TechBrief

**The goal of the Federal Motor Carrier Safety Administration (FMCSA) is to reduce commercial vehicle related fatalities, as well as the number of persons injured in commercial vehicle related crashes, by 50 percent by the year 2010.**

**FMCSA's Research and Technology programs encompass a range of issues and disciplines, all related to motor carrier and bus safety and security. FMCSA defines a "research program" as any systematic study directed toward fuller scientific discovery, knowledge, or understanding that will improve safety and security, and reduce the number and severity of commercial motor vehicle crashes. Similarly, a "technology program" includes those that adopt, develop, test and/or deploy innovative driver and/or vehicle best practices, and technologies that will improve safety and security, and reduce the number and severity of commercial motor vehicle crashes.**

**Currently, FMCSA's Office of Research and Technology conducts programs in the area of *Driver Safety Performance*, *Commercial Vehicle Safety Performance*, *Carrier Compliance and Safety*, *Safety Systems and Technology*, *Cross-Cutting Safety Initiatives*, and *Security*. The study described in the following Tech Brief was designed and developed as part of FMCSA's Research and Technology *Safety Systems and Technology Program*. The primary goal of this program is to improve the safety, security, and productivity of commercial vehicle operations.**


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# Evaluation of the Commercial Vehicle Information Systems and Networks (CVISN) Model Deployment Initiative

## Background

CVISN is a collection of information systems and communications networks, owned and operated by governments, motor carriers, and other stakeholders, that support Commercial Vehicle Operations (CVO). The CVISN program provides a framework or "architecture" that enables government agencies, the motor carrier industry, and other parties engaged in CVO administrative, safety assurance, and regulatory activities to exchange information and conduct business transactions electronically.

Technologies used in CVISN include information systems and networks that provide electronic links between motor carriers, state agencies, and various national clearinghouses and databases. For example, CVISN information and communication technologies permit roadside enforcement staff to direct drivers on the highway to either bypass or enter weigh and inspection stations. They also provide enforcement staff with up-to-date safety and credentialing information from state or national motor carrier databases.

The Commercial Vehicle Information Systems and Network Model Deployment Initiative (CVISN MDI) began in 1996 with two "prototype" states—Maryland and Virginia—and eight pilot states—California, Colorado, Connecticut, Kentucky, Michigan, Minnesota, Oregon, and Washington. The main purpose of the initiative is to demonstrate the technical and institutional feasibility, costs, and benefits of the primary Intelligent Transportation System (ITS) user services for CVOs. The evaluation of the CVISN MDI was conducted by Battelle, under contract to the ITS Joint Program Office (ITS JPO), and managed by the Federal Motor Carrier Safety Administration (FMCSA).

An initial goal of the CVISN MDI is to have every state reach an "ambitious but achievable" level of deployment, called Level 1. To accomplish 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 specific capabilities in the following three areas:

1. Safety Information Exchange

   Facilitate the collection, distribution, and retrieval of motor carrier safety information at the roadside. These data help Federal and state enforcement staff focus scarce resources on high-risk carriers and drivers, which in turn helps to reduce the number of crashes involving commercial vehicles.

2. Electronic Screening

   Allow commercial vehicles that maintain good safety and legal status to bypass roadside inspection and weigh stations, saving time and money for participating carriers, and allowing states to devote more resources toward removing unsafe and noncompliant carriers.

3. Electronic Credentialing

   Assist in the areas of electronic submission, processing, approval, invoicing, payment, issuance of credentials, electronic tax filing and auditing, and participation in clearinghouses for electronic accounting and distribution of registration fee payments among states.

## Evaluation Goals and Methods

The CVISN evaluation strategy was developed in cooperation with state and Federal government agencies and industry partners. The primary goals of the evaluation project were to document the benefits of CVISN when fully implemented and to conduct a comprehensive benefit/cost analysis to determine if the investments in CVISN are justified. Five states (Connecticut, Kentucky, Maryland, Oregon, and Virginia) were chosen to support the data collection effort, as the rate of the deployment in these states was further along when the evaluation took place.

## Overview of Key Findings

While the data from early deployments are limited, it is clear that CVISN is a good investment for the United States because CVISN can:

- Produce substantial cost savings for states and motor carriers
- Improve the efficiency and fairness of commercial vehicle operations
- Save lives

However, in order to achieve each of these benefits, it's important to recognize that CVISN must be deployed nationwide, and according to consistent standards. In addition, its three major systems should be fully integrated with one another.

