EVALUATION REPORT

Evaluation of the I-95 Commercial Vehicle Operations Roadside Safety and SAFER Data Mailbox Field Operational Tests

FMCSA
Federal Motor Carrier Safety Administration

I-95 CORRIDOR COALITION

March 29, 2002

Prepared for:

U.S. Department of Transportation
ITS Joint Program Office, HOIT-1
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EXECUTIVE SUMMARY

Background

In 1998, the United States experienced nearly 400,000 crashes involving large trucks, resulting in approximately 5,000 deaths. Although new research (e.g., the Large Truck Crash Causation Project) is being planned by the Federal Motor Carrier Safety Administration (FMCSA) 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 some portion of these crashes. Recent studies indicate that approximately 10 percent of all large truck crashes, and the resulting lives lost, could have been avoided if all trucks and drivers were in compliance with safety regulations.

The Federal Motor Carrier Safety Administration (FMCSA) was established within the Department of Transportation on January 1, 2000. Formerly a part of the Federal Highway Administration, the FMCSA has as its primary mission the prevention of commercial motor vehicle-related fatalities and injuries. Administration activities contribute to ensuring safety in motor carrier operations through strong enforcement of safety regulations, targeting high-risk carriers and commercial motor vehicle drivers; improving safety information systems and commercial motor vehicle technologies; strengthening commercial motor vehicle equipment and operating standards; and increasing safety awareness. To accomplish these activities, the Administration works with Federal, state, and local enforcement agencies, the motor carrier industry, labor safety interest groups, and others. In 1999, the Agency announced as one of its specific goals to reduce commercial truck-related injuries and fatalities by 50 percent before 2010.

Over the past few years new technologies, including computer software and database and communication systems, have been developed to assist in the enforcement of motor carrier safety regulations. These systems, which are now being tested by state enforcement agencies, have significant potential for improving highway safety.

This document summarizes the results of the evaluations of two field operational tests (FOTs) of innovative technologies for deployment and exchange of roadside safety information:

- The Safety and Fitness Electronic Record (SAFER) Data Mailbox (SDM) system, a real-time data exchange system that enables roadside enforcement staff to submit commercial vehicle inspection results to a centralized database (SAFER) and to obtain prior inspection reports from other locations, including out of state, in order to identify carriers violating out-of-service (OOS) orders.
- I-95 Corridor Coalition's Field Operational Test (FOT) 7, which tested a wide range of inspection procedures and technologies used by roadside enforcement personnel to target high-risk carriers.

In 1997, the states of Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia agreed to participate in a FOT to evaluate the performance, costs, and benefits of SDM. Funding for the SDM system was originally authorized by the U.S. Congress in the Department of Transportation and Related Agencies Appropriations Bill, 1996 (published August 4, 1995). Connecticut, a state with extensive experience using laptop computers in its commercial vehicle enforcement program, joined the project in early 1998. However, Connecticut's participation in the SDM project was not funded through the Eastern States coalition grant. Because all of the state participants in the SDM project were members of the I-95 Corridor Coalition, it was agreed to continue the deployment of SDM under the I-95 FOT program. The Coalition's FOT 7, which focused on roadside safety enforcement technologies, included six eastern states: Connecticut, Maryland, Massachusetts, New York, Pennsylvania, and Rhode Island.

The results of these projects are presented jointly in this report because of the overlap in states participating and the shared evaluation objectives. Many states combined funds from the SDM project and FOT 7 to accomplish the same objectives. In addition, Battelle, as evaluation contractor for both projects, as well as for the Commercial Vehicle Information System and Networks (CVISN) Model Deployment Initiative, coordinated evaluation data collection and analysis activities among these projects. While SDM focused more narrowly on technologies for identifying out-of-service order violators, there are common issues related to time, cost, and institutional concerns raised by all three projects, leading to closely related conclusions.

A challenge in evaluating SDM and FOT 7 was the variation among states in commercial vehicle enforcement practices and in the degree to which they have adopted safety information exchange technology. The uses of these technologies and related systems vary with both individual characteristics of the inspectors and with the characteristics of the administrative systems in which they operate. Chapter 2 of this report provides an overview of current commercial vehicle enforcement practices in the participating states.

Objectives

The evaluation goals for CVISN, the SDM project, and for FOT 7 were established by the member states. Specific hypotheses or study questions were developed to guide the analysis of each evaluation goal. While the goals for the two projects were not identical at the outset, they had common components which can be summarized as follows:

FOT 7, SDM, and CVISN Evaluation Goals

- Demonstrate the effectiveness of using current safety performance data to help identify high-risk carriers, drivers, and vehicles and to identify out-of-service (OOS) order violators during roadside enforcement,
- Evaluate the time, cost, and other impacts of electronic collection of roadside safety information for upload and dissemination to regional and national databases,
- Identify institutional issues and benefits related to the use of this technology, and
- Assess the effectiveness of public outreach programs for deterring OOS violations.

As detailed in the SDM and FOT 7 Evaluation Plans, a single set of tests, representing a variety of data collection and/or analysis efforts, were proposed to address the evaluation goals and hypotheses. Several of these tests were also designed to be used in the CVISN evaluation. The tests were modified as necessary to ensure that SDM and FOT 7 were addressed. Chapter 4 provides a summary of each test conducted, and Chapter 5 details the findings of these tests.

Findings

The findings from this study lead to several general conclusions and trends:

- Utilization of laptop computers with ASPEN software, including components of SAFER Data Mailbox, has increased steadily since the system became operational in 1997. Most eastern states are uploading inspection results to SAFER on a regular basis, but the time between completion of the inspection and uploading the report varies from state to state, depending on the type of communication technologies used.
- Inspectors report a general satisfaction with the ASPEN system, and report that laptop computers have become an integral part of conducting motor carrier inspections.
- Computer technology is seen as helping inspectors (a) gather more complete inspection information, (b) work more efficiently, and (c) save time compared with traditional paper-based inspection systems. Findings on actual time savings versus paper were equivocal. Some inspectors reported a net time savings, while others reported that computer-based systems required just as much time as paper-based systems to conduct inspections at roadside or at weigh stations.
- Inspectors perceive that using more current and accurate inspection data, as provided by computer-based inspection technologies, helps them (a) target their inspection efforts better, (b) find recent out-of-service orders more readily, and (c) spot patterns in motor carrier violations more easily.
- Until electronic screening technologies are deployed and integrated with the Inspection Selection System (ISS), it is not practical to screen all trucks on the highway using ISS. However, it was demonstrated that inspection selection efficiency, measured in number of out of service orders per inspection, increased by about 2 percent when ISS is used in combination with manual pre-screening.

Simulation results indicated that inspection selection efficiency will increase by 11 percent when ISS is integrated with electronic screening.

- Few violators of out-of-service orders have been identified using SAFER Data Mailbox. However, inspectors have found that past inspection results provide useful information for detecting current violations.
- The full potential for SAFER Data Mailbox will not be realized until all states upload inspection results in a timely manner (i.e., in less than 2 hours). Greater potential is possible if the system is used in combination with electronic screening systems which automatically identify the vehicle at highway speeds.
- Inspectors responded most positively to the improved uniformity, legibility, and neatness of the computer-generated inspection reports.
- Roadside tests of the Inspection Selection System in Connecticut showed that computers offered a marginal advantage in helping inspectors target high-risk carriers for inspection over vehicles from other carriers in the general population.
- Costs for equipment were estimated to range from $7,500 to $9,175 per system, with itemized component costs as follows:

- Sierra Wireless MP210	$800 – 1,615
- Desktop PC plus internal modem	$1,200 – 1,600
- Brayley box	$2,300
- Laptop PC	$3,000 – 3,360
- Printer	$200 – 300

- Inspectors tended to speak more of immediate, day-to-day operational benefits of the computers than any perceived long-term, national benefits in highway safety resulting from the wider adoption of computer-based inspection technologies.
- Issues remaining to be resolved include
  - The overlapping of government jurisdictions and responsibilities for purchasing equipment, maintaining systems, and training staff
  - Data security and reliability
  - Convenience of laptop computer and peripheral equipment used in patrol vehicles and at roadside inspection sites
  - Costs and availability of wireless communication services, especially in rural areas.

Lessons Learned

The I-95 FOT-7 and SDM projects encountered many of the challenges that are typical of attempts to deploy new technologies to improve complex operations, such as those involved commercial vehicle safety enforcement. All of the states participating in these FOTs agree that these improvements are needed and support the use of information exchange technologies such as ASPEN software and programs like SAFER Data Mailbox. However, there are many factors that affect the success of such deployments. For example, ASPEN underwent several revisions during the testing phase of SDM. Also, each state participating in the project had to deal with unique problems involving software installations, hardware maintenance, system training, and integration of databases. Most states agree that smaller, more targeted projects may be more effective in testing technologies like SDM.

The biggest challenge faced by states implementing SDM involved the use of wireless communications. Connecticut was successful in converting to wireless systems partly because of their own in-house capabilities, but also because they have wide coverage with CDPD communication services. Other states found themselves investigating more costly and technically challenging alternatives. For example, New York and Pennsylvania investigated the use of satellite technology. However, it was never implemented due to cost constraints, technical challenges, safety concerns, and delays in deploying the required satellite infrastructure.

The following are some lessons learned by participants in the SDM project. These lessons are expected to provide guidance for long-term implementation of SDM statewide, in other states, and implementation of similar projects in the future.

- States should be included in the consultant selection process.
- Project responsibilities should be shared among all participating states.
- Identify features unique to a state and take those into account in designing and implementing the project. Information exchange and other things that work in one state may not necessarily work with other agencies or states.
- Redesign the Brayley box with commercial vehicle inspectors and their working environment in mind. Brayley boxes are not considered effective by some states. The laptop (MDT) configuration was found to be more flexible compared to Brayley boxes.
- In implementing SDM systems, communication costs should be taken into account.
- It became clear that the level of available wireless communication services varied greatly between states. Coastal states like Delaware, Connecticut, and Rhode Island generally had CDPD services available statewide, while larger, inland states like New York and Pennsylvania often lacked such coverage in large portions of their state. Furthermore, alternative analog services available in these areas were expensive and not reliable. Unfortunately, the technical consultant to the SDM project made the initial assumption that CDPD coverage would be available to almost all areas of the seven participating states, which turned out to be incorrect. In response, New York is continuing to explore other wireless options, such as CDMA, that is showing some promise upstate. Attempts to deploy and test an alternate system in Pennsylvania using satellite communications were not successful.
- Early on, the SDM project was envisioned to test out various wireless technologies beyond CDPD once it became apparent that adequate coverage was not available in all the involved seven Eastern States. Unfortunately, the technical consultant never demonstrated adequate knowledge of the alternatives, including the use of analog wireless and satellite wireless. In many cases, the states were left to solve their own technology deployment issues, after the consultant made the initial technology selection for them.

- For larger states, the issue of providing ISS type data for all carriers—both interstate and intrastate—also was identified. States view all carriers the same but only interstate carriers are under the jurisdiction of USDOT. Inspectors need to be able to have real-time access to safety and credentialing data for all carriers, but most systems developed by USDOT to date have provided this for only interstate carriers. FMCSA appears to understand this issue and is trying to address it.

Directions for Future Research

The customization or adaptation of computer systems to the roadside working environment, noted in the focus groups and interviews, are important indicators of the degree to which inspectors are accepting the technology. Firsthand observations or accounts of such user adaptations, if analyzed in greater detail, may provide clues to not only the degree to which inspectors are invested in the technology, but also the practical, operational needs the inspectors face in day-to-day operations.

The integration of safety information exchange technologies with electronic screening systems could produce significant benefits by focusing enforcement efforts on high risk carriers. This will result in fewer crashes involving unsafe trucks and drivers. However, research is need to find the best ways to use the safety information to identify trucks and drivers that represent the biggest risks.

Satellite communication may offer an alternative for wireless exchange of data to and from the roadside. While initial and operating costs seem high, and data transfer rates are relatively low, satellite communication may provide states a way to avoid the substantial cost of building, deploying, and maintaining new statewide infrastructure for existing wireless technologies such as CDPD.

Future research should also explore the ratio of time to information that is at the center of the inspection system. The time spent in conducting and reporting on an inspection using paper and computer-based systems could be compared and analyzed, as could the amount, accuracy, and timeliness of information available to decision-makers resulting from both ways of conducting inspections.

The effect of computer-based inspection technologies on the motor carrier companies and the truck drivers themselves could be explored. The tests discussed in this report were more concerned with the adoption of the technology among the inspector community. It can be assumed that changes in inspection practices will lead to adaptations among drivers and operating companies. Many of the same tests used to gauge inspector attitudes and opinions, such as interviews, focus groups, and observations, plus more quantitative measures of compliance and highway safety, could also be applied to the motor carrier community.

1. INTRODUCTION

In the United States in 1998, a total of 4,935 large commercial vehicles were involved in fatal crashes, an estimated 89,000 were involved in injury crashes, and an estimated 318,000 were involved in property-damage-only crashes (FMCSA 2000). Although new research (e.g., the Large Truck Crash Causation Project) is being planned by the Federal Motor Carrier Safety Administration (FMCSA) 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 some portion of these crashes. According to a study conducted at Oregon State University, 4.6 percent of all commercial vehicle crashes involved truck mechanical defects as a factor contributing to the crash (Miller, et al. 1996). Another study (Volpe 1999) estimated that 5.7 percent of truck crashes had driver-contributing factors that could have been identified during roadside inspections. Combining these figures, one could conclude that approximately 10 percent of all large truck crashes, and the resulting lives lost, could have been avoided if all trucks and drivers were in compliance with safety regulations.

While it may not be feasible to eliminate all violations of safety regulations, these statistics (approximately 400,000 crashes and 5,000 deaths) are useful for defining the potential benefits of improving safety enforcement processes at the roadside. Over the past few years new technologies, including computer software and database and communication systems, have been developed to assist in the enforcement of motor carrier safety regulations. These systems, which are now being tested by state enforcement agencies, have significant potential for improving these processes.

In the 1990s the Department of Transportation (DOT) initiated several efforts to further develop and test these technologies. The development efforts included the establishment of the Safety and Fitness Electronic Record (SAFER) database system and related software for accessing and distributing data. SAFER provides local enforcement agencies with access to useful safety information on interstate motor carriers, including recent inspection reports on individual trucks.

To test these systems, DOT funded a variety of field operational tests (FOTs) and the Commercial Vehicle Information Systems and Networks (CVISN) Model Deployment Initiative, which included a wider range of technologies applicable to commercial vehicle operations. DOT also funded coalitions of states, such as the I-95 Corridor Coalition, which promoted collaboration among states and the development of regional solutions to certain problems.

Software and Systems at a Glance

The following are some of the most important software applications and intelligent transportation systems in use in commercial vehicle operations and enforcement today. A list of abbreviations and their definitions appears at the end of this report. More information can be found in a CVISN glossary prepared by Johns Hopkins University (1998).

Aspen: A pen-based roadside inspection system that allows commercial vehicle inspection data to be electronically transferred to SAFETYNET, either via AVALANCHE or the CVIEW/SAFER Data Mailbox System.

AVALANCHE: Serves as a communications handler and preprocessor for inbound vehicle inspection reports coming from the ASPEN inspection software.

BLIZZARD: A software system for managing exchanges of inspection data between SAFER Data Mailbox, CVIEW, and SAFETYNET.

CDLIS (Commercial Driver's License Information System) A software system that serves as a pointer to the complete record kept by the state issuing the license. The system is intended to provide states with the ability to check a nationwide information system for possible duplicates or for a suspended license before issuing a commercial driver's license to an applicant.

CVIEW (Commercial Vehicle Information Exchange Window) A state-based system that provides carrier, vehicle, and driver safety and credential information to fixed and mobile roadside inspection stations.

CVISN (Commercial Vehicle Information Systems and Networks) The collection of state, Federal, and private-sector information systems and communications networks that support commercial vehicle operations. When fully deployed, the system will enable the delivery of electronic services to states and carriers in areas such as safety, credentials, and electronic clearance.

ISS (Inspection Selection System): A software algorithm that prioritizes carriers using SAFER snapshot data.

NCIC (National Crime Information Center) A national, computerized central index operated by the FBI and linking documented files of local and State criminal justice agencies for real-time inquiries.

PC*MILER: A commercially available point-to-point highway routing, mileage, and mapping software application, offered by ALK Associates, Inc. (Princeton, NJ). Provides latitude/longitude routing, route optimization, leg and cumulative mileage, time and cost estimates, detailed driving instructions, etc. The system is used by both motor carriers and state safety investigators.

PIQ (Past Inspection Query) A module of Aspen that retrieves information on past inspections of a specific vehicle (by license plate number) and driver from the SAFER/driver-vehicle system. The PIQ system requires landline or wireless communications between the roadside and a central database system.

SAFER (Safety and Fitness Electronic Record) An on-line nationwide data network that, when fully deployed, is intended to return a standard carrier safety fitness record to the requestor in a few seconds.

SafeStat (Safety Status Measurement System) A summary measure of a motor carrier's safety performance and history.

SAFETYNET: A distributed system for managing safety data on both interstate and intrastate motor carriers and for the federal and state offices to electronically exchange data on interstate carriers with MCMIS.

SIE (Safety Information Exchange) The electronic exchange of safety data and supporting credential information regarding carriers, vehicles, and drivers involved in commercial vehicle operations. These decisions would be based on the ready availability of historical safety performance information.

Source: Johns Hopkins (1998, 2000)

FOTs that involved the development and deployment of safety information exchange technologies for use by state safety enforcement personnel include the SAFER Data Mailbox (SDM) FOT, involving six eastern states, and three safety-related FOTs (FOT 7, FOT 9, and FOT10) sponsored by I-95 Corridor Coalition Commercial Vehicle Operations (CVO) Working Group. In particular, FOT 7 tested a wide range of technologies for use by roadside enforcement personnel.

The SDM system uses a variety of advanced database and electronic communication technologies to provide up-to-date motor carrier and vehicle-specific safety information to enforcement officers at the roadside. The SDM FOT was designed to demonstrate the feasibility of using SDM technology to help enforcement staff identify commercial vehicles and drivers that violate out-of-service (OOS) orders. In part, this initiative was an outgrowth of several activities undertaken by states and the Federal Highway Administration (FHWA) in the mid-1990s to ensure that serious commercial vehicle safety violations were corrected before these operators returned to the nation's highways.

The Corridor Coalition's FOT 7 is closely linked to the SDM project, partially because it involves some of the same states, but, more importantly, because they share the same objectives. Both FOTs use the same communication links to help focus enforcement resources on high-risk carriers and drivers and to evaluate the broader impacts of safety information exchange technology.

The SAFER Data Mailbox Field Operational Test

In 1997, the states of Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia agreed to participate in a FOT to evaluate the performance, costs, and benefits of SDM. Connecticut, a state with extensive experience using laptop computers in its commercial vehicle enforcement program, joined the project in early 1998. However, Connecticut's participation in the SDM evaluation was not funded through the Eastern States coalition grant. The FOT was divided into two phases. In Phase 1, SDM provided the capability to send electronic inspection reports from the roadside to the national SAFER database immediately after an inspection is performed. Phase 2 tested the ability to retrieve past inspection results on specific vehicles. These are the key features of SDM that allow enforcement officers to identify violators of OOS orders. The FOT was officially completed by the end of January 1999. However, most states planned to expand the deployment of SDM and related technologies after the test was completed. Descriptions of SDM and its key components are provided in Chapter 2. Because all of the states participating in SDM were members of the I-95 Corridor Coalition it was agreed to continue the deployment of SDM under the I-95 FOT program.

In addition to the seven Eastern states, participants in the SDM project included the Johns Hopkins Applied Physics Laboratory (SAFER development), SAIC (SAFER operations and maintenance), RSIS (SDM support contractor), and the FMCSA (formerly the Office of Motor Carriers of the FHWA), the funding agency and developer of the ASPEN software system.

Battelle, prime contractor for ITS Program Assessment Support to the ITS Joint Program Office, and Battelle's subcontractor, Castle Rock Consultants, were responsible for SDM evaluation.

The I-95 Corridor Coalition's Safety-Related FOTs

The I-95 Corridor Coalition is a partnership of the major public and private transportation agencies, enforcement agencies, toll authorities, and industry associations that serve the Northeast Corridor of the United States, from Maine to Virginia. The Coalition places a high priority on commercial vehicle operations because of the significant role that motor carriers play in moving goods and people throughout the region. The goal of the Coalition's CVO program is to enhance the safety and economic well-being of the I-95 Corridor. To accomplish this goal, the Coalition funded FOTs in four areas: inspection procedures and technologies that target high-risk carriers (FOT 7), electronic registration (FOT 8), electronic screening (FOT 9), and safety management (FOT 10). Because of its concurrent role in the evaluation of CVISN and SDM, Battelle was contracted to serve as the independent evaluator for the safety-related FOTs (FOTs 7, 9, and 10).

At the time that this evaluation got under way, Virginia, the state participating in FOT 9, was reassessing its approach to conducting the electronic screening test. For this reason, the Coalition's CVO Program Track Safety Subcommittee directed the evaluation team to defer plans to evaluate FOT 9.

