trucking Associations (ATA) Foundation, predicted benefit/cost ratios between 1:1 and 19.8:1 for electronic credentialing; between 1.9:1 and 6.5:1 for electronic screening; and between 1.3:1 and 1.4:1 for automated roadside safety inspection (Mitretek Systems 1999). A benefit/cost assessment in Maryland, which combined CVISN credential processing and safety enforcement technologies, estimated worst-case benefit/cost ratios to be 1.45 for state agencies and 6.67 for motor carriers

(Bapna et al. 1998). Several of these analyses were based on preliminary cost estimates prepared before actual deployment, so findings should be interpreted with caution.

This paper summarizes what has been learned concerning the benefits, costs, issues, and challenges experienced by states and private organizations involved in developing and deploying ITS/CVO technologies. Much of the information is based on Battelle's experience as the independent evaluator for the CVISN Model Deployment Initiative and related field operating tests, including those involving eastern states that make up the I-95 Corridor Coalition. However, many of the opinions herein are derived from organizations participating in developing and deploying these technologies. Some of their views were obtained in formal discussions at recent conferences and meetings, including the following:

- Institute for Transportation Engineers (ITE) 2000 International Conference, April 2000, Irvine, California.
- CVISN MDI Prototype and Pilot States Program Managers Meeting, April 25, 2000, Tampa, Florida.
- Great Lakes and Southeast States CVISN Mainstreaming Conference, May 11–12, 2000, West Palm Beach, Florida.

At each of these forums, a brief presentation—"The Evaluator's Perspective on Deployment Status, Challenges, Benefits, and Outlook"—was followed by facilitated discussions. Participants were encouraged to offer opinions on successes, failures, obstacles, lessons learned, and issues to be resolved. A summary of what we have learned about ITS for CVO is presented in the following sections, organized under the three CVISN technology areas. A brief overview at the end predicts what the future might hold and includes ideas about what needs to happen to help ensure success.

SAFETY INFORMATION EXCHANGE

FMCSA has established goals to reduce commercial vehicle fatalities 50 percent by 2010, with a baseline of 5,374 fatalities in 1998, and to reduce the number of persons injured in commercial vehicle crashes 20 percent by 2008, with a baseline of 127,000 injuries in 1998. Although FMSCA plans new research (e.g., the Large Truck Crash Causation project) to better understand the causes of these crashes, vehicle safety defects and driver violations of the Federal Motor Carrier Safety Regulations (FMCSR) are known to contribute to a portion of them (Volpe Center 1999). Therefore, more and more state agencies responsible for enforcing safety regulations are deploying new technologies that enable enforcement personnel to use current motor carrier and vehicle-specific safety performance data—obtained through safety information exchange—during roadside inspections.

In 1996, about 64 percent of states deployed roadside computers with an early version of Aspen, the software that facilitates recording and processing of inspection data and provides historical information on the safety performance of motor carriers (Radin 2000). Since then, FMCSA activated the SAFER database, which contains carrier safety data as well as recent inspection results, and Aspen was enhanced to take advantage of more current data being available at the roadside. As of December 1999, 84 percent of states were using Aspen, with more than half connected to the SAFER system (Pennsylvania Transportation Institute 2000).