Given those requirements, here's an overview of the key findings from the evaluation, from the perspectives of Safety, Cost, Customer Satisfaction, and Benefit/Cost Analysis.

### Safety

CVISN roadside enforcement technologies are expected to have two types of impacts related to roadside safety:

1. The *direct* benefit of improved targeting of enforcement activities on high-risk carriers resulting in more out-of-service (OOS) orders for the same number of inspections performed
2. The *indirect* benefit of increased compliance with motor carrier safety regulations resulting from better enforcement

To date, CVISN utilizes the Inspection Selection System (ISS), used in combination with manual prescreening to select commercial vehicles for inspection. This has already demonstrated an ability to increase the number of out-of-service (OOS) orders issued by two percent compared to traditional (without ISS) screening methods. Based on this data, a crash avoidance model was created which estimated that the use of ISS (without electronic screening), would result in 84 fewer commercial vehicle crashes per year nationwide. Taken one step further, it was then shown that if ISS were combined with electronic screening, approximately 600 commercial vehicle-related crashes could be avoided per year. Using this data as a starting point, it would, therefore, not be unreasonable to expect a modest 10 to 25 percent reduction in safety violations each year if CVISN were widely deployed, fully integrated, and combined with innovative enforcement and outreach strategies.

### Cost

From the viewpoint of electronic screening and safety information exchange at the roadside, CVISN deployment costs were found to be reasonable when viewed in the context of a state's existing roadside enforcement operations. In addition, based on the initial deployments of CVISN, it is believed that electronic credentialing could offer substantial cost savings to states as well as motor carriers, depending on the level of motor carrier participation in the project, and that the savings gained, largely through lower labor costs, would be expected to result in some state staff persons becoming available to work on other priority assignments.

However, these cost estimates do have important limitations. First, they don't necessarily take into account the level of experience with CVISN necessary to provide adequate data for this analysis. Second, is the fact that the computers, infrastructure, and facilities are often maintained (and, thus, their operating costs are accounted for) by agencies that may be different from those engaged in the CVO functions. Third, operation and maintenance costs are often lumped together with other cost items, making it difficult to isolate those costs directly related to credentialing and other CVO functions. And finally, it's worth noting that electronic screening and safety information exchange do not offer states the direct economic savings and payback that electronic credentialing does, except through improvements in transportation safety.

### Customer Satisfaction

The general awareness throughout the national trucking industry of CVISN-type initiatives is currently very low, especially among the smaller trucking companies. Given that fact, some concerns have already been raised regarding the standardization of rules, as well as the procedures that would be required across states, specifically

as they relate to which vehicles or firms most merit inspection among the motor carriers and drivers who are aware of these technologies.

The following items were mentioned most often in the surveys that have been conducted to date:

- Responses to questions about electronic screening methods expressed concerns about cost-effectiveness for the company and expansion of state regulation
- There was fairly universal condemnation of two practices that drivers regarded as inherently unsafe, specifically:
    1. Setting up temporary inspection sites at the side of the road for the purpose of pulling over trucks for inspection
    2. Long waiting lines (tailback) of trucks at scale houses extending back out onto the highway
- Among the drivers with personal experience of electronic screening, the opinions about it were markedly positive, with time savings being given as the primary reason
- State CVO inspectors believe that Safety Information Exchange technology gives them greater credibility with the motor carriers
- Computer-based inspections are seen to represent a significant improvement over previous, paper-based systems, making the work of inspectors more efficient
- Most state CVO administrators are still generally enthusiastic about deploying CVISN as it has already become integral to the jobs of their CVO roadside inspectors

## Benefit/Cost Analysis

The results of the Benefit/Cost Analysis are summarized in Table 1. Specifically, for the three roadside enforcement scenarios, the Benefit Cost Ratios (BCRs) range from 0.62 to 5.0, with a BCR less than 1.0 for the simplest roadside enforcement scenario (the upgrade to Aspen without electronic screening—again, not justifiable on the basis of economics alone).

Moving up to roadside enforcement scenarios that involve electronic screening (RE-2, RE-3, and RE-3*), the BCRs increase considerably, as do the present values (NPVs) of the net benefits of these improvements. Starting with Scenario RE-2 which assumes no change in compliance behavior, the NPV is over $2.5 billion. As compliance behavior hypothetically improves, the increase in the NPV is truly impressive, totaling nearly $6 billion for Scenario RE-3* and over $10 billion for Scenario RE-3.