The objective of FOT 10, Coordinated Safety Management, was to move toward a performance-based motor carrier safety compliance and management program that would reduce highway accidents and incidents in the I-95 corridor. The Coalition funded two projects. The state of Maine was to implement a modification to its state databases to allow use of a single U.S. DOT number for interstate, and some intrastate, vehicle credentialing. Participants in the second project included the states of Connecticut, New York, and Pennsylvania, and the ATA Foundation. This project was to study best practices in CVO enforcement and motor carrier safety compliance programs. The FOT would result in a CVO enforcement "toolbox" and a motor carrier safety "toolbox," as well as educational materials and recommendations for outreach. This project complemented and extended the other safety-related tests, and therefore did not require a separate evaluation. Instead, results from of FOT 10 were to be used as input to the evaluation of FOT 7.

Because of the delayed status of FOT 9, and the interrelationship between FOT 7 and FOT 10, the Subcommittee directed the Battelle evaluation team to focus only on FOT 7. FOT 8, which dealt with electronic credentialing, was being evaluated separately.

FOT 7

The Coalition requested letters of intent for states to participate in FOT 7 in early 1997. The purpose of the FOT was to test the implementation of procedures and technologies that enable state inspectors and enforcement officers to focus roadside inspections on high-risk motor carriers. Six states were awarded funds to participate: Connecticut, Maryland, Massachusetts, New York, Pennsylvania, and Rhode Island. The project was designed to:

- Accelerate the deployment of pen-based and laptop computers [initiated under the Motor Carrier Safety Assistance Program (MCSAP)] and provide uniform training in their use to roadside inspectors and enforcement officers throughout the Corridor.
- Use these computers and specialized decision-support software (developed by the Volpe National Transportation Systems Center and others for the FHWA) to assist inspectors and enforcement officers in the selection of carriers for roadside inspection.
- Use these computers and specialized data entry software (developed by the FHWA) to streamline inspection procedures and reporting.
- Establish roadside communication links to the SAFER system (developed by the FHWA) so that inspectors and enforcement officers have real-time access to motor carrier safety performance records, and
- Pilot test the SAFER data mailbox system so that inspectors and enforcement officers have immediate access to regional and national data on vehicle and driver out-of-service orders and recent motor carrier inspection reports.

Battelle and its subcontractors were also responsible for evaluating FOT 7. Chapter 2 includes details on states' approaches to implementing this test.

Coordination of SDM and FOT 7 Results in this Final Report

The approach developed to evaluate the SDM project was described in the *SAFER Data Mailbox Evaluation Plan* (March 1999). The plan presented the evaluation goals and hypotheses to be tested and described the variety of data collection and/or analysis efforts proposed to answer the study questions. A similar plan described the evaluation approach to the I-95 Corridor Coalition Safety-Related Field Operational Tests, primarily focusing on FOT 7 (*Draft Evaluation Plan,* April 1999). There was substantial overlap in the evaluation objectives of both FOTs, as well as in the number of states participating. Connecticut, New York, Maryland, and Pennsylvania were participants in both programs. Many states combined funds from the SDM project and FOT 7 to accomplish the same objectives. The evaluation plans highlighted the close coordination among the SDM project, the Corridor Coalition's FOTs, and a third project, the CVISN Model Deployment Initiative (MDI) involving ten prototype and pilot states (Maryland, Virginia, Washington, Oregon, California, Colorado, Minnesota, Michigan, Kentucky, and Connecticut).

As evaluation contractor for all three efforts, Battelle coordinated data collection and analysis activities in order to make maximum use of available evaluation resources and to reduce the "evaluation burden" on states participating in multiple projects using the same technology. In recognition of the shared interests of the two projects, this report presents the results of both the SDM demonstration and FOT 7. While SDM focused more narrowly on out-of-service violators, there are common issues related to time, cost, and institutional concerns raised by both projects, leading to closely related conclusions.

Organization of this Document

In the remainder of this document, we provide an overview of safety information exchange technology deployment and the approaches employed by the participating states (Chapter 2). Chapter 3 presents the evaluation goals, measures to be tested, and hypotheses or study questions originally posed for the SDM and FOT 7 projects, as well as the combined four goals addressed in this report. In Chapter 4, we describe the technical approach to the evaluation with a brief synopsis of the primary data collection and analysis efforts undertaken. Chapter 5 presents our findings, and conclusions are stated in Chapter 6. References and a list of abbreviations are also included.

Appended to this report are several documents that expand on or provide background for the information and results:

- Appendix A presents a summary and analysis of quantitative and open-ended responses to a survey of motor carrier inspectors, along with detailed tabulations of numerical answers and transcripts of verbal responses.
- Appendix B presents results from in-person interviews and focus groups conducted with motor carrier inspectors.
- Appendix C gives the results of a roadside screening assessment study in Connecticut.
- Appendix D is summary a tabulation of safety information system deployment plans as reported by nine Eastern states.
- Appendix E presents the results of a study of costs and institutional issues related to SDM technology deployment.

2. OVERVIEW OF SAFETY INFORMATION EXCHANGE TECHNOLOGY DEPLOYMENT

A challenge in evaluating SDM and FOT 7 was the variation among states in commercial vehicle enforcement practices and in the degree to which they have adopted safety information exchange technology. The uses of technologies such as ASPEN, the Inspection Selection System (ISS), SAFER, and related systems vary with both individual characteristics of the inspectors and with the characteristics of the administrative systems in which they operate. The following provides a brief overview of current commercial vehicle enforcement practices in general and the specifics of deployment in the participating states. Appendix D summarizes responses from nine states to a questionnaire on current commercial vehicle enforcement practices.

Current Commercial Vehicle Enforcement Practices

All participating states have fixed sites and mobile units for conducting commercial vehicle enforcement, ranging from one site in Delaware to as many as 200 sites in New York. Most inspections are performed along major interstates and state highways at fixed weigh stations, rest areas, exit parking areas, or other suitable roadside locations. States use various resources while conducting commercial vehicle inspections such as

- Trained personnel—Department of Transportation or Public Utility Commission safety inspectors, State Police Officers, etc.
- Vehicles—vans, trucks, patrol cars
- Computer equipment—file servers, laptops, pen-based computers, etc., and
- Communication technologies for reporting inspection results or to obtain prior inspection reports—paper, diskette, telephone land lines, switch circuit cellular, cellular digital packet data (CDPD) technology, 800 MHz wireless, and satellites.

A typical inspection team consists of two or three inspectors. The inspectors usually select trucks for inspection randomly, on the basis of reasonable cause (e.g., an observed potential violation), or based on recommendations of the ISS. In general, vehicles displaying current Commercial Vehicle Safety Alliance (CVSA) decals are not selected unless an obvious violation is noted. For interstate carriers, inspectors equipped with laptop computers use ISS ratings and related safety information (available on laptops) to focus the inspection on particular areas. For example, ISS may influence the inspectors decision on what level of inspection is performed and then in turn indicate that special attention may be warranted in certain areas such as brakes, suspension, or driver violations.

The type of inspection performed is influenced by carrier reputation, ISS rating information, and inspector experience. A roadside safety inspection typically involves checking the driver's license and the vehicle. If the inspection is performed at a weigh station, the vehicle weight may also be checked.

For roadside screening processes, the inspectors/troopers currently use the ISS data that is downloaded from MCMIS and is provided to them on diskettes. The registration, tax, and driver license data are all available through call-in when the inspectors require additional driver and vehicle information. In the case of Connecticut, CDPD mobile data terminals are used to obtain weekly ISS updates from SAFER and access CDLIS, NLETS, and NCIC data in real-time. Most of the participating states indicated that safety information on in-state carriers is not currently available at the roadside, although New York developed a drop-down data base of intrastate carriers and had begun to collect safety inspection information that might be used to identify high-risk intrastate carriers in the future.

The transfer of inspection data from the roadside to state and federal agencies can be accomplished many different ways. Before inspectors were equipped with laptop computers, the inspection data were mailed to the state SAFETYNET sites for keying, verification, and analysis and reporting; then uploaded to MCMIS. Several options are available when inspectors are equipped with laptop computers, depending on the particular technologies and systems deployed in the state. The traditional approach (before SDM and wireless communication) involves entering the inspection data into ASPEN; then transmitting the data to SAFETYNET using telephone lines or loading the data onto diskettes and mailing them to the SAFETNET sites where they are processed and sent on to MCMIS. The state then retrieved the data for in-state use. During the SDM project, states tested various methods of wireless communication to send inspection results directly to SAFER via the data mailbox system.

Connecticut uses a slightly different approach. The inspection data from ASPEN are transmitted to an application server via CDPD, then to SAFETYNET using a LAN connection. Finally, the inspection data are uploaded to MCMIS via telephone lines. Configurations involving SDM are discussed in more detail in the next section.

The sites and circumstances under which inspections are conducted can vary widely among the states. For example, Connecticut's Union Scale represents the high-technology, high capital investment end of the continuum. This facility is equipped with dual scales, including one weigh-in-motion (WIM) scale. It has a long approach, minimizing the problem of trucks backing up into the highway. It has a remotely controlled sign that directs trucks to the scales, so inspectors can turn the flow on and off at will and there is no need to rush a high volume of trucks through to maintain a safe traffic situation. The site includes a systematic screening mechanism to select trucks for inspection. Vehicles are pre-screened for further inspection at the WIM scale. The pre-screening is based on such variables as operating weight, excessive speed over the scale, apparent driver avoidance of the scales by half-straddling, and an automated random selection process coupled with electronic signs directing drivers to a static scale queue or back to the highway. The vehicles selected in the pre-screening are diverted by an automated signal onto a fixed scale where they are weighed more precisely and where inspectors can examine the truck and use the ISS.

In New York, at the Glens Falls site, in contrast, there is only a parking lot at a rest area. There is no weighing mechanism. A crew of inspectors selects trucks by sight, seeking obvious violations, or what some inspectors term “a ragged truck.” If there are no trucks with apparent violations, the inspectors choose trucks more or less randomly as they complete one inspection and are ready for the next.

Another variant among sites is the ability to operate in adverse conditions or at night. Most sites are not sheltered, and in inclement conditions an inspector may elect not to conduct a Level I (full driver/vehicle) inspection because water dripping from the rig creates difficult and possibly hazardous working conditions. On rainy days, many inspectors report they do almost entirely Level III (driver only) inspections. Similarly, where inspections occur at rest areas, such as in Glens Falls, New York, inadequate lighting makes it impossible to conduct a full inspection at night. The Union Scale includes a sheltered and lighted inspection facility which enables inspectors to provide consistent ratios of inspections at all levels regardless of weather or time of day (Figure 1).

Figure 1. Enclosed inspection facility at Union, Connecticut

The Middletown Scale in Connecticut is typical of many single, fixed-scale sites where a single line of trucks file through, and trucks are chosen for inspection based on obvious violations or at random (Figure 2). States also use portable scales at locations that are rotated so that truckers find it difficult to predict and avoid the inspection.

Figure 2. Trucks lined up to cross the scale at Middletown, Connecticut

SAFER Data Mailbox

SAFER Data Mailbox is a real-time data exchange system that enables roadside enforcement staff to submit commercial vehicle inspection results to a centralized database (SAFER) and, conversely, obtain prior inspection reports obtained at other locations, including those in other states. This technology is designed to help enforcement staff identify commercial vehicle drivers that are violating out-of-service (OOS) orders. The basic components of the SDM system are: Sierra Wireless MP210, personal computer with a modem and serial ports, printer, Windows 95 or higher operating system with a dial-up networking facility, and ASPEN. The essential component for portable operations is the Sierra Wireless MP210 that supports CDPD and circuit-switched dial-up (AMPS) communications.

Figure 3 describes the typical configuration of SDM that is being implemented in the Eastern States Coalition's field operational test. For this interim configuration the roadside units communicate directly with SAFER through the data mailbox. Figure 4 describes the configuration currently being used by Connecticut. The main difference is that, in Connecticut, inspection results are first sent to Connecticut's SAFER-CVIEW application server via CDPD. This server is then polled every 15 seconds for incoming inspections and if any are found they are forwarded the FMCSA-developed BLIZZARD32. The BLIZZARD32 module then sends one copy of the data to the SDM and one copy to SAFETYNET 2000 for integration into state systems that upload to SAFER. SAFER then forwards the inspections to MCMIS. The interim configuration described in Figure 3 shows inspection results initially going to the SDM, and then back to the state databases. The initial long-term vision for the SDM configuration by the participating Eastern States was much closer to the design currently used by Connecticut. That is, inspection data would initially be transmitted from the roadside to a state data system and then immediately transferred to SAFER, but FMCSA's consultants were unable to accommodate that approach at the onset.

The FMCSA developed the CVIEW system as a data exchange mechanism that is operated on the state level. Although it operates like SAFER, it is operated by the state, allowing greater control and increased flexibility regarding interfaces with state legacy systems. More importantly, CVIEW is used to exchange both intrastate and interstate snapshots of vehicles within the state and connects to SAFER to exchange interstate snapshots. CVIEW communicates directly with the state roadside system (ASPEN) and several legacy credentialing and safety information systems within the state.

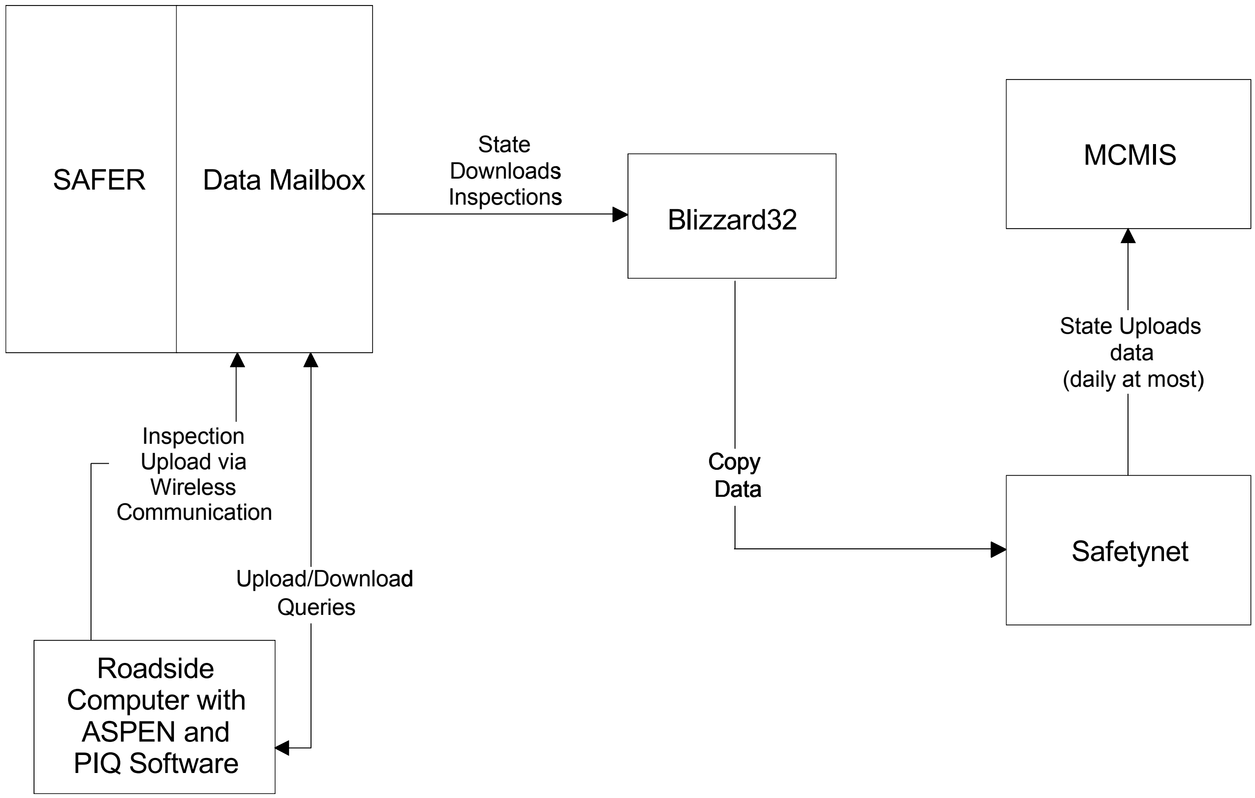

Figure 3. Eastern States Coalition SAFER Data Mailbox Configuration

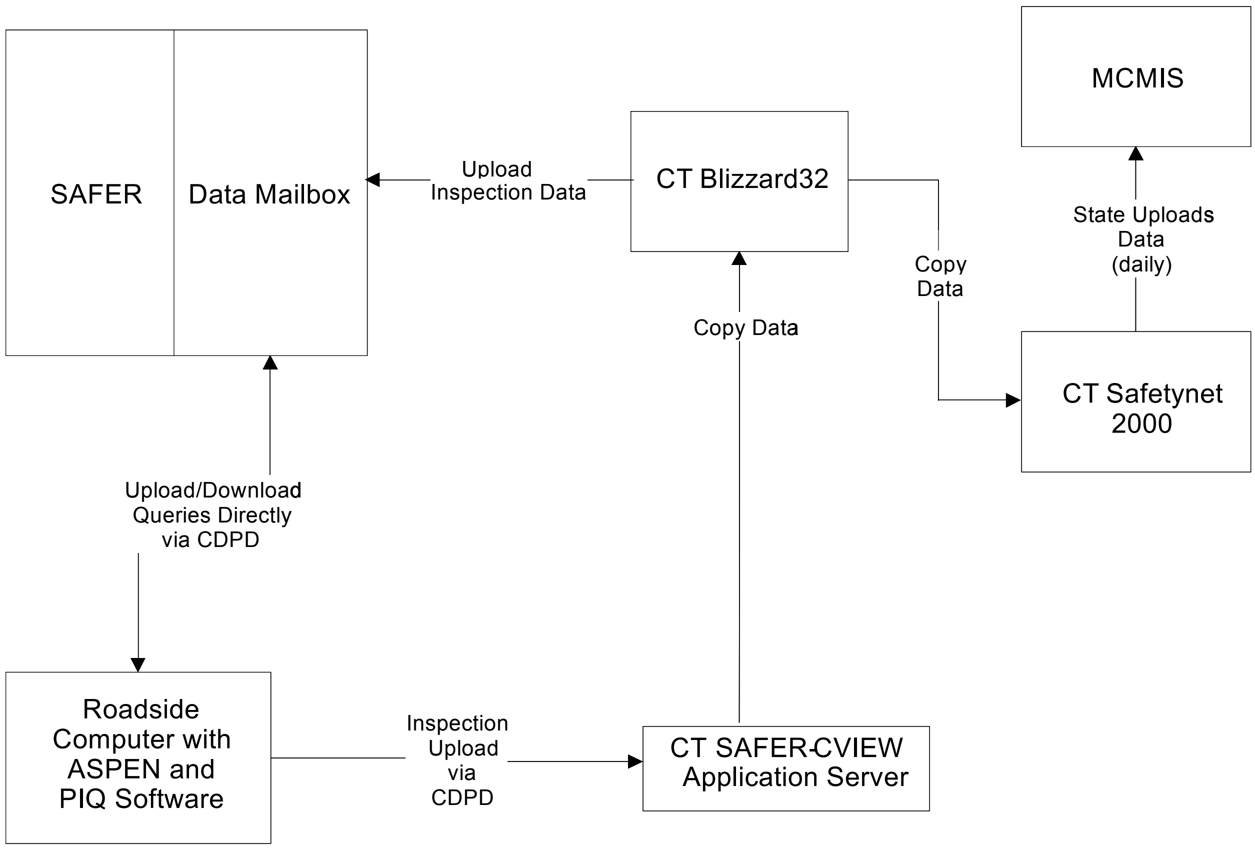

Figure 4. Connecticut SAFER Data Mailbox Configuration

Under either configuration, SAFER stores inspection reports for up to 60 days. Using ASPEN, the officer in the field can perform a Past Inspection Query (PIQ) to obtain copies of recent inspections of a particular vehicle. If the vehicle or its driver had a recent OOS order, the officer will determine whether or not corrective action was taken.

State Approaches to Safety Information Exchange Deployment

At the time FOT 7 was initiated, states participating in CVISN and/or the SAFER Data Mailbox project had already succeeded in demonstrating the ability to upload and download data from state and national safety databases. Participation in FOT 7 provided support to increase the number of computers available for inspection and enforcement, and to enhance their use and evaluation. Three participating states, Connecticut, Rhode Island, and Massachusetts, were working on a regional approach to ensure interoperable communication among all roadside inspectors for real-time data exchange to eliminate duplicative inspections and to help identify high-risk carriers.

The participating states pursued different approaches to implementation of the safety information exchange technology, particularly in regard to uploads to SAFER, updates from SAFER to ISS, the use of the PIQ. The variation can be explained in part by differences among states in the physical set-up of the equipment, and in the inspectors' familiarity with the systems. In states such as Connecticut and Rhode Island, where all inspectors are using wireless units, the process of uploading to SAFER is simple and convenient. Uploads occur at least daily. In other states, the frequency of uploads is no more than weekly, and often less.