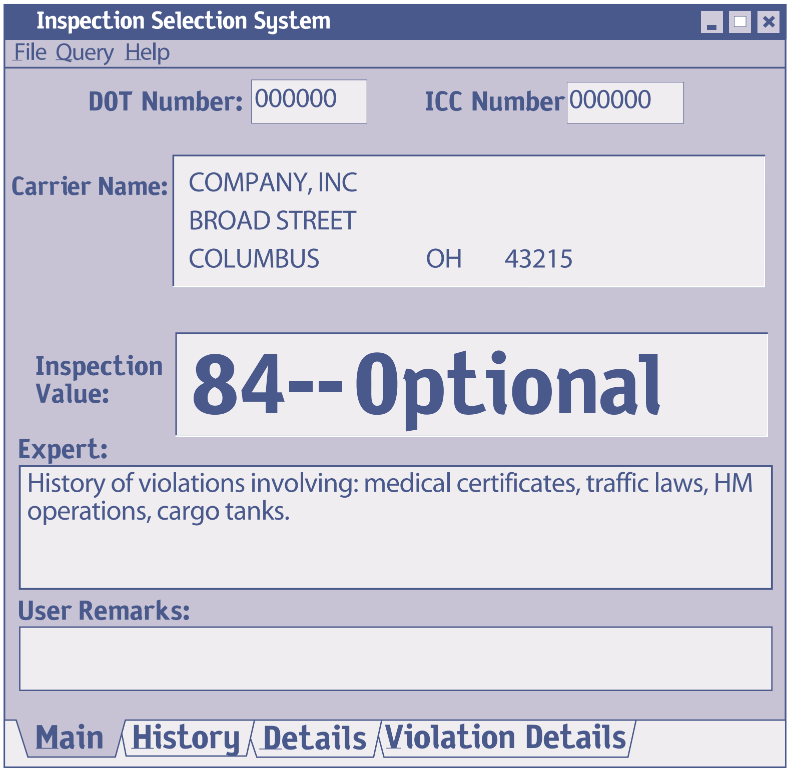
In parallel with SAFER activities, FMCSA has also implemented the Performance Registration Information Systems Management (PRISM) program. PRISM, formerly referred to as Commercial Vehicle Information System (CVIS), links motor carrier information, including inspection information, with registration and licensing information. The PRISM project was piloted in five states for four years, ending in 1997. The pilot study showed that a link could be established between Federal and state information systems and that commercial vehicle registration could serve as a powerful enforcement tool in motor carrier safety programs (Office of Motor Carrier Research and Standards [OMCRS] 1999). Currently, 15 states participate in PRISM (Hart 2000), and U.S. DOT expects to add four to five new states each year for the next several years (OMCRS 1999).

This growth in deployment of safety information exchange technology stems in part from recognition by state commercial vehicle enforcement agencies that this technology facilitates the inspection process and helps focus inspection resources on high-risk carriers (i.e., those with poor safety records). Forthcoming results from a roadside screening study in Connecticut show computers to offer an advantage in helping inspectors select high-risk carriers for inspection from other vehicles in the general population (Battelle 2000). However, this advantage is expected to increase as states develop new ways to integrate this capability into electronic screening and other types of vehicle screening programs at the roadside.

One of the advantages of Aspen is that it provides a tool to record, store, and transmit inspection results. Previously inspection reports had to be handwritten, then keyed in and checked for errors before being submitted in batches to Federal databases. Although cost savings result from eliminating this activity, these savings are offset by the additional time required from enforcement staff to enter the data at roadside for transmission to Federal and state databases (Battelle 2000). A budget analysis performed for U.S. DOT concluded that direct savings to the states from roadside electronic safety systems, including clearance, would generally be less than the cost to deploy and operate the systems (Apogee Research, Inc., 1997).

All states use this data reporting feature of Aspen. However, many differences characterize the way states make use of the data it provides. For example, Aspen contains the ISS, which provides a safety rating for each motor carrier organization (Lantz 2000). As shown in Figure 6-1, ISS gives a rating as well as a description of the carrier's safety record. But despite its name, most states do not use ISS to select vehicles for inspection. Instead, inspectors look up the ISS rating only after a vehicle has been selected for inspection. Two reasons explain this approach: (1) some states have laws that require "probable cause" to stop a vehicle for inspection and (2) there are logistical problems with entering a motor carrier identification number and interpreting results while the vehicle is moving through an inspection site. Nevertheless, inspectors report that they use information from ISS to adjust the way they conduct inspections. For example, the inspector might choose to adjust the level of inspection, or pay particular attention to safety issues reported in the past regarding the carrier in question.