In addition, the electronic credentialing scenarios (EC) are characterized by huge benefit/cost ratios. For Scenario EC-1, the BCR is 12.5, meaning that the total benefits of electronic credentialing for states not using the third-party VISTA (Vehicle Information System for Tax Apportionment) are more than 12 times as large as the total costs. For states using VISTA, such as those shown in Scenario EC-2, the BCR is over 40. Therefore, the electronic credentialing elements of CVISN easily pass the important BCR criterion for determining whether such systems are economically justified.

**Table 1: Summary of CVISN Benefit/Cost Analysis (BCA) Results**

| Scenario | $, in Millions (rounded) | | | |
|---|---|---|---|---|
| | Total Benefits | Total Costs | Net Present Value | Benefit/ Cost Ratio (BCR) |
| RE-1. Upgrade to Aspen only | 69 | 112 | -43 | 0.62 |
| RE-2. Electronic screening with no change in safety violation rates | 5,301 | 2,636 | 2,665 | 2.0 |
| RE-3. Electronic screening with a 25 percent reduction in safety violation rates | 12,995 | 2,601 | 10,394 | 5.0 |
| RE-3*. Electronic screening with a 10 percent reduction in safety violation rates | 8,379 | 2,622 | 5,757 | 3.2 |
| EC-1. Electronic credentialing in states without VISTA | 558 | 45 | 513 | 12.5 |
| EC-2. Electronic credentialing in states with VISTA | 339 | 8 | 331 | 40.4 |

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**Key Words**
Benefit/Cost Analysis, CVISN, Cost, Customer Satisfaction, Deployment, Electronic Credentialing, Electronic Screening, Safety, Safety Information Exchange.



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## Implications of These Findings

To address the concerns of all the primary stakeholders about the relative costs and benefits of investments in Intelligent Transportation Systems, it's important to recognize that the CVISN Benefit/Cost Analysis presents a comprehensive economic comparison of costs (including start-up and recurring costs) versus the value of the total benefits. It's also important to realize that the analysis was performed for two different scenarios involving electronic credentialing, and three scenarios for roadside enforcement.

Given these facts, the analysis of credentialing operations demonstrates that electronic credentialing is, in fact, a worthwhile investment. Even at 50 percent deployment (i.e., 50 percent of credentialing transactions handled electronically), the benefits (i.e., cost savings) exceed the costs by factors of 6 to 20, depending on certain operating features. Furthermore, the benefit/cost ratio is expected to be even larger once states deploy electronic credentialing for special permits, because the costs to deploy those additional systems will be relatively small since the special permit systems are actually built as add-in modules based on the IRP infrastructure. In addition, the benefits for special permits can be substantial, especially to the motor carrier who requires fast turnaround on such applications.

The Benefit/Cost Analysis of CVISN roadside enforcement technologies also demonstrates the need to integrate safety information exchange and electronic screening technologies. From a development perspective, while it would seem to make sense to think of safety information exchange and electronic screening as separate systems, these systems are actually designed for integrated application, meaning it may not actually be practical to select vehicles for inspection without also having some automated means of identifying vehicles and making decisions.

Another factor affecting the success of electronic credentialing is the recruitment of motor carriers. While the CVISN motor carrier survey suggests that most carriers are receptive to the idea of end-to-end electronic credentialing, questions still remain about how the carriers will communicate with the states electronically. Currently, the following three distinct approaches are being pursued, and it appears at this time that all of them may be utilized to meet the needs of a diverse population of motor carriers:

1. A web-based system that uses a standard Internet browser to connect to the states' web site to submit and retrieve credential applications and responses
2. A stand-alone PC-based program called a Carrier Automated Transaction (CAT) system
3. A system that involves making special modifications or upgrades to existing fleet management systems to communicate directly with state registration systems

Finally, it's important to point out that the benefits of CVISN roadside enforcement technologies could be greatly enhanced in the following two ways. First, as illustrated in Scenarios RE-3 and RE-3*, would be for the carriers to invest more in vehicle maintenance, and for the drivers to improve their compliance with safety regulations in order to avoid inspections and (more importantly) out-of-service orders. And second, by improving the quality of data and analysis algorithms upon which inspection selection decisions are ultimately based.

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