The states also differ markedly in the frequency and method of making updates from SAFER to ISS. In Connecticut, inspectors download updates weekly through their wireless systems, and their ISS files are therefore up to date. In other states, updates are sent on CD-ROM from the state police to the field users monthly, quarterly, or even less often.

In addition, the PIQ process is used in different ways in the participating states. In Connecticut, a PIQ is run at each inspection, in part because it is so convenient to do so. In New York, PIQs were not being used at the time of the pilot. Two reasons were (1) potential legal concerns regarding probable cause requirements and (2) the limited number of wireless connections that are available at mobile inspection sites due to limited CDPD coverage. PIQ usage has increased significantly since then in areas where wireless coverage is available to the inspector. The PIQ may be used in Maryland if there seems to be an important reason to run it, and if the land line computer connection is available.

As of May 2000, more than 1,200 inspections were being uploaded to SAFER each day from approximately 24 states. This represents about 20 percent of all inspections performed. Figure 5 shows that 12 states, including seven from the I-95 Corridor Coalition, are uploading at least 50 percent of their inspections to SAFER. Some of these inspections are being uploaded directly from roadside locations using wireless communication.

The states that have developed or are testing wireless communication systems are able to query SAFER and download past inspection results on individual trucks that were inspected within the past 60 days. Currently there are approximately 50 past inspection queries (PIQs) performed each day by inspectors in 18 states. As shown in Figure 6, seven states, including five from the I-95 Corridor Coalitions, perform PIQs on a regular basis (at least 5 PIQs per day). Connecticut performs approximately 20 PIQs per day, which represents about one-third of all vehicles inspected. Other states are using PIQs on a less frequent basis.

It should be noted that these values are based on the latest available data. Between 1999 and 2000 the number of inspections uploaded to SAFER has tripled and the number of PIQs performed has nearly doubled. Since then, utilization has continued to increase and states are continuing to explore new ways to make use of these technologies. As wireless communications systems continue to expand into rural areas, these technologies will become more prevalent. Also, many of the I-95 Corridor Coalition states are exploring the use of electronic screening systems, which allow safe carriers to bypass inspection stations. Combined with ASPEN and improved roadside communication systems, states in the I-95 corridor will realize dramatic increases in the efficiency of their roadside safety enforcement activities.

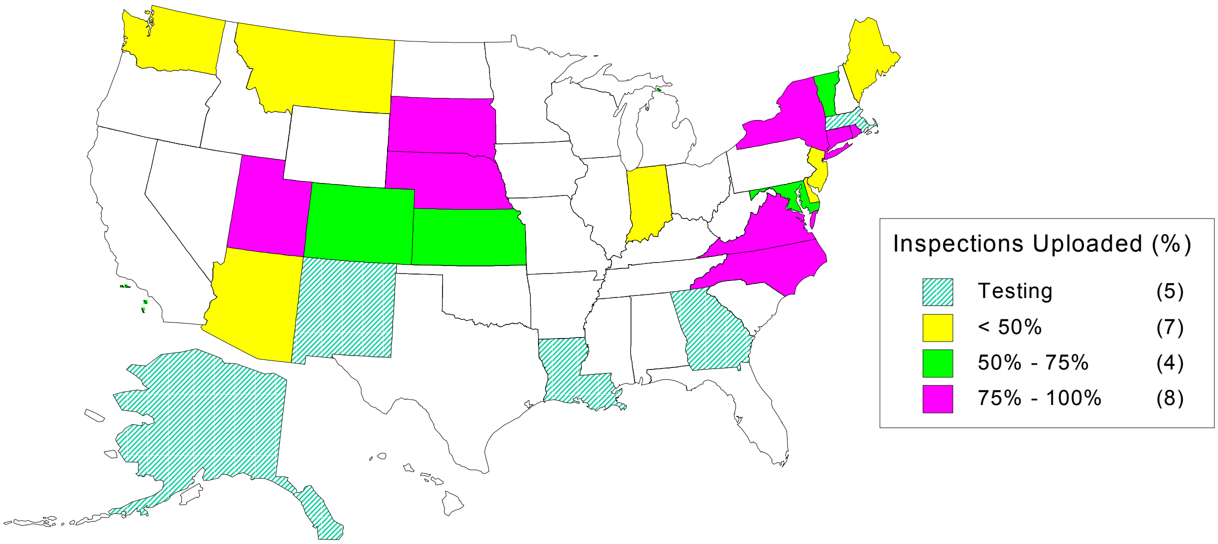

Figure 5. States Uploading Safety Inspection Results to SAFER (May 2000) - by Percent of States Inspections

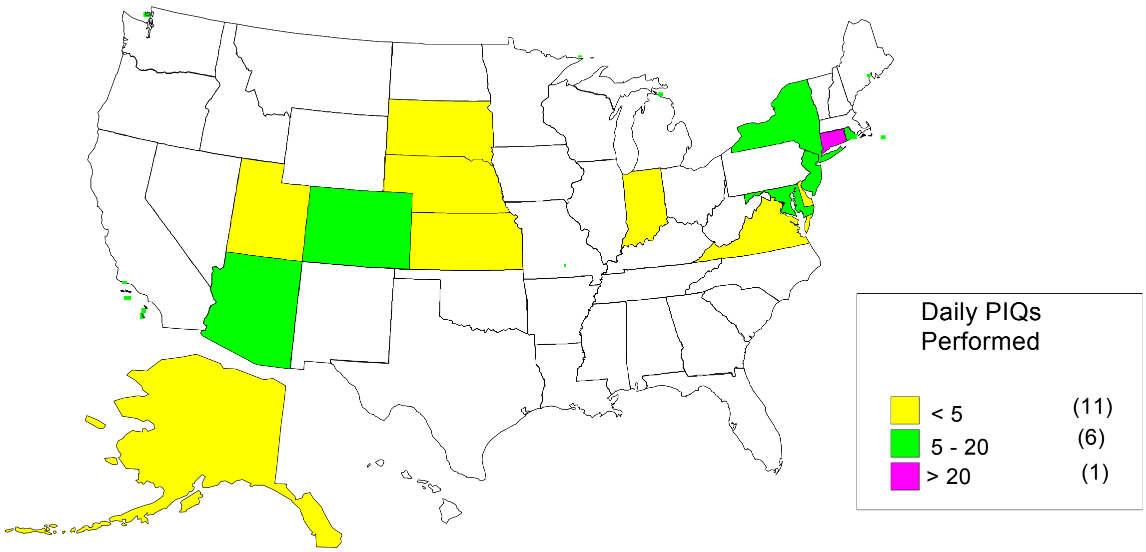

Figure 6. States Performing Past Inspection Queries (PIQs) from the Roadside (May 2000) - by Average Number Performed Per Day

3. EVALUATION GOALS, MEASURES, AND HYPOTHESES

As noted previously, in 1998 the U.S. experienced nearly 400,000 crashes involving large trucks, resulting in approximately 5,000 deaths. The Federal Motor Carrier Safety Administration (FMCSA) has set as one of its major objectives to reduce the numbers of fatalities and injuries from accidents involving CMVs by 50 percent by 2010. In an effort to achieve this objective, several programs have been or will soon be implemented to address various factors that may contribute to crashes. Many such programs address unsafe driving, both in terms of unsafe vehicles and unsafe drivers. The goal of these programs is to develop and evaluate methods for better identifying unsafe drivers and vehicles and removing them from the road until such time as they become safe.

The I-95 Corridor Coalition's safety-related CVO FOT 7 is one program that compares methods for improving the identification of unsafe driving. It is being evaluated in close coordination with two other related efforts:

- The SAFER Data Mailbox (SDM) FOT currently underway involving the states of Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia, and
- The Commercial Vehicle Information Systems and Network (CVISN) Model Deployment Initiative (MDI) involving ten prototype and pilot states (Maryland, Virginia, Washington, Oregon, California, Colorado, Minnesota, Michigan, Kentucky, and Connecticut).

Because FOT 7 is a deployment of CVISN technologies and involves many of the components being tested in the SDM project, the evaluation plan builds upon the goals identified in the CVISN and SDM evaluation plans. The I-95 Corridor Coalition CVO Program Track Safety Subcommittee members from FOT 7 states participated in establishing a set of evaluation goals and related study questions that were to be addressed in FOT 7. Their goals were essentially the same as the evaluation goals established for SDM and CVISN. The four basic goals for all three studies are:

<u>Evaluation Goals</u>

1. Demonstrate the effectiveness of using current safety performance data to help identify high-risk carriers, drivers, and vehicles and to identify out-of-service order violators during roadside enforcement,
2. Evaluate the time, cost, and other impacts of electronic collection of roadside safety information for upload and dissemination to regional and national databases,
3. Identify institutional issues and benefits related to the use of this technology, and
4. Assess the effectiveness of public outreach programs for deterring OOS violations.

In the following sections of this chapter, a more detailed discussion of the evaluation goals is presented. This discussion includes the hypotheses and study questions to be addressed in FOT 7 and SDM.

Demonstrate the effectiveness of using current safety performance data to help identify high-risk carriers, drivers, and vehicles and to identify out-of-service order violators during roadside enforcement

This goal focuses on how state inspection and enforcement personnel are using pen-based or laptop computers and links to safety databases to target high-risk carriers. A key aspect of this goal is to evaluate how well these systems are working at the roadside and to determine whether the use of these systems results in an increase in the number or rate of out-of-service (OOS) orders. Specifically, the following questions will be addressed:

- Do inspectors perceive that these methods are effective for targeting high-risk carriers?
- Does the use of technology improve an inspector's ability to identify high-risk carriers?
- Is SAFER Data Mailbox an effective tool for identifying OOS order violators?
- Does this technology improve an inspector's ability to identify high-risk carriers that come from other states or were previously inspected in other states?
- What percent of roadside inspectors have access to FHWA ISS (SDM) database for interstate carrier data on intrastate carriers in their own state?

Evaluate the time, cost, and other impacts of electronic collection of roadside safety information for upload and dissemination to regional and national databases

This goal has three distinct parts. The first part involves determining the impact of SDM and other electronic screening technologies on the amount of time for inspection or screening activities. The second part involves evaluating any other impacts that the use of SDM or other screening technologies may have on the inspection and screening process. The third part involves evaluating any cost changes in utilizing the SDM or other electronic screening systems for acquiring timely inspection data. The following questions illustrate the type of information needed to meet this goal:

- What systems (software, hardware) are states using to access safety performance data? Document/summarize technology in use. If possible, identify advantages of particular technologies under particular circumstances. Which technical solutions work best in certain situations?
- How are "high risk" carriers identified, or conversely, how are non-high risk carriers eliminated from consideration (Out-of-service orders? Recent inspection reports? Accident data? CVSA decal? Obvious defect? Inspector judgment)?
- What is the effect on uniformity of inspections? Is deployment of laptop computers improving uniformity of inspections?

- What are the true costs of purchasing, maintaining, and using the equipment?
- How much and what type of training is required for enforcement officers to be proficient on use of equipment?
- How are inspection procedures at roadside affected by need to electronically enter data? Is it feasible to do so?
- Are there other cost implications of real-time data access associated with new enforcement strategies, improved morale, and increased productivity?

The purpose of the cost analysis was to determine actual costs, not to evaluate U.S. DOT program funds used to advance the deployment or to subsidize the operational tests.

<u>Identify institutional issues and benefits related to the use of this technology</u>

There are a substantial number of organizations involved in and affected by innovations in roadside enforcement practices; each has its own objectives, priorities, and abilities. These organizations include state agencies with CVO responsibilities, federal agencies, contractors supporting these agencies, motor carriers, drivers, and regional and national CVO-related associations. This goal seeks to identify the institutional issues related to the success of implementing this FOT. Issues such as "probable cause," data privacy, multi-agency responsibilities and communications, and outreach to carriers were to be identified and documented. Many of these issues are common to the participating states, but some issues may be unique. Differences among states will be explored. Questions that illustrate the type of information needed include:

- What are the institutional impediments to use of technology? (e.g., laws that affect use of information (probable cause), privacy issues, agreements with carriers about sharing data)
- What are institutional benefits?
- Do these impediments/benefits vary among the participating states? Highlight key differences and, if possible, identify causes.

<u>Assess the effectiveness of public outreach programs for deterring OOS violations</u>

One of the primary goals of the technologies examined during FOT 7 is to reduce violation of OOS orders. The direct means of achieving this goal (i.e., identifying violators at the roadside) was addressed in the first evaluation goal. The indirect means involves educating the commercial vehicle operator community about the capabilities of the technologies in aiding identification of violators of OOS orders and, thereby, creating a deterrent to potential OOS order violators. The goal here is to assess the degree to which carriers and drivers are aware of this technology and measure the deterrent effectiveness of the public outreach program. Questions that were to be addressed under this goal include:

- To what extent do motor carriers and drivers know that states will have real-time access to recent inspection reports?
- In what ways does an awareness of new enforcement practices change motor carrier behavior?
- Which media (brochures, ads, newsletters, trade publications, word-of-mouth) are most effective for making SAFER capabilities known to drivers and motor carriers?
- Are drivers and motor carriers are aware of penalties for violating OOS orders?

Although this goal and the related questions are still of interest to SDM partners, it was not practical to devote evaluation resources in this area. Originally, the SDM project was to include a public outreach component. Some progress was made at developing outreach materials. However, technical problems in deploying SDM caused resources to be diverted from the public outreach effort. Thus, the public outreach component was never fully developed.

4. TECHNICAL APPROACH

As detailed in the SDM and FOT 7 Evaluation Plans, a set of tests, representing a variety of data collection and/or analysis efforts, were proposed to address the evaluation goals and hypotheses. Several of these tests were also designed to be used in the CVISN evaluation as well. The tests were modified as necessary to ensure that SDM and FOT 7 were addressed. Table 1 shows how each evaluation test addressed one or more of the evaluation goals. In the remainder of this chapter, we present an overview of each test that was conducted.

Table 1. Overview of goals addressed by different SDM and FOT 7 evaluation tests

Test	Goal 1	Goal 2	Goal 3	Goal 4
1. Inspector Interviews	T	T	T	
2. Inspector Surveys	T	T	T	
3. Driver and Motor Carrier Surveys	T			T
4. Connecticut Roadside Study	T	T		
5. SDM Utilization, Data Timeliness, and Response Times	T	T		
6. SAFER Cost and Institutional Benefits Survey	T	T	T	
7. Others (ATA studies, discussions with administrators, FOT 10 results)	T	T	T	
8. ATA	T	T	T	

Test 1: Inspector Interviews

Focus groups and individual interviews with roadside inspectors were held in Connecticut, Maryland, Massachusetts, New York, Pennsylvania, and Rhode Island (Appendix B). More than 50 inspectors participated. Inspectors were interviewed individually or in small focus groups. The qualitative interviews were designed to avoid disrupting the work of the inspectors. Interviews were conducted at various places, including fixed-site weigh stations, agency headquarters, roadside inspection sites, and a professional conference. In states where several agencies have responsibility for roadside inspections, we attempted to interview representatives from each agency. The results of this data collection provided insights related to five topics:

- Differences among and within states in adoptions of ASPEN, ISS, SAFER, and related systems
- Similarities among states in use of these systems
- Advantages and disadvantages as perceived by the inspectors using the systems
- Suggested changes in the systems
- Suggested topics for including in the quantitative research to follow.

In addition to the interviews and focus groups, an observer visited inspection sites, watched inspections in progress, and noted aspects of system use at weigh stations and other roadside inspection sites.

Test 2: Inspector Surveys

Information was collected from motor carrier inspectors in Connecticut, Maryland, Massachusetts, New York, Pennsylvania, and Rhode Island using a four-page self-administered questionnaire (Appendix A). Approximately 370 completed questionnaires were analyzed, which represented a response rate of about 50 percent. The surveys sought information in the following categories, among others:

- Background information on the respondents
  - Agency they worked for
  - Experience in performing inspections
  - Experience in using computers
  - Training
- Details on the technology and inspection systems in use
  - Length of time required for inspections at various levels
  - Software and hardware used, including types, amount of time used, and frequency of use
- Satisfaction with the equipment
  - Overall satisfaction
  - Satisfaction with various system components and features
  - Suggestions for improvements to the system
- Perceived benefits
  - Time savings
  - Completeness of information
  - Improved safety
  - Ability to identify high-risk carriers
  - Comparison of computer-based to paper-based inspection methods.

Test 3: Driver and Motor Carrier Surveys

The evaluation strategy for SDM was to use motor carrier and driver surveys that were being planned as part of the CVISN MDI evaluation project. These surveys are being modified to obtain information on motor carrier awareness of and attitudes toward these roadside enforcement technologies. However, the surveys will not be completed until late summer 2000. Nevertheless, the goals and hypotheses will be addressed in the evaluation report for the CVISN MDI.

Test 4: Connecticut Roadside Study

The primary objective of the Connecticut Roadside Screening Study was to measure screening effectiveness at several sites both where CVISN technologies have been deployed and where they had not been deployed (Appendix C). Comparisons among the various sites allowed for an assessment of how effective the CVISN technologies were. Specifically, the screening effectiveness was measured as the rate at which vehicles representing "high-risk" carriers versus non-high-risk carriers were inspected at specific sites, and, secondarily, as the rate at which vehicles from carriers with insufficient data were inspected after adjustments for inspection of high-risk carriers.

The data that were collected to assess screening effectiveness included data collected in the field, historical inspection data, and interviews with inspectors and agency personnel responsible for the management of inspection programs. Field data were collected by observing inspection operations of two different agencies at four different sites in the winter and spring of 1999. The two agencies who conduct motor carrier safety inspections are the Department of Motor Vehicles (DMV) and the Department of Public Safety (DPS). The four facilities that were observed were Union, Greenwich, Middletown, and Danbury. Historical data consisted of the results from over 58,000 inspections conducted in Connecticut between October 1995 and June 1999.

The historical inspection data obtained from the state of Connecticut were divided into three phases based on the degree to which the Inspection Selection System (ISS) was deployed. The three phases considered were:

- Phase 1: June 1996 to May 1997
- Phase 2: June 1997 to May 1998
- Phase 3: June 1998 to May 1999.

During Phase 1, the DMV utilized ISS while the DPS did not. During Phase 2, the DPS made the transition to the use of ISS. In Phase 3, both the DMV and the DPS had full access to ISS technology. During all three phases, only Greenwich and Union utilized ISS, while Middletown and Danbury did not. The DMV and DPS performed inspections at all four sites during all three phases, with one exception: there were no DPS inspections at Union during Phase 1.

Two analyses were performed in order to assess the efficiency of ISS in selecting vehicles from high-risk carriers. The first analysis compared the screening efficiency at sites with and without ISS during Phase 3 alone. Three subpopulations were considered in this analysis: pooled over DMV and DPS, DMV only, and DPS only. The second analysis compared the screening efficiencies of the two agencies within each of the three phases as a surrogate for a comparison of ISS usage versus non-ISS usage. This analysis was done using data from the ISS sites only.

Test 5: SDM Utilization, Data Timeliness, and Response Times

A study was conducted in several Eastern states, with special emphasis on roadside inspection activities in Connecticut. Its purpose was to document the extent to which inspection data collected in surrounding states was made available to inspectors, allowing them to identify out-of-service violators. Inspectors were observed during normal operations to document the amount of time required to enter license plate numbers and perform a PIQ. The data were analyzed to determine how long it took from the completion of an inspection for data to be uploaded to SAFER and/or other databases, and how long it took for these reports to be available at the roadside. Another focus was to document the results of PIQs on inspection outcomes.

Test 6: SAFER Costs and Institutional Benefits Survey

This survey collected data to estimate the costs to deploy and operate SDM and assess the institutional issues and benefits associated with its implementation (Appendix E). The questionnaire was distributed to representatives of all 10 states participating in the SDM test and the I-95 Corridor Coalition. We received responses from Connecticut, Maine, Maryland, New York, Pennsylvania, Rhode Island, and Virginia. The survey solicited information used to estimate the costs of hardware, software, labor, training, and communication costs, and identify a wide range of institutional issues and benefits. These estimates were intended to represent actual costs to the agencies, not the amounts received from U.S. DOT for the advancement of the evaluation program. Purchase, operating, and maintenance costs were included.

The questionnaire comprised three sections:

- Costs—for purchase, operation, and maintenance of equipment such as computer hardware, supporting software, data processing, testing and development, and training
- Technology solutions—configurations necessary to implement SDM
- Institutional issues and benefits—non-technical issues supporting or impeding deployment; policy implications; and expected effects on agency and carrier procedures.

Test 7: Other Data Collection Activities

In addition to the above listed tests, the evaluation incorporated complementary studies, such as the results of the I-95 Corridor Coalition's FOT 10, Coordinate Safety Management, performed by the ATA Foundation; discussions with participating state administrators; and feedback from presentations of preliminary results at technical meetings.

5. FINDINGS

The findings of the various tests performed to evaluate the SDM and I-95 Safety FOTs are presented in this chapter according to the joint goals shared by the two projects. Detailed findings from the separate tests are provided in Appendices A through E.