Figure 6-1. Example of the Inspection Selection System Data Available through Aspen

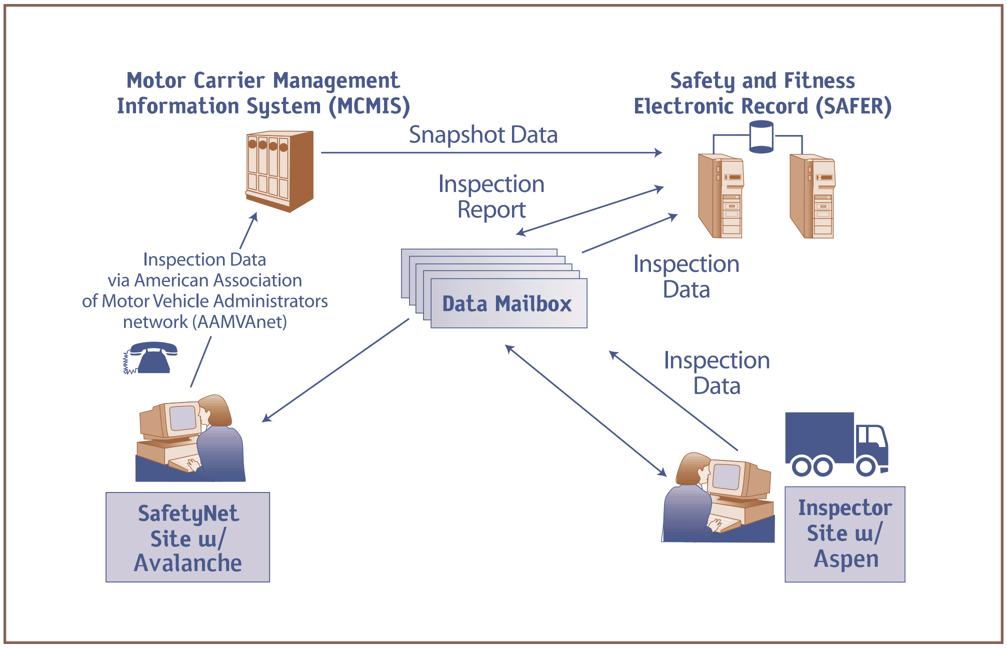


On the other hand, Connecticut officials have found a way to use ISS in selecting vehicles for inspection. Two weigh stations in Connecticut use weigh-in-motion equipment to prescreen trucks. Trucks that fail the screening or are otherwise chosen to stop at the fixed scale are screened again using ISS and prioritized for inspection. This is the only known use of ISS for prescreening trucks at the road-side. A study of the screening efficiency at these sites indicates that a vehicle from a high-risk carrier is twice as likely to be inspected than if inspections were performed at random (Battelle 2000). This efficiency may be due in part to inspector experience, but the study shows that efficiency is slightly greater at sites where the technology is more fully utilized. Also, the inspectors themselves report that ISS helps to improve their efficiency.

Another form of safety information exchange that shows promise is the SAFER data mailbox (SDM). Several states have tested or are routinely using SDM to transmit inspection reports directly from the roadside to the SAFER system. They can also receive previous inspection reports by performing a past inspection query on individual trucks stopped for inspection. States use a variety of communication methods to exchange safety information, including standard telephone lines (land lines) and wireless systems (e.g., cellular or digital). Figure 6-2 shows one way to configure SDM.

Initially, SDM was developed to help identify trucks (and drivers) violating out-of-service (OOS) orders. OOS orders are issued when serious vehicle defects or driver violations must be remedied before the vehicle can return to the highway. SDM was conceived as a tool for helping states identify trucks that leave an inspection site before OOS violations are corrected. However, given the time it takes to enter a vehicle license number, transmit a PIQ to SAFER, retrieve past inspections, and review the results, SDM will not have a big impact on catching OOS order violators unless systems are routinely used to automatically identify vehicles and process the information. Also, this system cannot reach its potential until it is up and running in many more states where officials are committed to uploading inspection results in a timely manner. Currently, some states can upload inspection results by wireless communication immediately following inspection; others perform uploads only once a week.

Figure 6-2. Typical Configuration of SAFER Data Mailbox (SDM)



Some eastern and southern states are now using SDM on a regular basis. Connecticut, for example, reports that inspectors routinely identify recently inspected commercial vehicles. Out of 1,095 PIQs performed in Connecticut during a two-month period in 1999, inspectors found 115 cases (11 percent) where an inspection had not been made on the vehicle in question within the past 45 days. OOS orders had been issued to 40 out of 115 vehicles with positive PIQs. Interviews with inspectors in Connecticut and elsewhere revealed SDM to be helping inspectors identify trends in violations, as some carriers tend to repeat the same kinds of violations over time. The general reaction of states using SDM is positive.