Goal #1: Demonstrate the effectiveness of using current safety performance data to help identify high-risk carriers, drivers, and vehicles, and to identify out-of-service order violators during roadside enforcement

We used four measures of effectiveness in addressing this goal. First, the perceived effectiveness of computer-based inspection technology was assessed in a general way through surveys, interviews, and quantitative studies of data timeliness. Next, an analysis of data from a roadside study conducted in Connecticut compares "inspection efficiency" at inspection sites that use CVISN and related ISS technology with and those that do not use these technologies. Various analyses are used to address hypotheses concerning the effectiveness of SDM for identifying OOS order violators. Finally, we discuss effectiveness as measured by the levels of deployment among various states.

Perceived Effectiveness

Surveys and interviews involving roadside inspectors revealed that using current safety performance data in roadside enforcement helps inspectors focus on problem areas and leads to increased inspections of high-risk carriers. The studies indicate that performing past inspection queries (PIQs) yields results that inspectors can use. There are definitely trucks on the road with recent out-of-service (OOS) orders, and each is a potential violator.

Focus group participants indicated that ISS scores are used as one tool to supplement the inspector's observation. At this time, ISS scores are not usually used to screen trucks, but instead serve as a supplemental piece of information to help target the inspection. Additional findings from the surveys and focus groups are presented under Goal Area 2.

Improvement in Inspection Efficiency as Measured in Connecticut Roadside Study

The *Connecticut Roadside Screening Study* was conducted to estimate the effectiveness of the CVISN safety information exchange deployment in Connecticut, which consisted of ASPEN/ISS systems accessed from laptop computers. The inspection operations of two agencies, the Department of Motor Vehicles (DMV) and the Department of Public Safety (DPS), were observed at four different weigh stations in the winter and spring of 1999. Data were collected from more than 10,000 vehicles entering these stations to characterize the distribution of trucks at each location and to evaluate the inspection selection process.

Following the roadside data collection, the motor carrier safety ratings for every truck observed at the Connecticut sites were determined using the SafeStat algorithm (VNTSC 1999b; VNTSC 1998). In addition, over 58,000 historical records from inspections conducted between October 1995 and June 1999 were used to determine the distribution of inspected CMVs among risk categories. The proportion of high-risk CMVs inspected was estimated and compared to the proportion of high-risk CMVs in the population to determine the inspection efficiency conducted with laptops and ASPEN. These data were also used to estimate the effects of using ISS in combination with manual pre-screening on the number of OOS orders issued for a fixed number of inspections performed. The major findings from the Connecticut Roadside Screening study are presented below. Additional analyses are in Appendix C.

Connecticut's roadside enforcement program presented a unique opportunity to evaluate the use of ISS as a selection tool. Connecticut, one of the first states to widely deploy laptop computers with Aspen and ISS, conducts a large number of inspections at four fixed weigh stations. Each station is equipped with a fixed scale, and all trucks are required to enter the station when it is open. Commercial vehicle inspectors are assigned at each station. However, at two of the stations, Danbury and Middletown, inspectors select vehicles for inspection using only judgment and experience. Inspections are then conducted with the aid of Aspen and ISS. At the other two sites, Union and Greenwich, all vehicles are pre-screened using weigh-in-motion results and quick visual inspections. Some trucks are allowed to bypass the fixed scale and return to the highway. The remaining trucks are sent to the fixed scale, and their identification numbers are entered into a roadside computer, which contains Aspen and ISS. The ISS information is then use to select vehicles for inspection.

The primary finding relevant to the effectiveness of ISS is that when ISS is used in combination with manual pre-screening to select commercial vehicles for inspection (as currently performed at Union and Greenwich sites in Connecticut), the number of OOS orders issued for a fixed number of inspections will increase by 1.9 percent compared to sites that do not use ISS and manual pre-screening for inspection selection. Although this is a small increase in inspection selection efficiency, it is important to recognize that ISS is used to select vehicles for inspection after most of the vehicles have been eliminated during manual pre-screening.

As CVISN deployment expands and begins to integrate the use of ISS with electronic screening, roadside enforcement officials should be able to improve the efficiency with which they select high-risk CMVs for inspection. Currently, only a few states use ISS or similar tools in combination with electronic screening. However, even in these states, carrier enrollment in electronic screening is not sufficient to demonstrate any impacts on the inspection selection process. Therefore, to illustrate what could happen, the impact of using ISS with electronic screening was simulated using results from the Connecticut Screening Assessment Study. An analysis was performed under the scenario that (a) all states deploy electronic screening at all major inspection sites and (b) all of the motor carriers with SafeStat ratings in the low-risk category (representing approximately 52 percent of all trucks) choose to enroll in the electronic screening program.

Under this scenario, enforcement officials could choose to let the low-risk vehicles bypass the inspection site and focus all of their efforts on inspecting medium- and high-risk carriers and carriers with insufficient safety data. It is assumed that ISS will be used with manual pre-screening on the 48 percent of trucks that are not allowed to bypass the inspection site. The following analysis demonstrates that, under this scenario, the number of OOS orders will increase by 11.2 percent compared to the average number that would be achieved using ISS with manual pre-screening as currently conducted at Union and Greenwich sites in Connecticut.

Key Findings from the Connecticut Screening Assessment Study

This section presents the analyses that support the key findings from the Connecticut Screening Assessment Study.

As discussed above, the Connecticut Screening Assessment Study was conducted at four commercial vehicle weigh stations in Connecticut to evaluate the effectiveness of ISS for improving the inspection selection efficiency of roadside operations. Inspection selection efficiency is measured by the number of OOS orders issued per 100 vehicles inspected. Increased efficiency means that more unsafe vehicles or drivers will be removed from the highway for the same number of inspections performed. During 13 days of data collection, approximately 10,000 vehicle identification numbers were recorded for all trucks entering the four weigh stations. At two of the stations (Danbury and Middletown), vehicles are selected for inspection without the aid of ISS. At the other sites (Union and Greenwich), vehicles are pre-screened using weigh-in-motion (WIM) and visual inspection. Vehicles sent to the fixed scale for weighing are then screened for inspection using ISS ratings. Figure 7 shows the configuration of the Union facility.

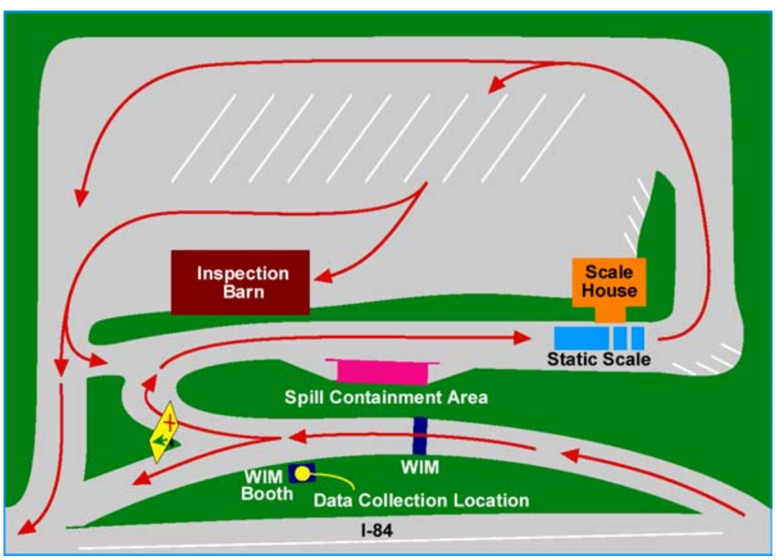

Figure 7. Schematic of Connecticut's Union Facility with WIM Sorting

The vehicle identification numbers were used to characterize the distribution of trucks in terms of safety risk at each inspection site. This was achieved during the analysis phase by calculating the SafeStat score for each truck. SafeStat is an automated motor carrier safety status measurement system developed for FMCSA that combines current and historical safety data to measure the relative fitness of motor carriers (VNTSC 1999b; VNTSC 1998). In addition to the inspection results obtained during the data collection phase, results of over 58,000 inspections performed over a four-year period at these sites were analyzed.

The analyses performed with these data are summarized in Table 2. The SafeStat scores for the 10,000 trucks that entered the sites were used to estimate the distribution of trucks that would be inspected if vehicles were selected at random. This serves as a baseline which allows us to make valid comparisons of inspection selection strategies at each site. For example, at the Danbury site, which does not use ISS for vehicle selection, the distribution of trucks includes 8.6 percent high-risk vehicles (according to SafeStat scores) and 47.2 percent low-risk vehicles. The actual inspection results show that inspectors are selecting more high-risk (12.0 percent versus 8.6 percent) and fewer low-risk (36.1 percent versus 47.2 percent) vehicles for inspection then they would if vehicles were selected at random. Multiplying these percentages by the statewide OOS rate gives the expected number of OOS orders per 100 vehicles inspected within each risk category. The statewide OOS rate for low-risk carriers is 38 percent compared to rates of 42 percent to 63 percent for the other risk categories (Medium, Insufficient Data, and Unknown). The totals represent the expected number of OOS orders for a given inspection selection strategy. The inspectors at Danbury average 48.4 OOS orders per 100 inspections using their own judgment and experience to select vehicles for inspection. Random selection would produce only 46.76 OOS orders per 100 inspections. Combining the Danbury and Middletown results, we see that inspector judgment and experience produce 3.5 percent more OOS orders than random selection. Even though Connecticut's OOS rates are much higher than the national average, the percent difference in these rates is consistent with similar findings from the National Fleet Safety Survey (1997).

The same calculations were performed with the data from the Greenwich and Union, which use ISS and manual pre-screening with WIM, in addition to judgment and experience, to make inspection selection decisions. This inspection selection process produces 5.4 percent more OOS orders than random selection. Using an odds ratio to adjust for differences in populations, we estimate that using ISS with manual pre-screening produces a net effect of 1.9 percent more OOS orders than would be achieved with inspector judgment and experience.

To simulate the impact of electronic screening under full deployment, we assumed that all low-risk carriers would enroll and be permitted to bypass all inspection sites. Since no low-risk carriers will be inspected, we assumed that inspectors would proportionally allocate the inspections among the other risk categories. The predicted number of OOS orders with electronic screening was then calculated in the same manner. The relevant finding is that by using electronic screening to eliminate the low-risk carriers (and thereby target high-risk carriers) can increase OOS orders by 11.2 percent.

Table 2. Estimating the Improvements in OOS Rates Resulting from the Use of ISS and Electronic Screening in Roadside Enforcement.

Station	Risk Category	CMV Inspection Selection Percentages: Random Selection [1]	Actual Inspection Selections [2]	With Electronic Screening [3]	State OOS Rate (%)	No. OOS Orders per 100 Inspections [4]: With Random Selection	Predicted from Actual Inspections	With Electronic Screening
Danbury (non-ISS)	High	8.6	12.0	18.8	63	5.42	7.56	11.83
	Medium	30.5	33.1	51.8	59	18.00	19.53	30.56
	Low	47.2	36.1	0.0	38	17.94	13.72	0.00
	Insufficient Data	10.7	13.7	21.4	42	4.49	5.75	9.00
	Unknown	3.0	5.1	8.0	53	1.59	2.70	4.23
	Total Expected OOS Orders per 100 Inspections					**47.43**	**49.26**	**55.63**
Middletown (non-ISS)	High	5.1	6.8	11.3	63	3.21	4.28	7.14
	Medium	26.1	27.4	45.7	59	15.40	16.17	26.94
	Low	49.8	40.0	0.0	38	18.92	15.20	0.00
	Insufficient Data	13.8	16.2	27.0	42	5.80	6.80	11.34
	Unknown	5.2	9.6	16.0	53	2.76	5.09	8.48
	Total Expected OOS Orders per 100 Inspections					**46.09**	**47.54**	**53.90**
Average for Non-ISS Sites						**46.76**	**48.40**	**54.77**
Percent Increase in OOS orders compared to random inspections							**3.5%**	**17.1%**
Greenwich (with ISS)	High	5.1	7.8	10.8	63	3.21	4.91	6.81
	Medium	29.2	26.9	37.3	59	17.23	15.87	21.98
	Low	45.4	27.8	0.0	38	17.25	10.56	0.00
	Insufficient Data	16.2	25.9	29.7	42	6.80	10.88	15.07
	Unknown	4.1	11.6	7.5	53	2.17	6.15	8.52
	Total Expected OOS Orders per 100 Inspections					**46.67**	**48.38**	**52.37**
Union (with ISS)	High	4.6	11.1	18.3	63	2.90	6.99	11.50
	Medium	25.8	32.2	53.0	59	15.22	19.00	31.25
	Low	55.7	39.2	0.0	38	21.17	14.90	0.00
	Insufficient Data	11.9	13.8	22.7	42	5.00	5.80	9.53
	Unknown	2.0	3.7	6.1	53	1.06	1.96	3.23
	Total Expected OOS Orders per 100 Inspections					**45.34**	**48.64**	**55.51**
Average for ISS Sites						**46.01**	**48.51**	**53.94**
Percent Increase in OOS orders compared to random inspections							**5.4%**	**17.1%**
Percent increase in OOS orders due to use of ISS — versus non-ISS							**1.9%**	
Percent increase in OOS orders with electronic screening of low-risk carriers — compared to ISS users without electronic screening								**11.2%**

1. Random selection percentages were determined from SafeStat scores of more than 10,000 vehicles that were observed at specified inspection stations during the Screening Assessment study (Spring 1999).
2. Actual selection percentages are based on more than more than 58,000 inspections performed at the specified inspection stations between October 1995 and June 1999.
3. Distribution was derived from actual selection percentages (note 2) and the assumption that electronic screening will eliminate low-risk carriers from the selection process (e.g., for Danbury high-risk category 18.8 percent = 12.0 percent/(1-0.361).
4. Product of CMV selection percentage and state OOS rate.

Thus, the primary findings from this study are that states can achieve a 1.9 percent increase in OOS orders using ISS with manual pre-screening or an 11.2 percent increase in OOS orders using ISS in combination with electronic screening. The implications of these findings should be viewed in the context of the number of crashes avoided because of an enhanced roadside enforcement program. Such an analysis was performed as part of the evaluation of the CVISN Model Deployment Initiative (Battelle, 2002). The analysis demonstrated that a 1.9 percent increase in OOS orders will result in 84 fewer commercial vehicle crashes in the U.S. each year. The 11.2 percent increase in OOS orders will result in 589 fewer crashes. More substantial benefits are possible if enhanced enforcement programs cause carriers to improve their compliance with safety regulations. However, there is currently no evidence that carrier compliance has changed since the introduction of these technologies.

Effectiveness of SAFER Data Mailbox for Identifying OOS Order Violators

The goal of this analysis was to demonstrate the effectiveness of using SDM, coupled with innovative enforcement strategies, to identify OOS order violators. Four hypotheses were evaluated:

- **Inspection reports will be made available to other roadside sites in a timely manner.**
- **Information on trucks with existing OOS orders will be available in SAFER.**
- **There will be trucks on the road with recent OOS orders**
- **It will be feasible to make use of real-time data to screen trucks (during inspection, not for selection) for OOS order violators under actual roadside conditions.**

The first two hypotheses focus on issues related to populating and querying the SAFER Data Mailbox. Inspectors must upload completed inspections in a timely manner, and they must find the information valuable if they are going to perform past inspection queries (PIQs). The third hypothesis addresses the degree to which there might be OOS order violators on the road. Finally, the fourth hypothesis deals with the logistics of using these technologies under actual roadside conditions.

For an inspection report to be available to other roadside sites in a timely manner it must be uploaded to the SAFER data mailbox shortly after the inspection is completed. Data from approximately 13,500 inspections uploaded to SAFER between May and June 1999 were available to assess the timeliness of inspection uploads. The analysis of upload times was restricted to states in the Eastern Standard Time (EST) zone. Figure 8 shows the distribution of time between the completion of the inspection report and upload of the inspection data to SAFER. For example, approximately 16 percent of the inspection reports were uploaded to SAFER within one hour of completion, and 56 percent were uploaded within 24 hours. Another 10 percent were uploaded between 24 and 48 hours later, and the remaining 32 percent were not uploaded for at least two days. However, these percentages vary greatly among states. Figure 9 shows how the distributions of upload time vary from state to state. States with facilities and access to wireless communications, such as Connecticut and Delaware, are able to upload most of their inspections within a few hours. Rhode Island (not shown) also tends to upload most of their inspection reports within hours of completing the inspection. The remaining states — such as New York and Maryland, for example — demonstrated the ability to upload inspection reports from the roadside. However, the majority of their inspection results are delivered to a central location and uploaded to SAFER in batch mode on a less frequent basis.

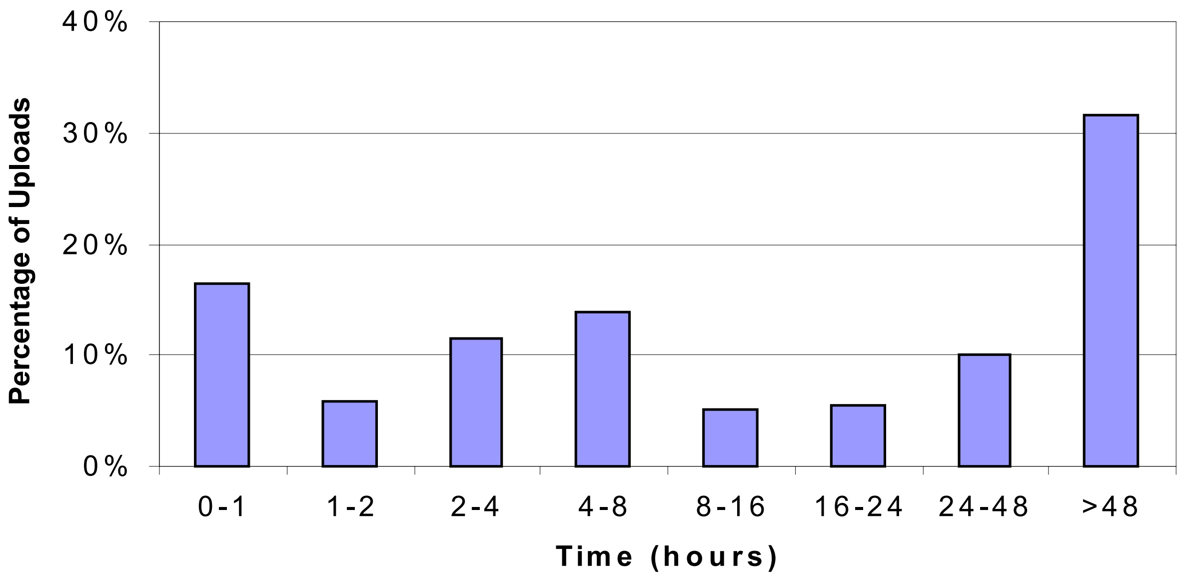

Figure 8. Distribution of Time Between Inspection and Upload of Inspection Report

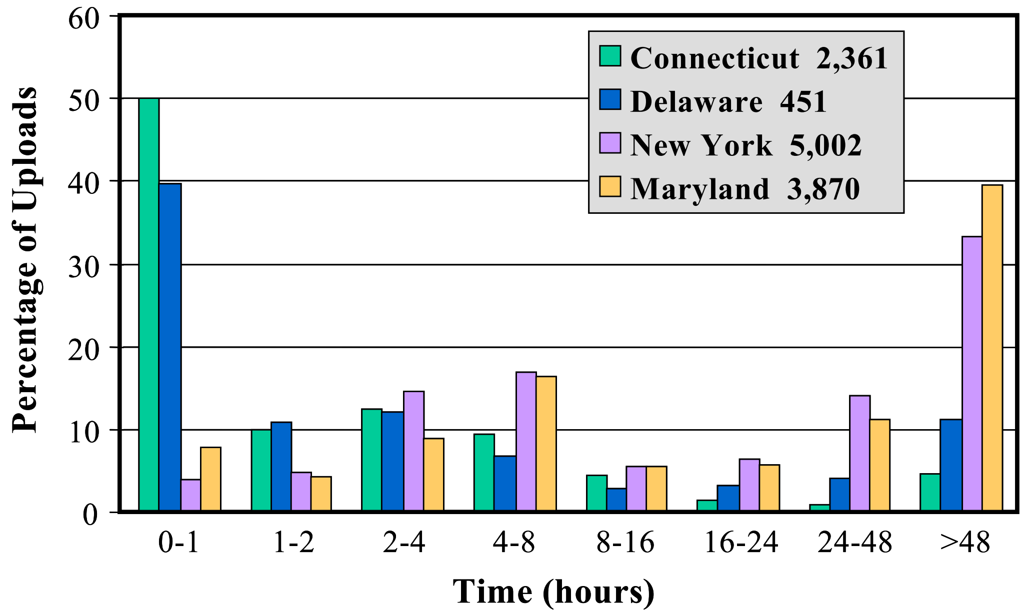

Figure 9. Distribution of Time Between Inspection and Upload of Inspection Report - by State (showing number of inspections uploaded in May and June 1999)

The second hypothesis deals primarily with the issue of utilization of SAFER. For information on trucks with existing OOS orders to be available for identifying violators, inspection results with OOS orders must have been uploaded and a PIQ must be performed on those trucks. The extent to which inspection results are being uploaded to SAFER was discussed in the previous section. As of May 2000, approximately 20 percent of all inspection reports are being uploaded to SAFER. Seven of the I-95 Corridor Coalition states are uploading at least 50 percent of their inspection. These percentages have been steadily increasing in recent years and it is anticipated that all states will eventually upload all of their inspection reports to SAFER.

The other aspect of utilization is whether inspectors performed PIQs during inspections, which is the only way to determine if a previous OOS order had been issued for the vehicle. Connecticut is the only state that routinely performs PIQs during inspections. As of May 2000 Connecticut was performing about 20 PIQs per day, which represents approximately one-third of all vehicles inspected. Again, this is possible because of Connecticut's widespread use of wireless communication technologies.

Data from PIQs performed during the two-month period of April and May in 1999 and 2000 were analyzed to determine the frequency with which PIQs performed at the roadside revealed at least one prior inspection report during the previous 60 days. Table 3 contains the results from the four eastern states that performed at least 200 PIQs during either time period, as well as the results from all states. The percentage of PIQs showing prior inspections ranged from 8 percent in Rhode Island to 38 percent in New Jersey. These differences may be due to many factors, including characteristics of the truck traffic in the state and the protocols the states use to select trucks for performing inspections and PIQs. Overall, we see that percentage of trucks with prior inspections increased from 19 percent to 25 percent between 1999 and 2000. This difference is statistically significant. The most likely reason for this change is the increase in the number of inspections that states uploaded to SAFER. During this period, the number of inspections uploaded to SAFER tripled, increasing from 12,000 to 35,000 per month.

Table 3. PIQs that Produced Prior Inspection Reports During the Previous 60 Days [1]

State	Year	Number of Trucks with Prior Inspections	Number of PIQs Performed	Percent of PIQs with Prior Inspections
CT	1999	115	1,095	11%
	2000	165	1,040	16%
RI	2000	18	229	8%
NY	2000	57	269	21%
NJ	2000	80	208	38%
All States	1999	318	1,718	19%
	2000	631	2,566	25%

[1] Data from states performing at least 200 PIQs during the April-May of 1999 or 2000, as well as all states (including those not shown) during the two-month periods.

Identifying trucks with prior inspections is valuable for two reasons: (1) the prior inspection results are used by inspectors to focus the current inspection on previous problem areas, and (2) it is a necessary condition to identifying trucks with current OOS conditions. So far, there have been a few reports of vehicles stopped for inspection and the PIQ revealed an existing OOS order. There are additional cases where the vehicle or driver had the same OOS condition that was cited for violation during a previous inspection, even though the original violation was corrected. Detailed documentation of findings from individual states would be needed to conduct a more quantitative assessment of these occurrences.

The third hypothesis is concerned with the question of whether there are enough trucks on the road with current OOS orders to justify using the PIQ feature of SDM for catching OOS order violators.. The Connecticut screening study provided an opportunity to investigate this issue by simulating what would happen if PIQs were performed on all trucks. During the 13-day field test, the license plate numbers of every truck passing through the weigh stations were recorded. Later, these license plate numbers were electronically matched with SAFER inspection reports to determine the proportion of trucks passing each weigh station that had a recent OOS order. Specifically, for each passing truck, we determined whether the truck had undergone a recent inspection, exactly how long ago the inspection occurred, and if an OOS order had been issued. This gave us an idea of what the general population of trucks on the road looked like in terms of prior inspections and violations.

Table 4 summarizes the results. There were 9,417 trucks in the representative sample of the truck population observed at the weigh stations. Approximately 97 percent of the trucks did not have a prior inspection report on file in SAFER. So, if a PIQs had been performed on every truck, only three percent would have revealed a prior inspection in the past 60 days. Furthermore, approximately 0.7 percent would have shown an OOS order issued during that time period. Table 4 also shows the amount of time that passed since the prior inspection was also performed. It seems likely that the shorter the amount of time, the more probable the driver would be in violation. About 0.03 percent of the vehicles,or 3 trucks, had a prior inspection within the past 12 hours, of which one had an OOS order issued. This vehicle may or may not be violating an OOS order. The majority of the prior inspections and OOS orders occurred more than one week prior to the time of the simulated PIQ (i.e., the data collection time). Thus, it would appear that at the time of this study (Winter and Spring 1999) there were relatively few opportunities to catch OOS order violators using SDM. Of course, these probabilities are likely to increase as more states upload inspections to SAFER

Table 4. Results of Simulated Past Inspection Queries (PIQs) on General Truck Population in Connecticut

Number of Trucks	Number with No Prior Inspections	Number of Trucks with Prior Inspections				
		<12 hrs	12-24 hrs	24 hrs to one week	> one week	Total
9,417 (100%)	9,134 (97%)	3 (0.03%)	2 (0.02%)	58 (0.62%)	220 (2.34%)	283 (3.01%)
OOS Orders Issued?		1 (0.01%)	0 (0.00%)	10 (0.11%)	54 (0.57%)	65 (0.69%)

The results of simulated PIQs on a sample of 1,621 trucks that were actually inspected in Connecticut in 1999 were very close to those seen in the general population of trucks. About 2 percent were found to have prior inspections within the past 60 days, and 0.7 percent found to have prior OOS orders.

To address the fourth hypothesis, we conducted tests to determine the amount of time required to perform the uploads and queries using ASPEN with different communication technologies. Also, our survey and focus groups with inspectors from several I-95 Corridor

Coalition states included several questions concerning the practicality of using these technologies under actual roadside conditions.

For it to be feasible to make use of real-time data to screen trucks for OOS order violators under actual roadside conditions, the system must be efficient and easy for inspectors to use. For instance, the methods that other roadside sites use to access the SAFER data mailbox system and its contents must be fairly quick or inspectors will be reluctant to utilize them. Table 5 shows the amount of time required to access the SAFER data mailbox system and perform activities, such as PIQ's or subscription uploads. The times varied according to the function being used and the communication method with SAFER (i.e., landline connection or CDPD). Performing a PIQ or an ISS carrier refresh were generally the fastest (and most frequently used) functions, taking approximately 1 minute. For PIQs, the time for a CDPD connection to return results was between 25 and 75 seconds, and a landline connection took 50 to 70 seconds. Only a landline connection was used to time other functions, with a carrier refresh taking between 40 and 70 seconds, while a full subscription upload (3,800 carriers) took 6 minutes.

Table 5. Time Required to Access SAFER and Perform SDM Activities

Activity	Communication Method	
	Land Line	CDPD wireless
PIQ	50-70 seconds	25-75 seconds
ISS Carrier Refresh	40-70 seconds	14-25 seconds
Subscription Upload	6 minutes for 3,800 carriers	<5 minutes (if done weekly)

Data from a survey of inspectors in CT, MA, MD, NY, PA, and RI provided additional information concerning performance under actual roadside conditions and possible reasons for the differences in usage among the states. Some of the issues affecting usage are as follows:

- The methods of transmitting reports to SAFER included use of wireless and landline connections, delivery of diskettes to state offices for submission to SAFER, and paper reports that another person transmitted at a later time. These methods resulted in vastly different upload times, and long upload times limited the usefulness of SAFER, because prior inspections were not available immediately.
- There were differences in the time it took to use the SAFER data mailbox systems, resulting in different attitudes by the inspectors. If they felt the process was very time consuming and/or not perceived as beneficial, then inspectors were not likely to use it.
- States used different approaches to using ASPEN. Most used ASPEN (including ISS and PIQs) after a truck was selected for inspections. Others used ISS to make the decision to stop a truck. PIQs were always performed after the truck was selected for inspection.

These types of information should illustrate the feasibility of using real-time systems to screen trucks for violators using the current SAFER data mailbox system. It should also give us valuable insight into how the system can be improved.

Effectiveness as Measured by Deployment Across States

Finally, an important measure of effectiveness is the degree to which the technology is deployed among states. As discussed earlier, most eastern states are uploading inspection results to SAFER and are using personal computers with ASPEN to conduct nearly all of their roadside inspections. However, there were many challenges in getting certain components, especially those related to wireless communications, to work reliably. Connecticut's success was unique partly because they developed the in-house capabilities needed to deploy and maintain these systems over a period of several years. Also, the major challenges in deploying these systems are the costs and accessability of wireless communication services. States such as Connecticut, Rhode Island, and Delaware, which have wide coverage areas for digital cellular services, had an easier time using CDPD technology. Other states found themselves investigating more costly and technically challenging alternatives. For example, New York and Pennsylvania investigated the use of satellite technology. At the time, there were plans to have the entire country covered by low level geosynchronous satellites, but the plans were not implemented due to funding issues. Also, the corresponding land-based units emitted significant amounts of radiation and the cost per communication was nearly ten times the cost of cellular alternatives. Therefore, this approach was not implemented.

In general, the states will not deploy systems that do not work reliably in the field. However, they are committed to finding solutions and will deploy the new technologies when it can be demonstrated that they will work under the constraints of their environment. Figure 10 shows the current level of deployment of supporting technologies, such as wireless modems, landline modems, vehicle mountings for laptop computers, and portable printers, for various agencies across six states. Deployment level is measured by the percent of inspectors equipped with the various systems.

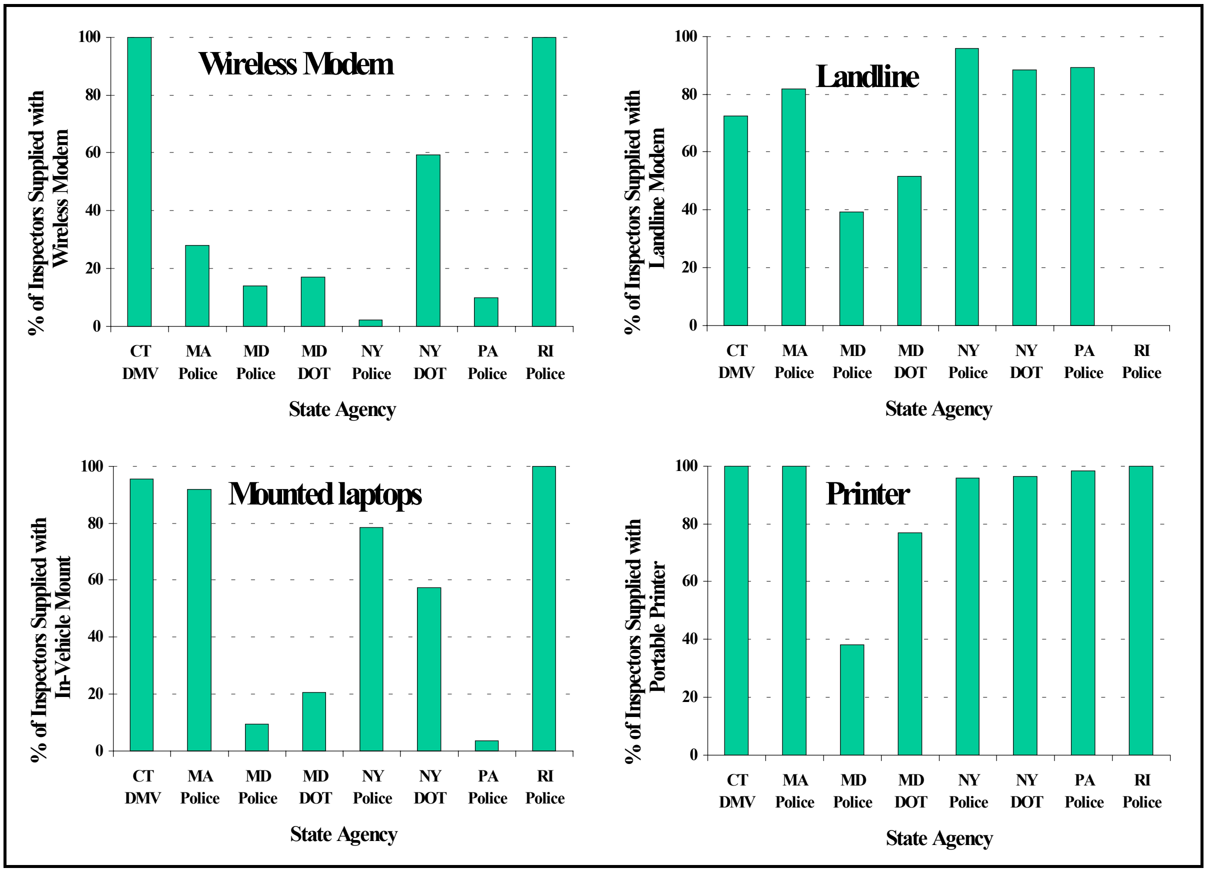

Figure 10. Percentage of Inspectors Equipped with Safety Information Exchange Components

Goal #2: Evaluate the time, cost, and other impacts of electronic collection of roadside safety information for upload and dissemination to regional and national databases

Time savings and other benefits of the technology

Using safety information exchange technology has become integral to the jobs of most roadside inspectors studied. This technology can save time for roadside inspectors and improve the speed and accuracy of data reporting. Other benefits reported include more uniform reporting and credibility with the carriers. The states demonstrated variation in the number of inspections uploaded to SAFER, and in the number of PIQs performed. Aside from Connecticut, the level of utilization of the SDM among the states was low, so the impacts of a fully deployed system have not yet been realized.

Inspectors who participated in focus groups noted time savings as the most important benefit of electronic inspection systems, especially in completing inspection forms using ASPEN and in selecting proper violation codes. The drop-down menu of violation codes was helpful in reducing delay and confusion caused by handwriting or clerical errors.

Inspectors generally agreed that the technology saved overall inspection time and time spent specifying violation codes, especially in Connecticut and Rhode Island. However, when compared to other results in the survey, this result is contradictory. Inspectors indicated that conducting a Level I inspection would take longer using ASPEN than using paper forms only. Level II and III inspections were reported to take about the same amount of time either way. A related time factor is the clerical and administrative time spent entering, checking, and correcting data from paper forms. This effort is reduced when inspectors enter information themselves.

In response to open-ended survey questions about the benefits of using the laptop system, inspectors reported that the neatness or professional appearance of the reports was the most important benefit. Other comments noted time savings, accuracy, legibility, and the availability of prior inspection reports.

A study of the time required to access the SAFER data mailbox system and perform activities such as PIQs or subscription uploads was conducted, to evaluate the feasibility of using real-time data to screen trucks during inspection. PIQs and carrier refresh functions required approximately 1 minute, depending on the telecommunication technology being used. As another example, a full carrier subscription refresh across a landline modem required 6 minutes.

Use of laptops, software, and communications technology

Laptop computers and portable printers are widely used in conducting motor carrier inspections. Most inspectors reported using paper reports in fewer than ten of their last 100 inspections. Inspectors participating in the focus group reported using a core of computer-based services related to ASPEN, ISS, and SAFER, but their patterns of use varied widely. Among four software applications, the Inspection Selection System (ISS) enjoys the most widespread use in inspections. Other applications reported to be used less often were the Past Inspection Query (PIQ), the Commercial Driver License Information System (CDLIS), the National Crime Information Center (NCIC), and PC*MILER. In one state, all inspectors reported running a PIQ on every inspection, while in another state, inspectors run such PIQs only sporadically because they must use a separate, more distant computer for the PIQs

Inspectors reported that they were generally satisfied with the ASPEN system. Satisfaction with the reliability of the computer, support for solving problems, and computer training were more varied across the states and agencies surveyed. Because inspectors had different levels of access to ITS hardware, equipment, and software, the expressed preferences are influenced by each inspector's degree of access and his/her familiarity with ASPEN and the other software features.

Methods of wireless communication are not consistent among the states. A large percentage of inspectors in three states appeared to be supplied with wireless modems for mobile transmission of inspection data. Other states relied more heavily on landline modems, CD-ROM distribution, or diskette distribution to update data files in the field and at a central computer facility. The variation in methods of transmitting reports to SAFER resulted in vastly different upload times, and long upload times limited the usefulness of the data, because prior inspections were not available immediately.

The level of available wireless communication services varied greatly between states. Coastal states like Delaware, Connecticut, and Rhode Island generally had CDPD services available statewide, while larger, inland states like New York and Pennsylvania often lacked such coverage in large portions of their state. New York is continuing to explore other wireless options, such as CDMA, that are showing some promise upstate. Attempts to deploy and test an alternate system in Pennsylvania using satellite communications were not successful.

Areas for improvement for the computer technology included support and training, the use of ISS to select vehicles for inspection, frequency of ISS/carrier refresh events, and the frequency of inspection report transmissions.

The physical arrangement of the computer and printer in the patrol vehicle was frequently noted as an area for improvement by focus group participants, especially when inspections involved stopping a moving vehicle. Because of the variety of patrol vehicles and computer hardware, it is difficult for states to provide uniform, efficient mounting hardware that is usable and portable while protecting the computer and remaining convenient for the inspector. Important issues are ensuring safety and providing a mounting system that does not interfere with other enforcement vehicle systems (e.g., wiring, radios, airbags) or with normal operations.

Focus group participants listed the following as the most needed improvements in computer and peripheral hardware: laptop screens that are visible in sunlight, greater damage resistance for laptop computers to be used outdoors, and greater coverage area for wireless communication services. Recommended improvements in software included

- Greater selection of codes in the drop-down menu for specific violations, especially in the area of HAZMAT violations
- Better warnings to prevent inspectors from exiting the system before forms are complete
- Better access to other programs from within the ASPEN environment
- Ticket writing capability
- Better method of customizing fields for particular jurisdiction, and some way of preserving the customized settings when software is upgraded or reinstalled
- Availability of Canadian postal codes

- Addition of tollbooth locations as valid points of origin in PC*MILER, and some way of preserving tollbooth records given greater adoption of EZ Pass and similar automated systems
- More advanced training in using the ASPEN system
- Capability to add or append longer notes to an electronic inspection report
- Automation of certain commonly used violation criteria (e.g., lookup tables for brake adjustment violations

Costs

Based on cost survey responses from seven of the ten states participating in the SDM test and the I-95 Corridor Coalition, equipment costs (in 1999 U.S. dollars) are expected to range from $7,500 to $9,175 for one each of the main SDM system components, as outlined below:

• Sierra Wireless MP210	$800 – 1,615
• Desktop PC plus internal modem	$1,200 – 1,600
• Brayley box	$2,300
• Laptop PC	$3,000 – 3,360
• Printer	$200 – 300

These costs do not include power converter, mounting hardware, or docking stations. Software other than that normally provided with new PCs is also not included in these average cost estimates. Total equipment costs for states participating in the SDM evaluation program ranged from $7,613 to $216,570. Estimates for the costs of long-term statewide deployment of electronic equipment to support commercial vehicle inspections ranged from $72,500 to $831,400 per state.

Telecommunication costs are expected to constitute the largest share of operating cost for the SDM equipment. During the evaluation program, communication costs were $55 per month per unit for connection charges only (not including air time charges). Some states anticipate higher overall telecommunication costs when the system is deployed. Connecticut's costs on a per-unit basis (now $39 per unit per month), however, are expected to decline with increased use.

In general, respondents expected labor costs and inspection time to remain steady following deployment of SDM equipment.

Maintenance costs were not analyzed, in part because most states did not have separate maintenance budgets for SDM systems being evaluated. All states deploying SDM technology will incur training costs, but the extent of these costs has not been estimated. In one example, Connecticut provides 16 hours for inspectors to train in using SDM equipment.

Goal #3: Identify institutional issues and benefits related to the use of this technology

The studies identified institutional obstacles to the widespread implementation of safety information exchange technology, but no insurmountable barriers were identified. Based on cost survey responses from seven of the ten states participating in the SDM test and the I-95 Corridor Coalition, one important institutional issue is the overlapping of responsibilities in some states between law enforcement and regulatory agencies in inspecting commercial vehicles. This division of responsibilities could result in problems in budgeting for equipment, operation, maintenance, and telecommunication. In general, the agencies responsible for law enforcement, vehicle size and weight enforcement, and economic regulations are in charge of SDM deployment.

Other potential concerns include information security, data privacy, electronic fire walls for data security, and data reliability. The survey noted that no state laws (e.g., requirements for probable cause to inspect) are likely to be affected by SDM implementation.

Institutional benefits are expected to include

- SDM-related safety improvements that may reduce political and public pressure to improve truck safety
- Increased efficiency in roadside enforcement, resulting from quicker access to more accurate data
- Enhanced prosecution of OOS violators
- Timely sharing of enforcement data among states and jurisdictions.

The following policies or procedures are likely to be changed as a result of SDM implementation:

- Frequency of updating inspection data (because of expected daily uploads and real-time access to safety information)
- Storage and retrieval protocols (because of real-time access and changes in frequency of uploads)
- Quality improvements in roadside inspections and the resulting data (because of ready access to prior data)
- Screening protocols (because of the potential for use of SDM for mainline screening for previous inspections)
- Management of roadside operations.
- Availability of near-real-time access to safety inspection data that may deter OOS jumping, if this capability were commonly available to roadside inspectors/ troopers.

The following are some lessons learned from the SDM project. These lessons are expected to provide guidance for long-term implementation of SDM statewide, in other states, and implementation of similar projects in the future.