While states have encountered challenges in attempting to deploy roadside computers with Aspen, ISS, and SDM, there appear to be no major impediments to widespread deployment. Difficulties include selection of hardware (hardened for field use), costs and availability of wireless communication services, and finding of qualified internal or external support for developing and integrating computer systems. Efforts such as the I-95 Corridor Coalition and the CVISN Mainstreaming program are helping to resolve these problems by providing forums for information sharing and joint efforts on technology issues. Mainstreaming is a formal program established by FMCSA to promote deployment of CVISN through cooperative planning and problem solving by participating states.

Finally, a key factor in the future of roadside enforcement activities involves deployment of CVIEW or equivalent systems. The purpose of CVIEW is to integrate interstate and intrastate carrier safety data, driver and vehicle information, and a variety of carrier credentials and insurance data. These data will be made available at the roadside in the form of "snapshots" and will be shared with neighboring states.

FMCSA has sponsored and funded development of CVIEW to facilitate state-level exchange of inter- and intrastate carrier, vehicle, and driver safety and credential data to support electronic screening operations and to allow states greater control and flexibility for establishing interfaces with internal state legacy systems. FMCSA will continue to fund development and maintenance support of CVIEW through Version 3.0, which includes all the capabilities required for CVISN Level 1 deployment. As of January 2001, FMCSA will not continue to support CVIEW development because of funding limitations. States that elect to develop a CVIEW system based on the FMCSA-sponsored model will be required to assume responsibility for CVIEW enhancement and maintenance operations.

ELECTRONIC SCREENING

Starting in the early 1990s, field operational tests, such as Advantage I-75 (Interstate 75 corridor), HELP/Crescent (I-5 corridor), and Oregon Green Light demonstrated the technical feasibility and time-saving benefits of using electronic screening systems for commercial vehicle operations. In particular, these tests proved that DSRC technologies provide reliable communication between moving vehicles and roadside enforcement operations. However, most of the growth in electronic screening deployment has occurred with the emergence of three programs: HELP, PrePass, NORPASS, and Oregon's Green Light. Currently, as Table 6-3 shows, 25 states in the United States and nearly 7,000 motor carrier fleets participate in these programs. Furthermore, total truck enrollment in the three programs has grown by approximately 100 percent per year for the past few years.

Table 6-3. State and Motor Carrier Participation in Electronic Screening Programs

	Pre-Pass	NORPASS	Green Light
States	17	7	1
Trucks	129,393	7,500	13,000
Fleets	5,019	800	1,000

PrePass, NORPASS, and Green Light provide similar services and enabling technologies to participating states and motor carriers. Both PrePass and NORPASS assist participating states in recruiting and enrolling motor carriers and provide flexible options to states for motor carrier enrollment and bypass criteria. However, significant differences characterize their business models and operations. PrePass uses private capital to build the infrastructure for automatic vehicle identification (AVI), then recovers those costs through user fees. Generally, trucks pay $0.99 per bypass, up to a specified limit. On the other hand, NORPASS uses state-owned AVI infrastructure and charges an annual administration fee of $45 per truck. Green Light is constructed and administered by the Oregon Department of Transportation (DOT). Oregon offers preclearance to motor carriers at no charge.

The potential benefits of electronic screening are widely acknowledged. The early field operational tests estimated an average time savings to participating motor carriers of between 1.5 and 4.5 minutes per bypass (U.S. DOT 1998). Carriers with good safety records also expect to have fewer inspections. States benefit from electronic screening because it helps them reduce station traffic and thereby avoid the costs of building bigger weigh stations, which can cost as much as $1 million or more, depending on size and on the type of facilities and technologies included. Electronic screening also helps states focus more of their inspection resources on high-risk carriers. As previously discussed, results from a roadside screening study in Connecticut demonstrated that computer-based inspection screening offers an advantage in helping inspectors target high-risk carriers for inspection (Battelle 2000). Integrating electronic screening and safety information exchange capabilities will likely extend this advantage to a higher percentage of the commercial vehicle traffic.