- Smaller, more targeted projects may be more effective in testing technologies like SDM.
- States should be included in the consultant selection process.
- Project responsibilities should be shared among all participating states.
- Identify features unique to a state and take those into account in designing and implementing the project. Information exchange and other things that work in one state may not necessarily work with other agencies or states.
- Redesign the Brayley box with commercial vehicle inspectors and their working environment in mind. Brayley boxes are not considered effective by some states. The laptop configuration was found to be more flexible compared to Brayley boxes.
- In implementing SDM systems, communication costs should be taken into account.
- It became clear that the level of available wireless communication services varied greatly between states. Coastal states like Delaware, Connecticut, and Rhode Island generally had CDPD services available statewide, while larger, inland states like New York and Pennsylvania often lacked such coverage in large portions of their state. Furthermore, alternative analog services available in these areas were expensive and not reliable. Unfortunately, the technical consultant to the SDM project made the initial assumption that CDPD coverage would be available to almost all areas of the seven participating states, which turned out to be incorrect. In response, New York is continuing to explore other wireless options, such as CDMA, that is showing some promise upstate. Attempts to deploy and test an alternate system in Pennsylvania using satellite communications were not successful.
- Early on, the SDM project was envisioned to test out various wireless technologies beyond CDPD once it became apparent that adequate coverage was not available in all the involved seven Eastern States. Unfortunately, the technical consultant never demonstrated adequate knowledge of the alternatives, including the use of analog wireless and satellite wireless. In many cases, the states were left to solve their own technology deployment issues, after the consultant made the initial technology selection for them.
- For larger states, the issue of providing ISS type data for all carriers — both interstate and intrastate — also was identified. States view all carriers the same but only interstate carriers are under the jurisdiction of USDOT. Inspectors need to be able to have real-time access to safety and credentialing data for all carriers, but most systems developed by USDOT to date have provided this for only interstate carriers. FMCSA appears to understand this issue and is trying to address it.

Respondents to focus group interviews reported that the availability of technical support staff was important in improving the effectiveness and deployment of the laptop computer systems.

In general, adoption of computer-based enforcement systems is dependent on solid commitment or “buy-in” from upper levels of state governments and from the managers of the technical support infrastructure agencies. Experience suggests that when a program’s “champion” leaves, the program can be set back.

With few exceptions, focus group participants tended to indicate that computer-based inspections represent a significant improvement over paper-based systems, making their work more efficient. One example comment given by several inspectors in Connecticut: “You can take away my gun before I’ll let you take away my laptop!”

Three primary advantages cited by focus group participants were (1) saving time in certain aspects of the inspection, (2) legibility of the reports, and (3) efficiency and effectiveness of the total process. Inspectors tended to speak in terms of immediate, day-to-day benefits rather than long-range impacts on highway safety.

Goal #4: Assess the effectiveness of public outreach programs for deterring OOS violations

As noted above, this goal is still of interest to SDM partners, but the course of SDM deployment led resources to be diverted from the public outreach effort. This component of the programs was never fully developed.

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6. CONCLUSIONS AND IMPLICATIONS

Overall Conclusions

The findings from this study lead to several general conclusions and trends:

- Utilization of laptop computers with ASPEN software, including components of SAFER Data Mailbox, has increased steadily since the system became operational in 1997. Most eastern states are uploading inspection results to SAFER on a regular basis, but the time between completion of the inspection and uploading the report varies from state to state, depending on the type of communication technologies used.
- Inspectors report a general satisfaction with the ASPEN system, and report that laptop computers have become an integral part of conducting motor carrier inspections.
- Computer technology is seen as helping inspectors (a) gather more complete inspection information, (b) work more efficiently, and (c) save time compared with traditional paper-based inspection systems. Findings on actual time savings versus paper were equivocal. Some inspectors reported a net time savings, while others reported that computer-based systems required just as much time as paper-based systems to conduct inspections at roadside or at weigh stations.
- Inspectors perceive that using more current and accurate inspection data, as provided by computer-based inspection technologies, helps them (a) target their inspection efforts better, (b) find recent out-of-service orders more readily, and (c) spot patterns in motor carrier violations more easily.
- Until electronic screening technologies are deployed and integrated with the Inspection Selection System (ISS), it is not practical to screen all trucks on the highway using ISS. However, it was demonstrated that inspection selection efficiency, measured in number of out of service orders per inspection, increased by about 2 percent when ISS is used in combination with manual pre-screening. Simulation results indicated that inspection selection efficiency will increase by 11 percent when ISS is integrated with electronic screening.
- Few violators of out-of-service orders have been identified using SAFER Data Mailbox. However, inspectors have found that past inspection results provide useful information for detecting current violations.
- The full potential for SAFER Data Mailbox will not be realized until all states upload inspection results in a timely manner (i.e., in less than 2 hours). Greater potential is possible if the system is used in combination with electronic screening systems which automatically identify the vehicle at highway speeds.
- Inspectors responded most positively to the improved uniformity, legibility, and neatness of the computer-generated inspection reports.
- Roadside tests of the Inspection Selection System in Connecticut showed that computers offered a marginal advantage in helping inspectors target high-risk carriers for inspection over vehicles from other carriers in the general population.

- Costs for equipment were estimated to range from $7,500 to $9,175 per system, with itemized component costs as follows:
  - Sierra Wireless MP210 $800 – 1,615
  - Desktop PC plus internal modem $1,200 – 1,600
  - Brayley box $2,300
  - Laptop PC $3,000 – 3,360
  - Printer $200 – 300
- Inspectors tended to speak more of immediate, day-to-day operational benefits of the computers than any perceived long-term, national benefits in highway safety resulting from the wider adoption of computer-based inspection technologies.
- Issues remaining to be resolved include
  - The overlapping of government jurisdictions and responsibilities for purchasing equipment, maintaining systems, and training staff
  - Data security and reliability
  - Convenience of laptop computer and peripheral equipment used in patrol vehicles and at roadside inspection sites.
  - Costs and availability of wireless communication services, especially in rural areas.

Directions for Future Research

The customization or adaptation of computer systems to the roadside working environment, noted in the focus groups and interviews, are important indicators of the degree to which inspectors are accepting the technology. Firsthand observations or accounts of such user adaptations, if analyzed in greater detail, may provide clues to not only the degree to which inspectors are invested in the technology, but also the practical, operational needs the inspectors face in day-to-day operations.

The integration of safety information exchange technologies with electronic screening systems could produce significant benefits by focusing enforcement efforts on high risk carriers. This will result in fewer crashes involving unsafe trucks and drivers. However, research is need to find the best ways to use the safety information to identify trucks and drivers that represent the biggest risks.

Satellite communication may offer an alternative for wireless exchange of data to and from the roadside. While initial and operating costs seem high, and data transfer rates are relatively low, satellite communication may provide states a way to avoid the substantial cost of building, deploying, and maintaining new statewide infrastructure for existing wireless technologies such as CDPD.

Future research should also explore the ratio of time to information that is at the center of the inspection system. The time spent in conducting and reporting on an inspection using paper and computer-based systems could be compared and analyzed, as could the amount, accuracy, and timeliness of information available to decision-makers resulting from both ways of conducting inspections.

The effect of computer-based inspection technologies on the motor carrier companies and the truck drivers themselves could be explored. The tests discussed in this report were more concerned with the adoption of the technology among the inspector community. It can be assumed that changes in inspection practices will lead to adaptations among drivers and operating companies. Many of the same tests used to gauge inspector attitudes and opinions, such as interviews, focus groups, and observations, plus more quantitative measures of compliance and highway safety, could also be applied to the motor carrier community.

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8. ABBREVIATIONS

ATA	American Trucking Associations
CDLIS	Commercial Driver License Information System
CDPD	Cellular digital packet data
CMV	Commercial Motor Vehicle
CVIEW	Commercial Vehicle Information Exchange Window
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial vehicle operations
CVSA	Commercial Vehicle Safety Alliance
DMV	Department of Motor Vehicles
DOT	U.S. Department of Transportation
DPS	Department of Public Safety [Connecticut]
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
FOT	Field Operational Test
HAZMAT	Hazardous materials
HR	High risk
ID	Insufficient data
ISS	Inspection Selection System
ITS	Intelligent Transportation System
MCMIS	Motor Carrier Management Information System
MCSAP	Motor Carrier Safety Assistance Program
MDI	Model Development Initiative
ML	Medium or low risk
MMDI	Metropolitan Model Deployment Initiative
NCIC	National Crime Information Center
NLETS	National Law Enforcement Telecommunication System
OOS	Out of service

OS/OW	Oversize/overweight
PIQ	Past Inspection Query
SAFER	Safety and Fitness Electronic Records
SafeStat	Safety Status Measurement System
SCA	SAFER-CVIEW Application
SDM	SAFER Data Mailbox
WIM	Weight in motion

APPENDIX A:

SURVEY OF MOTOR CARRIER INSPECTORS

APPENDIX A:

I-95 Corridor Coalition Survey of Motor Carrier Inspectors

May 26, 2000

Prepared for:

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. . . Putting Technology To Work

I-95 Corridor Coalition Survey of Motor Carrier Inspectors

Prepared for:

Field Operational Test 7
U.S. Department of Transportation
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Washington, D.C. 20590

May 26, 2000

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1.0 Introduction

The purpose of Field Operational Test (FOT) 7 is to test the implementation of procedures and technologies that will enable state inspectors and enforcement officers to focus roadside inspections on high-risk motor carriers. The technology includes the deployment of a central computer system, laptop computers with specialized software, and a connection to the central system, which allows inspectors to record inspection reports and access up-to-date motor carrier information to and from a centralized database. An important component to this FOT is the independent evaluation of the benefits and effectiveness of the deployed procedures and technology. Several different evaluation tests were developed to address the evaluation goals for this FOT (see Draft Evaluation Plan, I-95 Corridor Coalition Safety-Related Field Operational Tests). The focus of this document is on one of these evaluation tests: surveys of roadside motor carrier inspectors.

1.1 Objectives

There are three main goal areas of the FOT 7 Evaluation. Within each of these goal areas there are many different study questions that will be addressed by the evaluation effort. In particular, the survey of roadside motor carrier inspectors was designed to address many of these study questions in all three of these goals areas. Table A-1 presents a crosswalk of the overall evaluation goals, study objectives, and the specific topic areas/questions addressed by the survey of motor carrier inspectors.

Table A-1. Crosswalk of Evaluation Goals and Focus Areas of the Survey of Inspectors

Evaluation Goals	Study Questions	Survey Focus Area			
		Profile of Motor Carrier Inspectors	Technology of Deployment and Usage	Satisfaction	Perceived Benefits
1. Evaluate the effectiveness of using current safety performance data to help identify high risk carriers, drivers, and vehicles for roadside enforcement	1. Best technical solutions?	!	!	!	!
	2. What data do inspectors use?	!	!		
	3. Are high-risk carriers identified?		!		!
	4. How timely are the Data?		!		
	5. Do laptops improve uniformity?				!
	6. Improved interstate enforcement?				!
2. Evaluate the time, cost, and other impacts of electronic collection of roadside safety information for upload and dissemination to regional and national databases	1. Purchase and operating costs?				
	2. Type and amount of training?	!		!	
	3. Impact on inspection procedures?		!		!
3. Evaluate institutional issues and benefits related to roadside enforcement officers' use of this technology	1. What are the institutional impediments? (e.g., probable cause, data privacy)				
	2. What are institutional benefits?				!
	3. Differences among states?		!	!	!

2.0 Survey and Questionnaire Design

The survey was carried out among the roadside inspectors operating in the six member states of the I-95 Corridor Coalition: Connecticut, Maryland, Massachusetts, New York, Pennsylvania, and Rhode Island. Copies of the questionnaire form were sent to a key contact person in each state, who then distributed the questionnaires to all inspectors. The key contact person also collected the completed questionnaires from the inspectors and returned the forms to Battelle for processing and analysis. Telephone contact was maintained with these key contact persons throughout the course of the data collection period to improve the distribution and return of completed questionnaires. Combining all states, 370 useable questionnaires were completed by inspectors in the six states. Figure A-1 summarizes the estimated response rate by state and agency.

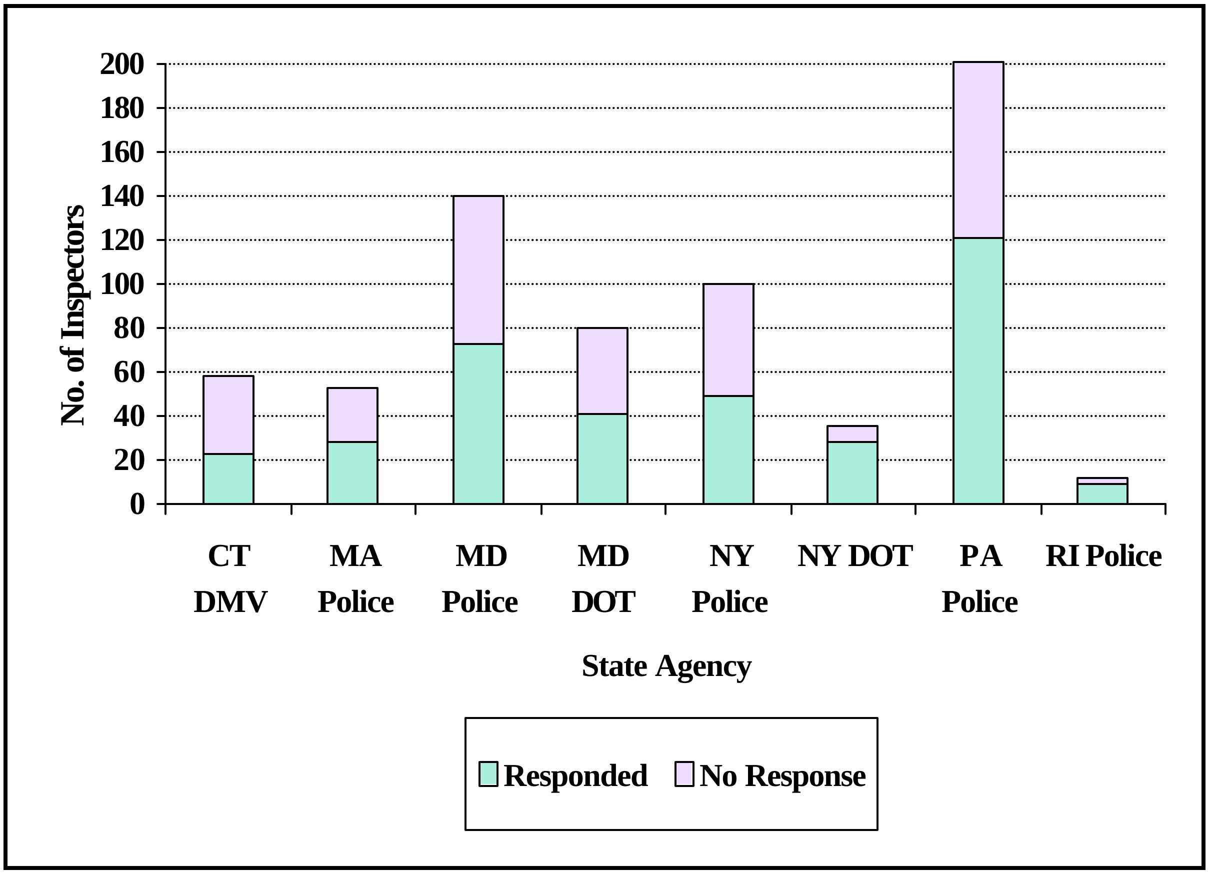

Figure A-1. Number of Surveyed Inspectors and Estimated Response Rates

The questionnaire itself was designed to be self-administered and was accompanied by detailed instructions. Additionally, the key contacts were asked to provide additional guidance and troubleshooting, if necessary, to assist inspectors in completing the questionnaire form. The questionnaire with instructions is provided as Attachment A1. Two conflicting requirements had to be taken into account while designing the questionnaire: the questionnaires needed to cover as many of the issues in the evaluation as thoroughly as possible, yet the length and complexity of the questionnaire needed to be restrained. A long and complex questionnaire would tend to achieve low accuracy and response rates, and significantly burden the respondents. The length of the questionnaire form was therefore restricted to two sides of a single 11 in. × 17 in. piece of paper and was designed so that it could be completed in about 10 minutes.

The types of questions asked in the questionnaire can be summarized in four categories. The first category is inspector profile, where the responses describe characteristics of the inspectors participating in the survey, such as the agency they work for, their inspection experience, computing experience, and training, that might have a significant effect on how the inspectors regard the new technology. The second category is inspection characteristics and technology implementation, where the responses provide an assessment of the technology, including the difference in the length of inspections due to the new technology by inspection level, and the types, frequency, and times of software and hardware use by the inspectors, and frequency of problems with the technology. The final categories are satisfaction and perceived benefits, where inspectors provide their opinion on the benefits and potential areas for improvement of the procedure and technology, in terms of how inspectors do their jobs and improved safety on the roads.

3.0 Results

The results presented in this chapter are based upon 370 useable questionnaires completed by inspectors in all six states. Table A2-1 in Attachment A2 provides a descriptive summary of the responses from these 370 inspectors by state and agency. Statistics such as the mean, median, standard deviation, and selected percentiles are presented for each quantitative question. Frequency distributions are presented for each categorical question. Many of the results presented in the following discussion are based upon these descriptive statistics. Additional analyses were conducted to further investigate specific results of interest and significance.

3.1 Profile of Surveyed Inspectors

Motor carrier inspectors, like the general population, can vary greatly in their experiences, knowledge base, aptitude, and perspective. Therefore, it is important to capture as many of these differences as possible so that the survey results can be interpreted appropriately. For example, consider comparing the satisfaction of a computer training course between two states, or between agencies within a state. If one state has a majority of experienced computer users while the other state's inspectors are typically less experienced users of computers, then differences in the reported sufficiency of training may be more due to the underlying knowledge base of the inspectors than due to differences in the training protocols. In this study, it is important to understand the makeup of the survey respondents both in terms of their general experience in conducting inspections, and their specific experience in using computers, which represent the bulk of the deployed technology.

3.1.1 General Experience as an Inspector

General experience as an inspector includes a number of factors including but not limited to the state and agency of employment, the number of years that the respondent had conducted inspections, whether the respondent was a supervisor, the percentage of time that the respondent spends performing inspections (i.e., whether performing roadside inspections is their primary job responsibility). The following summarizes the results of an examination of many factors pertaining to the general experience of the surveyed inspectors.

The surveyed inspectors were employed by several different states and agencies. Most of the surveyed inspectors are from the three western states of the I-95 coalition (Maryland, New York, and Pennsylvania), rather then the three eastern states (Connecticut, Massachusetts, and Rhode Island). An overwhelming majority of the surveyed inspectors (279 out of the 370) were employed by state police. Only in Connecticut, Maryland, and New York were any of the surveyed inspectors employed by the state DOT or other agencies. Table A-2 summarizes the distribution of responses by state and agency.

Table A-2. Distribution of Inspectors by State and Agency

	State Police	State DOT/DMV[2]	Other[3]	Missing	All Agencies
Connecticut	(2)[1]	22	0	(1)[1]	22
Massachusetts	28	0	0	0	28
Maryland	73	41	(4)[1]	(1)[1]	114
New York	49	28	0	0	77
Pennsylvania	121	0	0	0	121
Rhode Island	8	0	0	0	8
All States	279	91	0	(2)[1]	370

1 Too few responses were received in this group. These responses are not included in the analysis or results.

2 Includes Maryland Transportation Authority Police

3 Maryland Department of the Environment, and I-95 and JFK Inspectors

The experience of an inspector may affect how they rate the benefits of the new technology. For example, the perceived benefits of the deployment may be less for experienced inspectors, since they have developed over time a method of how to carry out inspections efficiently using paper and may be less willing to accept the new technology. Overall, the surveyed inspectors tended to have several years of experience conducting motor carrier inspections; around 75 percent of the surveyed inspectors have conducted inspections in their current position for more than two years. The average number of years spent by the surveyed inspectors varied from a low of 4.4 years among New York Police to a high of 10.2 years among Connecticut DMV inspectors. As summarized in Figure A-2, there did not appear to be an outstanding difference in the average number of years of experience across the States and Agencies.

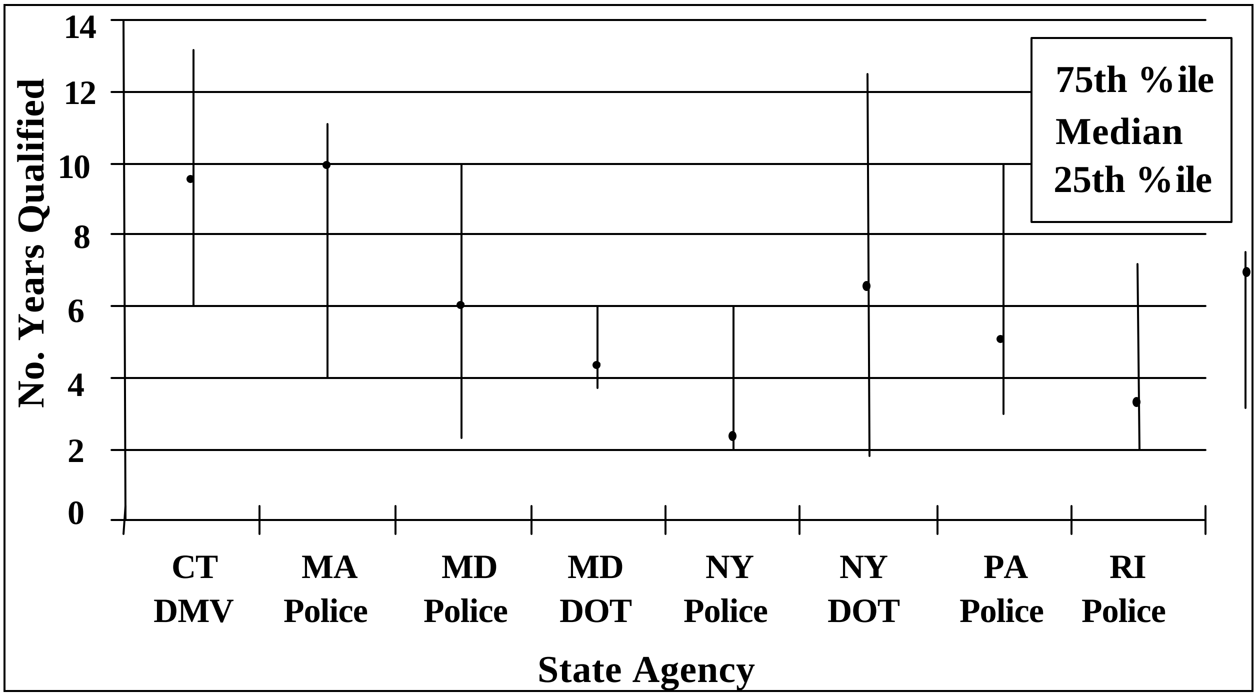

Figure A-2. Average Number of Years Spent as a Qualified Inspector by State and Agency

Similar to the number of years of experience, the number of inspections that inspectors have actually directly conducted themselves (rather than those where they have supervised others or supported in a peripheral role) and the percentage of their everyday work that is spent performing inspections are also important indicators of experience. On average, the surveyed inspectors reported that they conduct 5.4 inspections on a typical day of inspections in good weather. This did not appear to vary significantly among the surveyed inspectors across both agencies and states. However, the percentage of an inspector's work spent conducting hands-on commercial vehicle inspections did vary significantly from by agency and state. As one might suppose, on average a smaller percentage of the work of state police was spent conducting inspections compared to state DOT. Further, as illustrated in Figure A-3, the percentage of the work spent conducting hands-on inspections was much lower for Pennsylvania as compared to other states, because the majority of inspectors in the Pennsylvania State Police conduct inspections on a part-time basis in addition to other police duties.

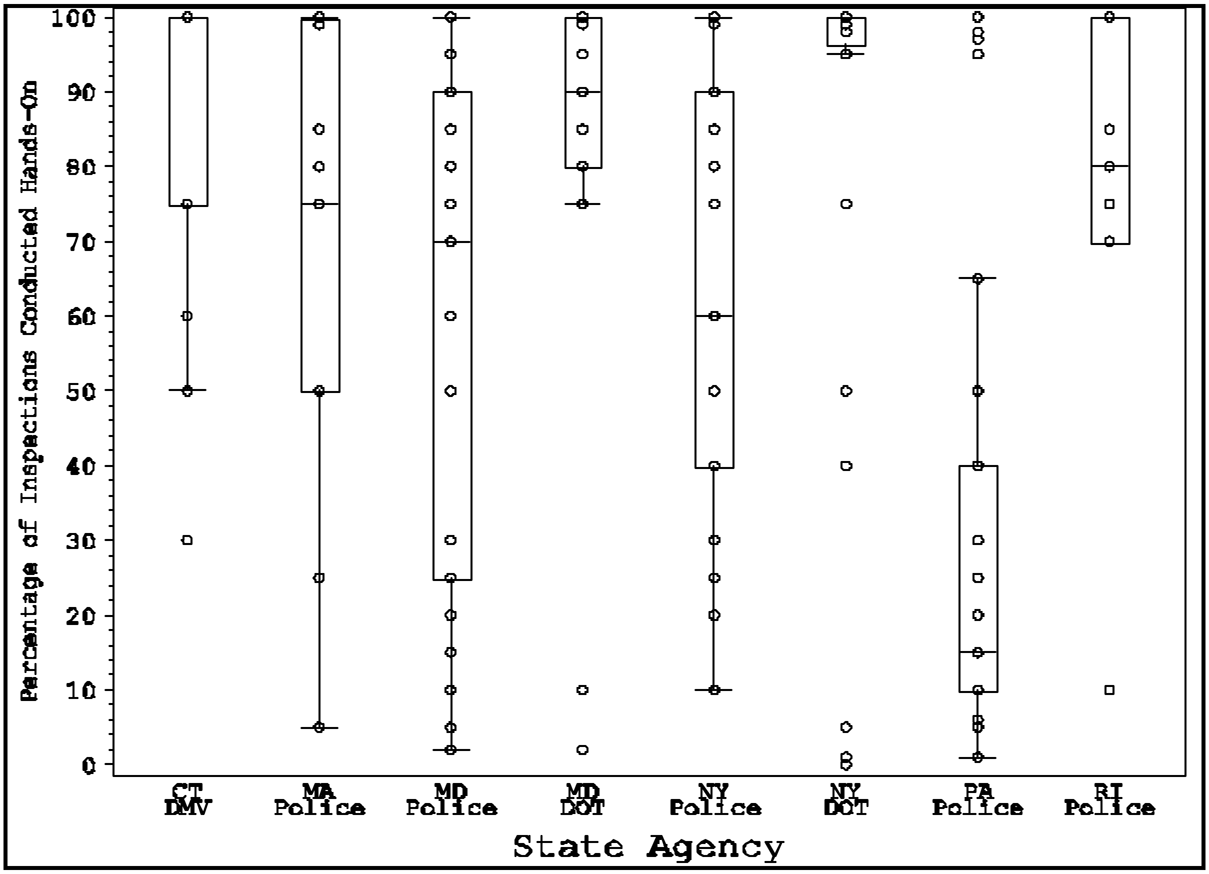

Figure A-3. Percentage of Work Spent Performing Hands-On Commercial Vehicle Inspections by State and Agency

Inspectors who work in teams may have a different view of the new technology than those who operate alone. For example, in a team one person may typically inspect the vehicle directly while another person works with the laptop to retrieve information and record results. On average, inspectors conducted about 7 to 13 of the last 100 inspections with another inspector (see Table A2-1, Attachment A2). One notable exception to this general trend was observed in Maryland where the surveyed inspectors tended to work much more frequently in teams spending on average, 64 of the last 100 inspections working in a team.

Most of the inspectors surveyed were not supervisors though there were some differences in the distribution of surveyed inspectors between the six states. Surveyed inspectors in Connecticut, Maryland, Rhode Island, and Pennsylvania included more inspectors who were supervisors as compared to Massachusetts and New York (see Table A2-1 in Attachment A2). Combining all states, the proportion of supervisors was about the same between state police and state DOT.

The location where the inspections are carried out can affect the type of equipment deployed as well as the way in which the equipment is used. For example, at a fixed-scale facility, the computer may be connected to a permanent phone line whereas at mobile locations wireless communications are employed. Inspectors were asked to provide the percentage of inspections, among the last 100 inspections conducted, that were reported to be conducted at fixed sites, non-fixed sites, and at the roadside by the surveyed inspectors. As seen in Figure A-4, inspections in Connecticut and Maryland tended to be conducted at fixed scale sites. Conversely, most of the inspections conducted in the other four states were at non-fixed scale sites or at the roadside. One item of note is that in Connecticut many of the surveyed inspectors gave the exact same breakdown of percentages (60 percent, 30 percent, and 10 percent at a fixed scale facility, non-fixed scale site, and stopped vehicle at roadside, respectively). This could imply that the percentages reported in Connecticut were more representative of a department policy than actual practice.

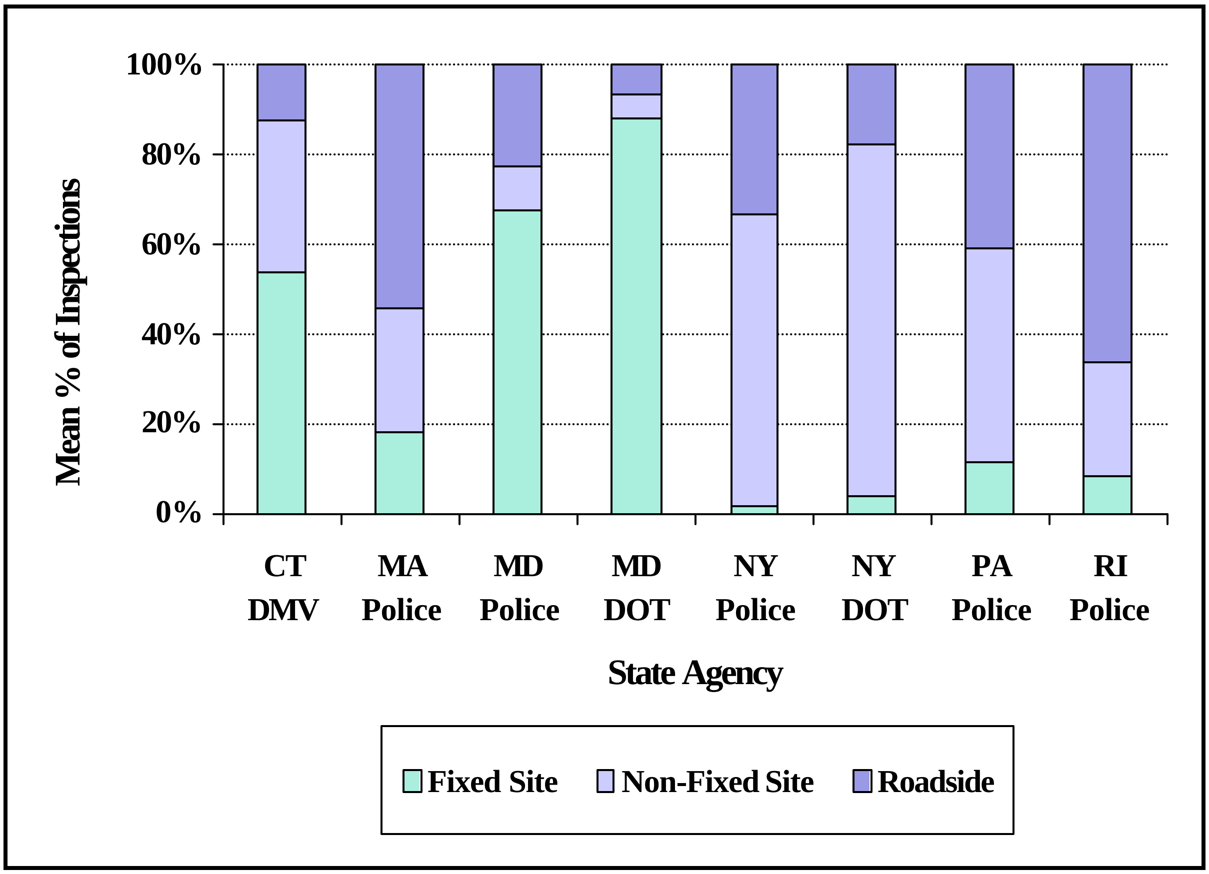

Figure A-4. Percentage of Inspections Conducted at Different Inspection Locations

3.1.2 Computer Experience and Training

The survey questionnaire collected information on three aspects of computer experience and training: use of a computer before the deployment, amount and nature of computer training, and the length of time that the surveyed inspectors have utilized a computer to conduct inspections. In each of these three aspects, some differences were observed between the surveyed inspectors in the various states and agencies.

Many of the surveyed inspectors (approximately 81 percent) had used a computer at some level before the technology deployment. Overall, approximately one-third (31 percent) used a computer on a daily basis. Table A2-1 in Attachment A2 summarizes the frequency of computer use at home or at work by the inspectors prior to the deployment and the frequency of computer use other than ASPEN at work by state and agency. At least 20 percent of the inspectors within each state/agency group reported being daily users of personal computers prior to the implementation of ASPEN, with over 40 percent within each state/agency having used a personal computer at least weekly at home or at work. The percentage with no prior personal computing experience ranged from a low of 8 percent in Connecticut up to 28 percent for the Maryland state police, but was similar in the remaining six state/agency groups averaging at approximately 18 percent. Following the deployment of the technology, there was a significant increase in the amount of daily computer use to conduct tasks other than those involving ASPEN. In particular, daily use of a computer significantly increased among Connecticut DMV, New York Police, and Pennsylvania Police. Also, the percentages of inspectors reporting infrequent or no use of computers at work for tasks other than those involving ASPEN was substantially higher in Massachusetts, Maryland, and New York compared to the other state/agency groups.

A majority (72 percent) of the surveyed inspectors received formal training on how to use a personal computer or Windows©. Roughly 80 percent had received formal training on how to use ASPEN. Table A2-1 in Attachment A2 summarizes the percentages of inspectors in each state/agency group that received formal general training and ASPEN specific training. In all state/agency groups except for Maryland Police and DOT, at least 75 percent of the surveyed inspectors responded that they had received some PC/Windows training, but only 26 percent of Maryland Police and 48 percent Maryland DOT reported receiving formal computer or Windows training. Only 51 percent of Maryland Police, 29 percent of Maryland DOT, and 50 percent of the surveyed inspectors in Rhode Island reported receiving ASPEN specific training whereas in all the other state/agency groups at least 90 percent received ASPEN training.

The Field Operational Test is in different stages in different state/agencies. This is also apparent when examining the length of time that an inspector has been using the deployed technology. Table A2-1 in Attachment A2 provides descriptive statistics on the length of time that the surveyed inspectors have been using the deployed technology, Figure A-5 summarizes this information graphically. As seen in both the table and figure, the surveyed inspectors from Connecticut appear to have used the equipment longer than those from any other state/agency while Maryland Police inspectors have had the least amount of time using computers to conduct inspections. On average, overall states and agencies, inspectors had used computers to conduct inspections for 1.7 years at the time of the survey.

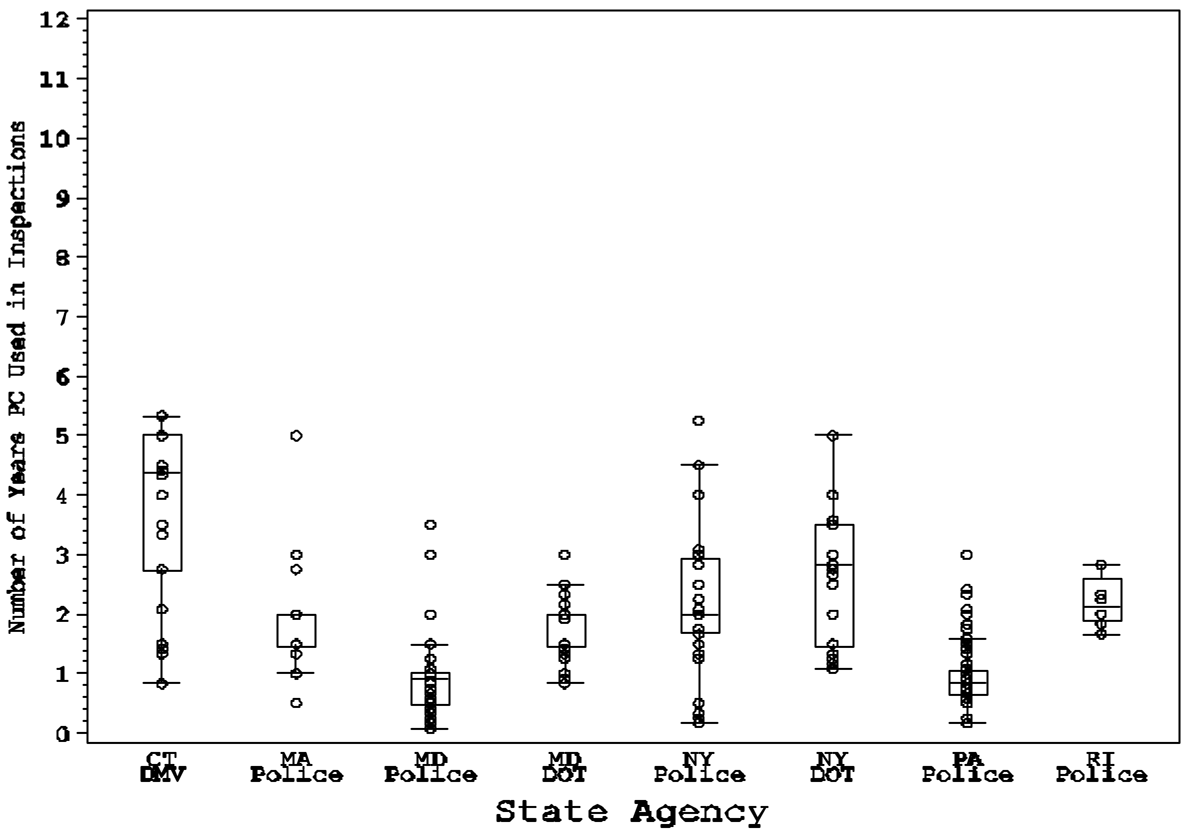

Figure A-5. Number of Years Using a Personal Computer During Inspections

3.2 Technology Deployment and Usage

One of the objectives of the FOT is to accelerate the deployment of pen-based and laptop computers. To this end, the questionnaire asked inspectors to indicate the type of hardware that they were using to conduct roadside inspections. Importantly, the responses of the surveyed inspectors may differ from the actual plan of deployment for a specific state/agency. In addition to obtaining information on the deployed hardware, inspectors were asked to provide information on how they use the hardware to conduct roadside inspections. The following summarizes the responses of the inspectors regarding the deployed technology, system usage, and data base usage.

3.2.1 Hardware Deployment

Virtually all of the inspectors surveyed in Connecticut, Massachusetts, New York, Pennsylvania, and Rhode Island were conducting roadside inspections using a computer. In Maryland, 100 percent of the DOT inspectors surveyed were using computers but only 67 percent of the police inspectors surveyed were currently using computers to conduct roadside inspections (see Table A2-1 in Attachment A2). In addition to the deployment of the computers themselves, states and agencies deployed different technologies such as wireless modems, landline modems, in-vehicle computer mounts, portable printers, and in-vehicle printer mounts, to supplement the computers and to increase their usefulness.

The percentage of the surveyed inspectors indicating utilization of a wireless modem, landline, mounted laptop, portable printer, or a printer mount are summarized by state/agency groups in Table A2-1 of Attachment A2. Figure A-6 summarizes the same information graphically. Some observations from Table A2-1 and Figure A-6 include:

- A large percentage of the surveyed inspectors in Connecticut DMV, New York DOT, and Rhode Island police appeared to be supplied with wireless modems.

- With the exception of Rhode Island, a significant percentage of surveyed inspectors in all state/agencies reported the deployment of landline modems, with the lowest percentage being reported among Maryland police.

- A small percentage of surveyed inspectors in Maryland and Pennsylvania had in-vehicle computer mounts for their computers.

- Less than 40 percent of the surveyed police inspectors in Maryland reported having a portable printer.

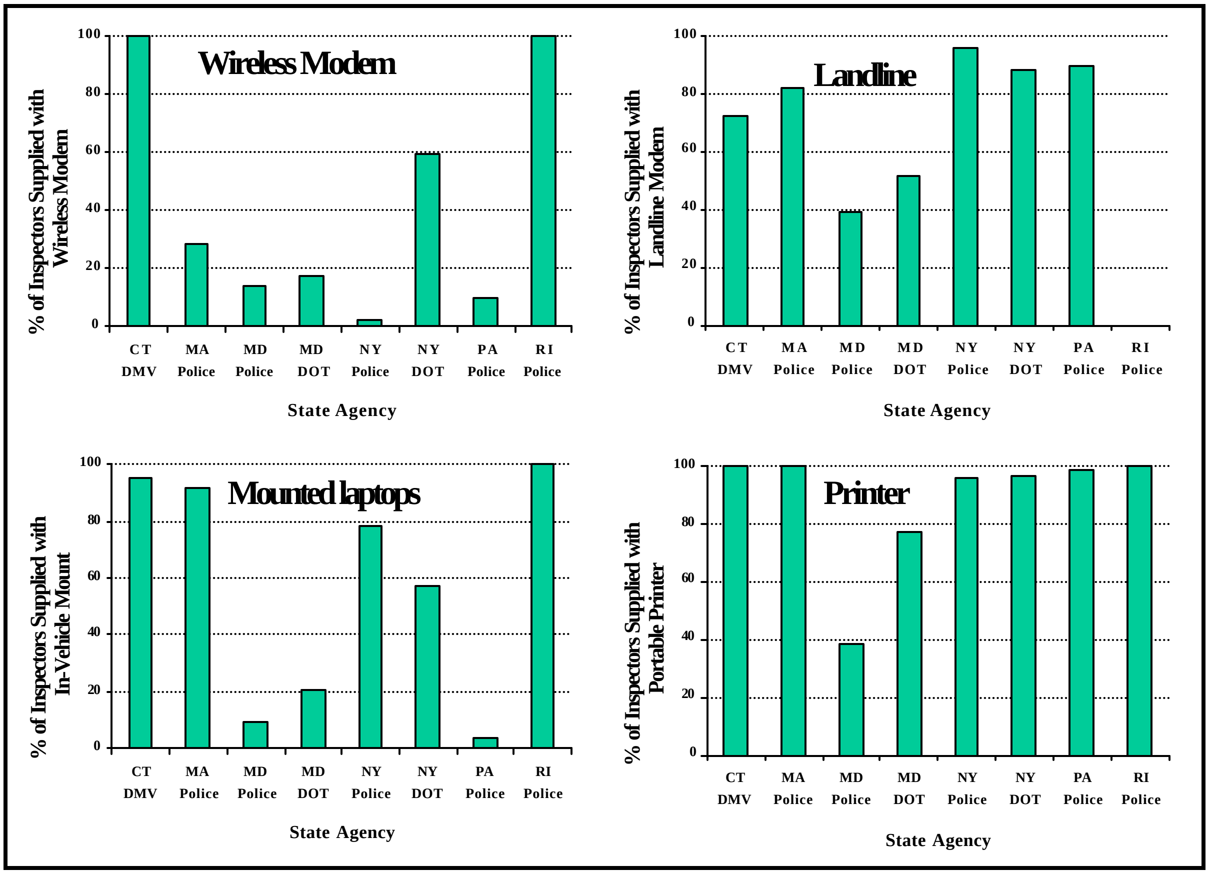

Figure A-6. Percentage of Inspectors Reporting Deployment of Wireless Modems, Landline Modems, Mounted Laptops, and Portable Printers

3.2.2 System Usage

A limited amount of information was obtained from the surveyed inspectors regarding the frequency with which completed inspection reports were transmitted to SAFER or AVALANCHE and the frequency with which inspectors receive updates to ASPEN/ISS. Figure A-7 summarizes the reported frequencies for the transmission of completed inspections while Figure A-8 summarizes the reported frequencies for receiving updates to ASPEN/ISS.