Several key issues can affect further deployment of electronic screening. Most people in the CVO industry agree that interoperability, or the ability for a vehicle to operate with the same equipment and under similar rules as it travels from state to state, is critical to increased participation. Interoperability has three primary dimensions: technical, operational, and business. Technical interoperability refers to the type of DSRC transponders used. So far, transponder type has not been a problem, as all electronic screening applications are using the same equipment. However, interest exists for establishing interoperability with other applications, such as electronic toll collection and border crossings.

Operational interoperability refers to criteria used to enroll and, more importantly, permit trucks to bypass weigh stations. Motor carriers can be expected to want the same bypass criteria as vehicles travel from state to state. Complete uniformity of enrollment and bypass criteria is unlikely to occur, however, because states have different regulations and requirements. For example, states with high volumes of hazardous material (HAZMAT) cargo are likely to have different regulatory priorities than states that deal with agricultural products. Also, differences among states in truck size and weight regulations will lead to differences in bypass criteria. Some success has been achieved toward operational interoperability with the Commercial Vehicle Safety Alliance defining e-screening eligibility categories and the Intelligent Transportation Society of America (ITS America) CVO Committee's Policy Subcommittee working toward establishing minimum enrollment criteria.

The interoperability issue receiving the most attention involves business, namely the relationship between the separate PrePass and NORPASS systems. Some believe that it will be necessary to establish one business entity so that all carriers can deal with multiple states through a single business plan. However, this view is not universal. Features of PrePass and NORPASS are attractive to different types of motor carriers and state agencies. For example, states with an existing AVI infrastructure at fixed sites may prefer the NORPASS plan, whereas states that rely more on mobile enforcement (i.e., stopping and inspecting vehicles along the roadway) or have fewer available capital resources may prefer the PrePass plan. Also, the different fee structures (annual versus use-based) are likely to be attractive to different types of carriers.

Recently, PrePass and NORPASS established a one-way interoperability agreement whereby qualified motor carriers enrolled in NORPASS can operate in the PrePass network (Werner 2000). No corresponding agreement was reached concerning PrePass carriers operating at NORPASS sites. Most agree that some type of interoperability is necessary to attract more carrier participation. However, few agree on the best solution. Some states have negotiated, or are in the process of negotiating, special interoperability arrangements with both PrePass and NORPASS; however, these agreements may not apply to bordering states. While finding a Federal solution has been suggested, it is not a popular choice. The best solution, according to some of the state CVISN program managers, is to have every state pursue business arrangements either with PrePass or NORPASS, then work within the program to achieve interoperability as needed. Most believe that the issues will be resolved through the marketplace.

ELECTRONIC CREDENTIALING

State agencies and motor carriers agree that electronic credentialing offers opportunity for significant cost savings related to motor carrier registration processes. Preliminary estimates, based on experiences in Kentucky, are that cost savings using electronic credentialing can be as high as 75 percent for both the state and the participating motor carriers. For the state, this percentage translates into a potential cost savings of $20 per processed credential. A budget analysis of costs and benefits over time in eight case study states concluded that electronic credentialing can be financially self-supporting (Apogee Research, Inc., 1997).

Although most states are committed to deploying electronic credentialing, these systems have not yet achieved the same level of widespread deployment as experienced roadside systems. This result primarily stems from the many technical challenges involved in establishing interfaces between new and legacy, or archival, databases and software systems.

To date, three states—Maryland, Virginia, and Kentucky—have successfully demonstrated Level 1 capabilities for electronic credentialing. These states are now working with a limited number of carriers to test and refine the developed systems. Additional development continues as issues are identified. The experiences of these states, as well as those of the other seven CVISN pilot states, are being shared with others through FMCSA-sponsored mainstreaming efforts and training workshops.

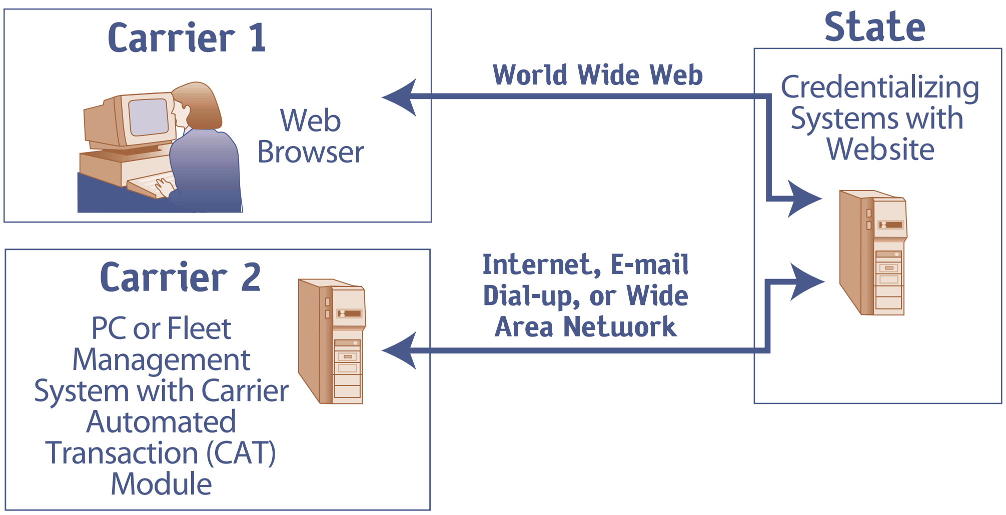
Some of the lessons learned by pilot and prototype states deal with understanding the scope of the project and obtaining the appropriate capabilities to get the job done. Originally, many states had unrealistic expectations that making new systems operational was a simple "plug and play" exercise. However, integration of legacy systems (e.g., licensing, insurance, fee payment, invoicing) with new applications (e.g., SAFER, carrier automated transaction [CAT] software, and Web applications) requires careful planning. Furthermore, some states relied too heavily on technical support from outside contractors without providing adequate technical leadership from state personnel familiar with the business applications. The use of in-house capabilities is considered important, particularly given the shortage of qualified contractors familiar with credentialing operations.

Two issues concern the future direction of electronic credentialing: (1) type of data communications that should be adopted and (2) type of software system (specialized computer programs or Web applications) preferred by and acceptable to motor carriers. The first issue focuses on which of two standards to use for data transmission—electronic data interface (EDI) or eXtensible Markup Language (XML). Some prefer EDI because it is well established; however, others find XML to be more appropriate for Web applications. FMCSA recently sponsored a study to explore the technical approach preferred by large carriers, service providers, fleet management system vendors, and states for electronic credentialing. Results, expected to be available in late 2000, will be used by FMCSA to issue new policies on electronic credentialing.

Originally, the CVISN architecture focused on the use of specialized computer-to-computer (also called PC-based) software, such as the CAT system. With this application, participating carriers obtain the specialized software, then dial in to state credentialing systems to perform various functions (e.g., new and renewal applications, invoicing, error checking, etc.). Discussions with motor carriers using this system in Kentucky reveal that it works well, with carriers experiencing time and cost savings of up to approximately 75 percent.

Since 1999, interest has grown in developing Web-based systems that allow carriers to conduct credentialing business over the Internet. The key advantage of this approach is that any carrier with access to a Web browser can participate in electronic credentialing. Discussions with motor carriers and credentialing software developers suggest that both PC-based and Web-based systems will be needed to satisfy the variety of needs within the motor carrier industry. Figure 6-3 shows the dual interface approach being considered.

Figure 6-3. Dual Interfaces for Electronic Credentialing

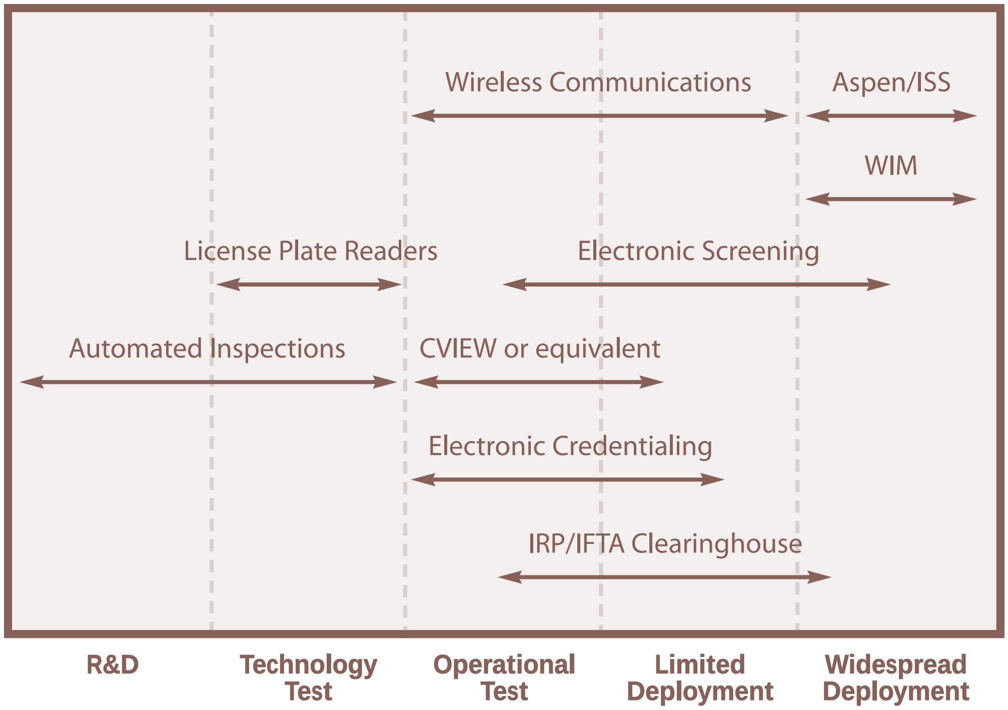


A VIEW OF THE FUTURE

Because of rapid changes in technology, especially in the areas of computer electronics and communication, predictions of where CVISN technology will be in five or 10 years are difficult to make. Nevertheless, a good starting point is to look at the key technology components in terms of their current deployment level, conceptually illustrated in Figure 6-4.

Some technologies used in roadside operations, such as weigh-in-motion equipment, and software systems, such as Aspen (including ISS), are already widely deployed. On the other hand, license plate readers, because of their inherent inaccuracies, are not likely to play a key role in roadside operations. In addition, FMCSA is planning to examine new technologies that identify commercial vehicles not equipped with transponders. Automated inspection technologies, such as those used to detect defective brakes, are still being developed and tested.

Figure 6-4. Conceptual View of the Status of CVISN Technology Deployment in 2000



Growth in electronic screening is expected to continue, both in terms of the number of states participating and number of screening sites. Carrier enrollment, a key to success, is heavily dependent on solving interoperability issues. Furthermore, as states decide the type of bypass criteria to use, they must communicate these criteria to the carriers and, to the degree possible, establish some level of uniformity within key corridors.

The type and amount of safety information that will be used to conduct roadside inspections or to select the vehicle for inspection is likely to change dramatically as faster and less costly wireless communication technologies become available. Systems like the SAFER data mailbox will permit greater use of vehicle-specific safety data (i.e., prior inspection results) during vehicle inspections. Collection and dissemination of other types of data, such as driver information and crash and citation data, will be integrated into roadside systems like Aspen and CVIEW—necessitating continued development and refinement of these systems.

Although electronic credentialing got off to a slow start, recent successes and the desire to reduce costs will help promote further deployment. It now appears that multiple solutions, including PC- and Web-based systems as well as current "paper" systems, will be needed to satisfy the various needs of a diverse industry.

The IRP and international fuel tax agreement (IFTA) clearinghouses, which are being developed to facilitate distribution of funds among states, are still in the early stages of deployment. The IRP clearinghouse currently has 11 states participating in a pilot project. The IFTA clearinghouse has two participating states, with eight more signed up to participate.

One of the key lessons learned over the past few years is that collaboration among states, in cooperation with the Federal Government, is key to success. Through the mainstreaming program and corridor coalitions, states have been working together to identify and solve technology problems. Many of the issues presented in this paper were identified and discussed extensively in such forums. As key stakeholders in the future deployment of CVISN, their views on what works and does not work must be considered in charting the future direction of this technology deployment.

ACKNOWLEDGMENTS

This paper presents information derived from Battelle's experience as an independent evaluator for the CVISN Model Deployment Initiative and the I-95 Corridor Coalition CVO safety field operational tests. Many of the state CVISN program managers and key personnel have contributed to this effort through their participation in data collection efforts and thoughtful conversations on important issues. The author is especially grateful to Lt. Rudolph Supina, Connecticut Department of Motor Vehicles; Commissioner Ed Logsdon, Kentucky Transportation Cabinet; and Gregg Dal Ponte, Oregon DOT, for exceptional cooperation in the data collection efforts; and Norm Schneider, New York DOT, for his support and guidance as chair of the I-95 CVO Safety Committee. Major subcontractors on the Battelle team include Charles River Associates, Castle Rock Consultants, E-Squared Engineering, RS Information Systems, Western Highway Institute, Apogee Research, and Oregon State University. Vince Brown of Battelle provided significant editorial support in preparation of this paper.

REFERENCES

Apogee Research, Inc., *Budgetary Implications of ITS/CVO for State Agencies* (Washington, D.C.: Federal Highway Administration, 1997), EDL No. 10125.

Bapna, S., J. Zaveri, and Z. A. Farkas, *Benefit/Cost Assessment of the Commercial Vehicle Information Systems and Networks in Maryland* (Baltimore, MD: National Transportation Center Morgan State University), EDL No. 9369.

Battelle, *Evaluation of the I-95 Commercial Vehicle Operations Roadside Safety and SAFER Data Mailbox Field Operational Tests* unpublished draft (Columbus, OH: Battelle, June 29, 2000).

U.S. DOT, *Commercial Vehicle Operations—Roadside ITS Field Operational Test Cross-Cutting Study* (Washington, DC: U.S. DOT, November 1998), EDL No. 7863.

Federal Highway Administration, *The Performance and Registration Information Systems Management (PRISM) Pilot Demonstration Project*, MCRT-000-005 (Washington, DC: Federal Highway Administration, December 1999).

Hart, C. J., untitled presentation, *Proceedings of the National Intelligent Vehicle Initiative (IVI) Meeting* (Washington, DC: ITS America, July 19-20).

John A. Volpe National Transportation Systems Center, *OMCHS Safety Program Performance Measures: Assessment of Initial Models and Plans for Second Generation Models* (Cambridge, MA: John A. Volpe National Transportation Systems Center, May 28, 1999).

Lantz, B.M., *ISS-2: The Integration of the Motor Carrier Safety Status Measurement System (SAFESTAT) into the Roadside Inspection Selection System* (Fargo, ND: Upper Great Plains Transportation Institute, North Dakota State University, January 2000).

Mitretek Systems, *Intelligent Transportation Systems Benefits: 1999 Update*, FHWA-OP-99-012 (Washington, DC: U.S. DOT, May 28, 1999), EDL No. 8323.

Pennsylvania Transportation Institute, *Survey of Motor Carrier Safety Activities – Interim Technical Memorandum 2* (University Park, PA: Pennsylvania State University, January 2000).

Radin, S., *Tracking State Deployments of Commercial Vehicle Information Systems and Networks: 1998 National Report* (Washington, DC: U.S. DOT, May 30, 2000), EDL No. 13082.

Richeson, K.E., *Introductory Guide to CVISN*, POR-99-7186 (Laurel, MD: Johns Hopkins University Applied Physics Laboratory, May 1999).

SAFER, "Integrating State Systems into SAFER," *SAFER Report V. 1.2* (Washington, DC: Federal Highway Administration, November 30, 1998).

U.S. DOT, *Introduction to ITS/CVO: Module 8 ITS/CVO Mainstreaming and Next Steps* (Washington, DC: U.S. DOT, undated).

Washington State Patrol Department of Licensing, *Information Technology Feasibility Study for the Washington State Commercial Vehicle Information Systems and Networks Pilot Project* (Olympia, WA: Washington State Patrol, January 8, 1998) EDL No. 9363.

Werner, J., "Nationwide Interoperability of CVO Transponders Takes a First (Small) Step," ITS Cooperative Deployment Network (ICDN) Web Page http://www.nawgits.com/icdn/cvo-compat.html (Austin, TX: Institute of Transportation Engineers, March 29, 2000).