In Connecticut and Rhode Island, transmissions of reports are generally carried out over the wireless modem, which reflects the very high proportion of the inspectors being supplied with this equipment. As expected due to the convenience of a wireless modem, inspectors in Connecticut and

Rhode Island indicated that reports are transmitted after each inspection[1]. For updates of information, Connecticut also generally uses the wireless modem on a weekly basis, whereas Rhode Island uses CD-ROMs on a quarterly basis. In Massachusetts and Pennsylvania, most report transmissions are generally carried out by landline modem and are usually not carried out after each inspection, but occur on an average of around once a week. Updates are rarely carried out with modems in the two states, with Massachusetts generally using CD-ROMS and diskettes on a quarterly basis and Pennsylvania using diskettes and other methods on a less than quarterly basis. In Maryland, the low level of deployment was mirrored in the inconsistency in transmission methods across the surveyed inspectors, which generally occurred on a daily or weekly basis. Update methods were also fairly inconsistent, although most used a landline modem on a weekly or quarterly basis. Finally, in New York, the transmission methods were consistent with the deployment level of wireless and landline modems within each agency, with most state police inspectors and about half of the state DOT inspectors using a landline modem. A few of the state DOT inspectors in New York took advantage of the wireless modem to transmit reports after each inspection, though most inspectors (from both police and DOT) generally transmitted inspection reports on a daily basis. For updates, almost all inspectors in New York used CD-ROMs to update, at most, on a quarterly basis.

[1] This finding conflicts somewhat with those of the SAFER Data analysis. It may be that inspectors in Connecticut and Rhode Island have indicated department policy rather than what actually occurs.

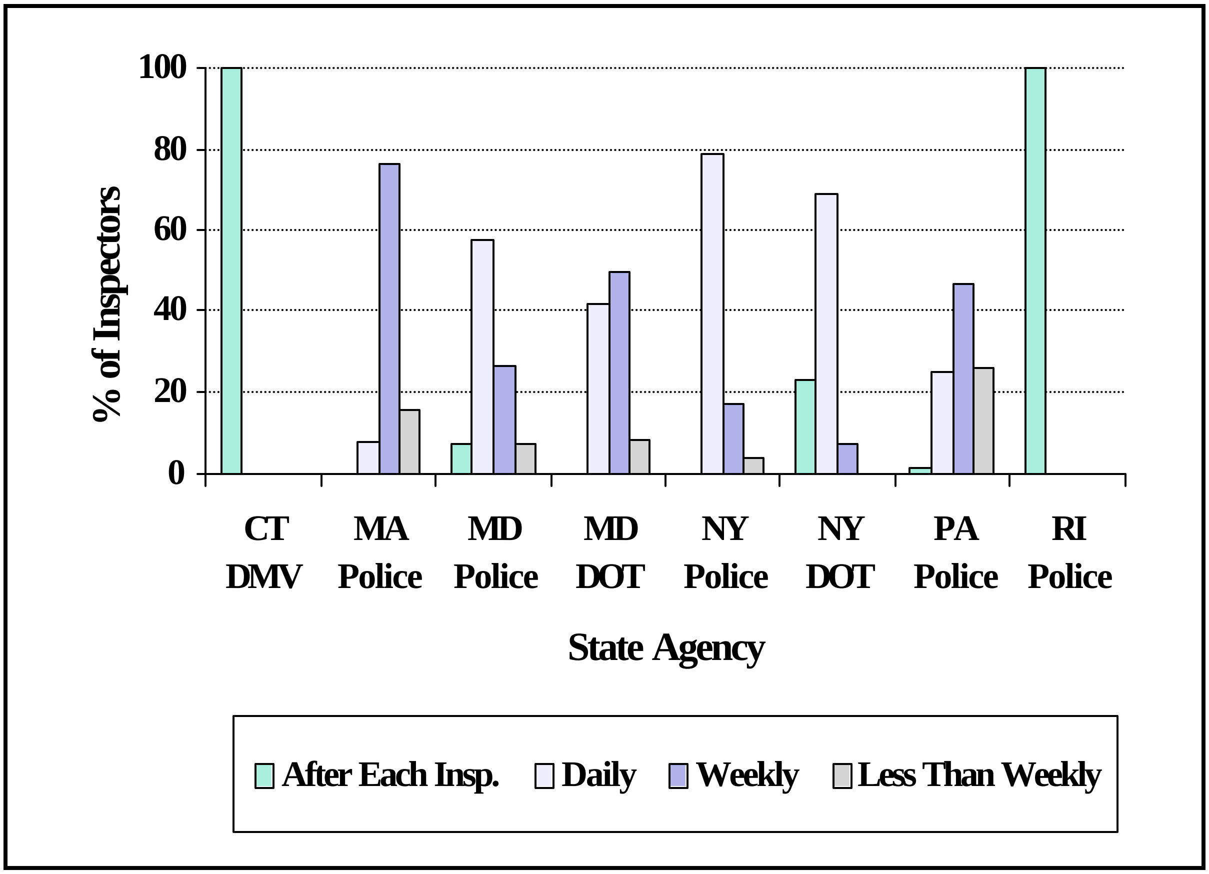

Figure A-7. Frequency of Inspection Report Transmissions by State/Agency

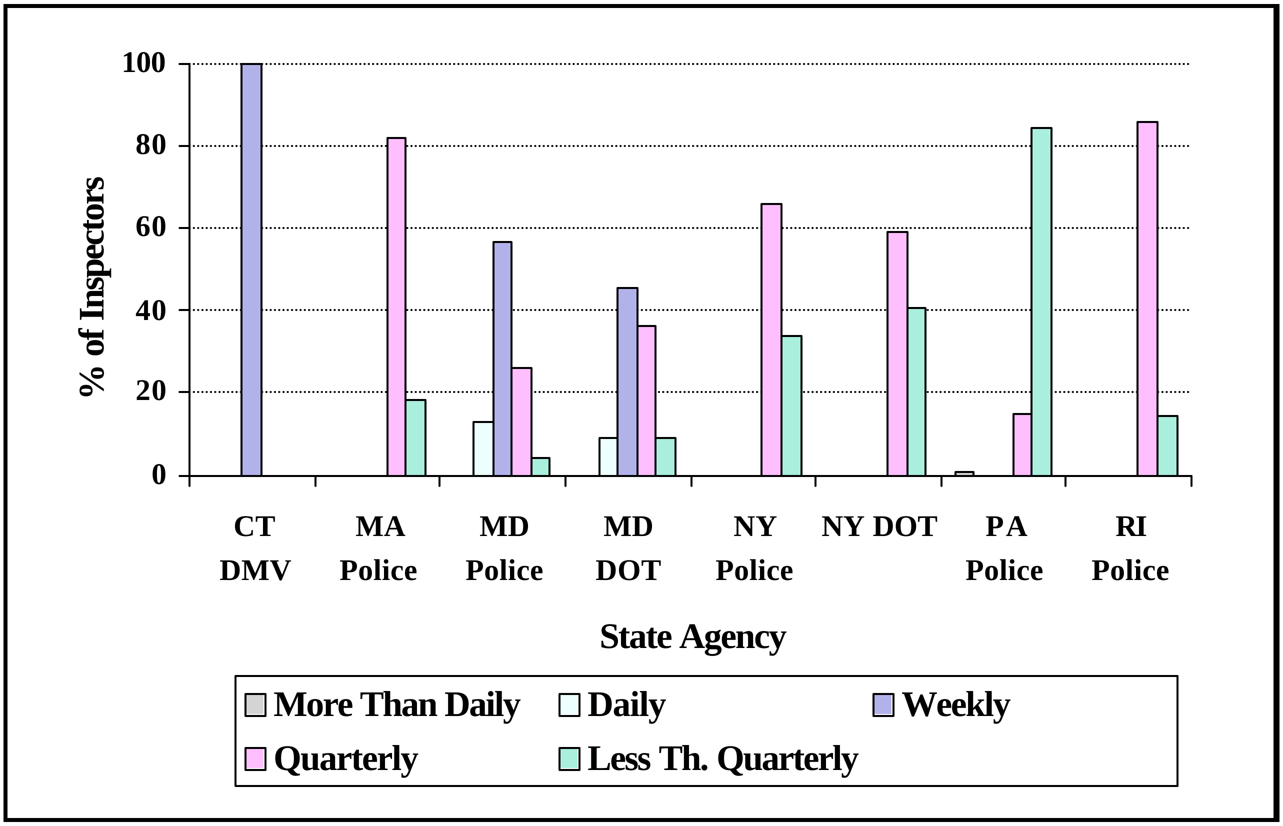

Figure A-8. Frequency of ASPEN Data Base Update

3.2.3 Software Usage

The survey questionnaire collected information of the use of a number of different software programs and data bases including the Inspection Selection System (ISS), Past Inspection Query (PIQ), Commercial Driver License Information System (CDLIS), National Crime Information Center (NCIC), and PC*MILER. One prerequisite to the use of these various software packages is the usage of ASPEN with a personal computer to conduct a roadside inspection. With the exception of Maryland Police, most inspectors reported using paper reports in less than 10 percent of their last 100 inspections. Connecticut DMV, New York Police, and New York DOT reported almost no use of paper reports. Paper reports were used on average by Maryland Police more than computer reports (approximately 60 percent reporting the use of paper reports).

Figure A-9 summarizes the use of ISS, PIQ, CDLIS, and NCIC, as reported by the surveyed inspectors, for their last 100 inspections. Clearly, ISS enjoys widespread use in all of the state/agency groups, except Maryland Police; much more so than any of the other software programs/data bases. In fact, other than Connecticut DMV and Rhode Island Police, only a very small percentage of inspectors in the other state/agency groups reported using PIQ, CDLIS, or NCIC.

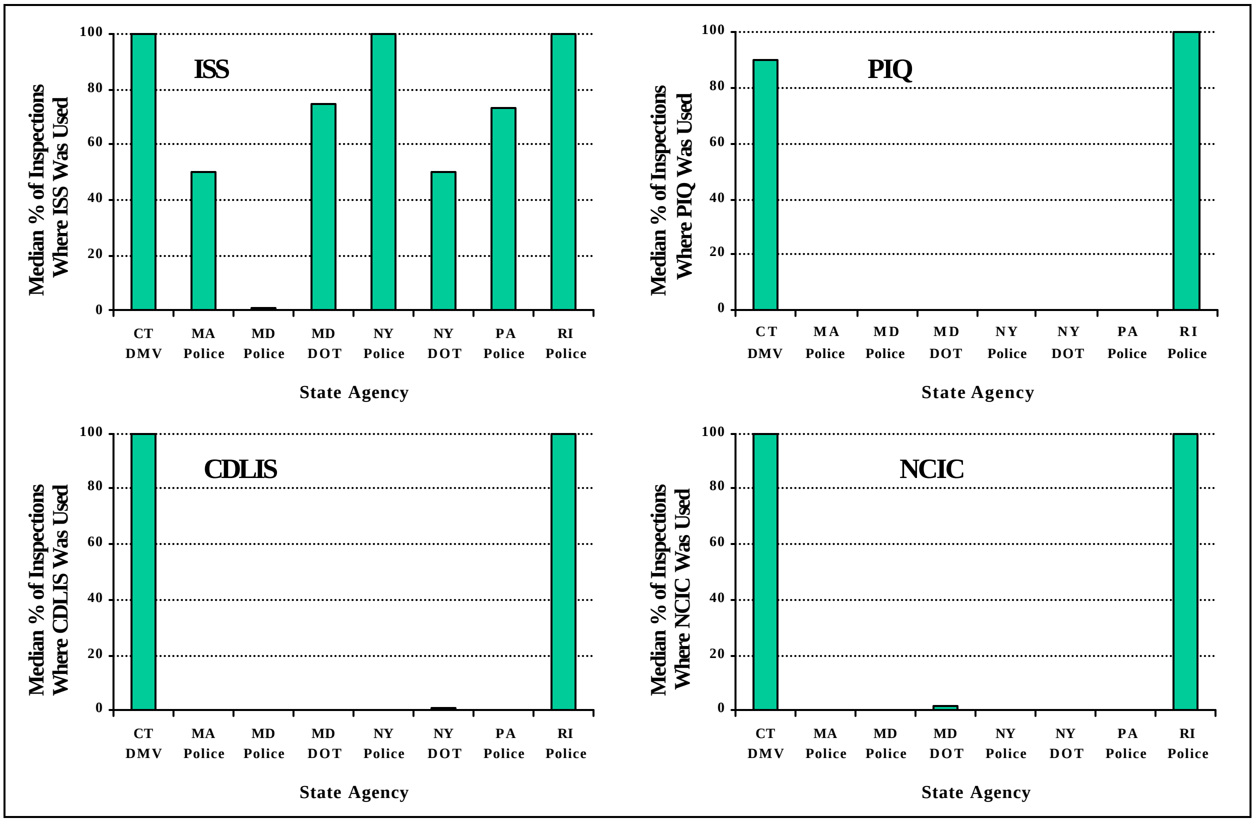

Figure A-9. Usage of ISS, PIQ, DCLIS, NCIC in the Last 100 Inspections

Inspectors were asked to provide information on the specific scenarios under which they used a particular piece of software. In particular, the surveyed inspectors were asked to characterize the situations where they most often used ISS (Question 13). As observed in Figure A-10, except for Connecticut, where most of the inspectors reported that they used ISS "most often" to select a truck, inspectors tended to use ISS "most often" after selecting a truck but before conducting the inspection. In Maryland, the state police inspectors are more likely to use ISS to select trucks (30%) than the state DOT inspectors (7%), indicating a difference between the way the two agencies within the same state operate. In a similar question, inspectors were asked to indicate the number of times in the last 100 inspections that they used the ISS inspection score to help them choose a truck to inspect (Question 26). Over all state/agency groups, ISS was not routinely utilized in the last 100 inspections to choose a truck for inspection. Inspectors in Connecticut used ISS on average 38 times, followed by inspectors in Rhode Island and Massachusetts, with averages of 29 and 19 times, respectively.

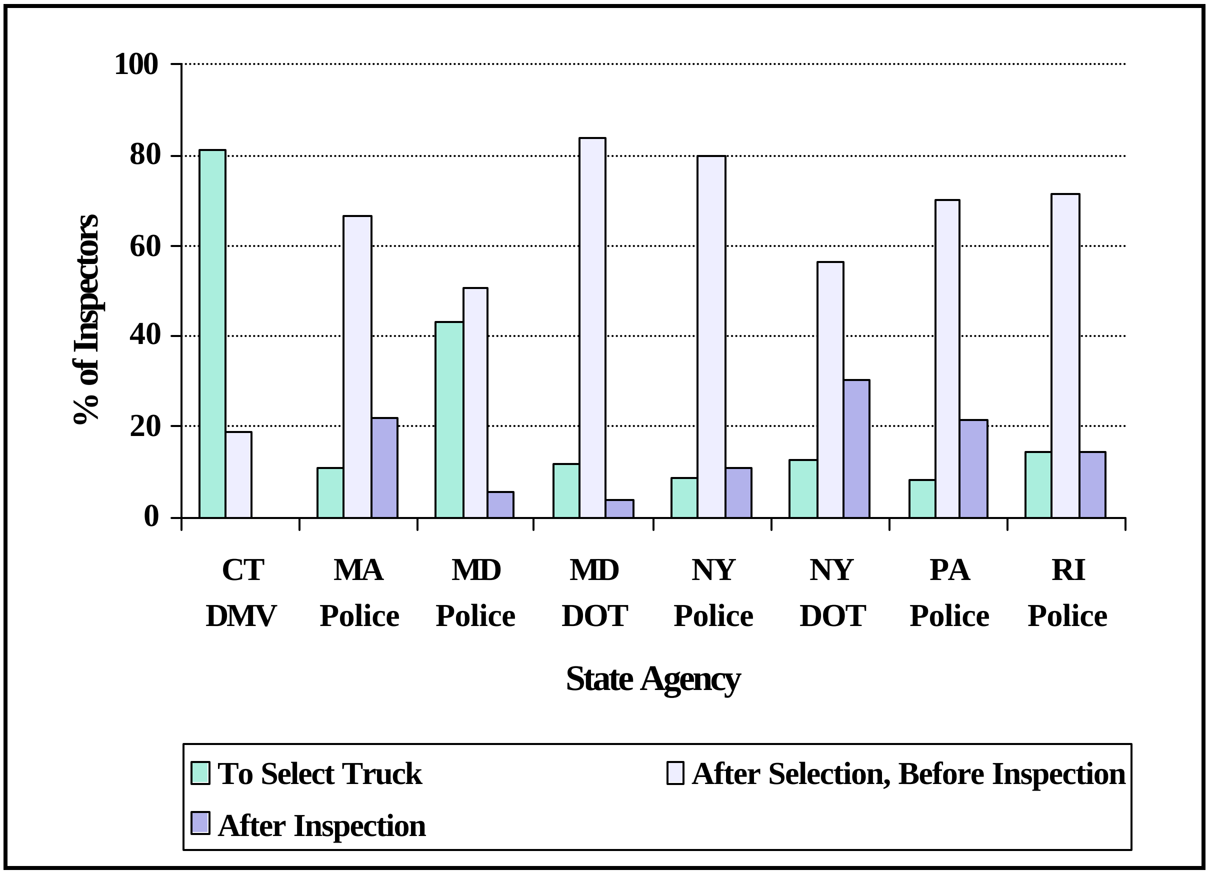

Figure A-10. Percentage of Inspectors Using ISS During Different Stages of the Inspection Process

Using PIQ before truck selection appeared to not be a common practice among inspectors everywhere, except in Rhode Island where it was used, on average, during 54 percent of the last 100 inspections. Even in Rhode Island the practice varied substantially among inspectors. Since the percentage of inspections using PIQ any time during the last 100 inspections was very high for Connecticut and Rhode Island (Figure A-9), this result indicates that if PIQ was used in an inspection, it was very rarely used before truck selection by the surveyed inspectors.

3.3 Satisfaction

The inspectors in the survey were asked to indicate their general satisfaction with the deployment of the new technology including the overall satisfaction with the ASPEN system, reliability, support, and training. The surveyed inspectors were also asked to provide satisfaction ratings for specific hardware components such as wireless modems, land line modems, in-vehicle computer mounts, portable printers, computer monitors/screens, and keyboard/screen pointer devices. For both general satisfaction and satisfaction with specific hardware components, inspectors were asked to indicate their response using a five point scale with "1" indicating that they were very dissatisfied and a "5" indicating that they were very satisfied.

General satisfaction with the FOT deployment is summarized in Figure 11. Overall, it appears that the surveyed inspectors were satisfied with the ASPEN system as responses among the state/agency groups averaged between neutral, "3," and satisfied, "4." Satisfaction with the reliability of the computer, support for solving problems when using the laptop, and with computer training were more varied across the eight state/agency groups. As illustrated in Figure A-11, there seemed to be some dissatisfaction with the reliability of the computer and the technical support available for solving problems when using the laptop, particularly in Maryland and New York. With the exception of New York DOT, the surveyed inspectors were, on average, satisfied with the computer training they received with the average satisfaction rating ranging from 3.4 to 3.9. The DOT Inspectors surveyed in New York had an average satisfaction rating for training of 2.7, which indicates a measure of dissatisfaction.

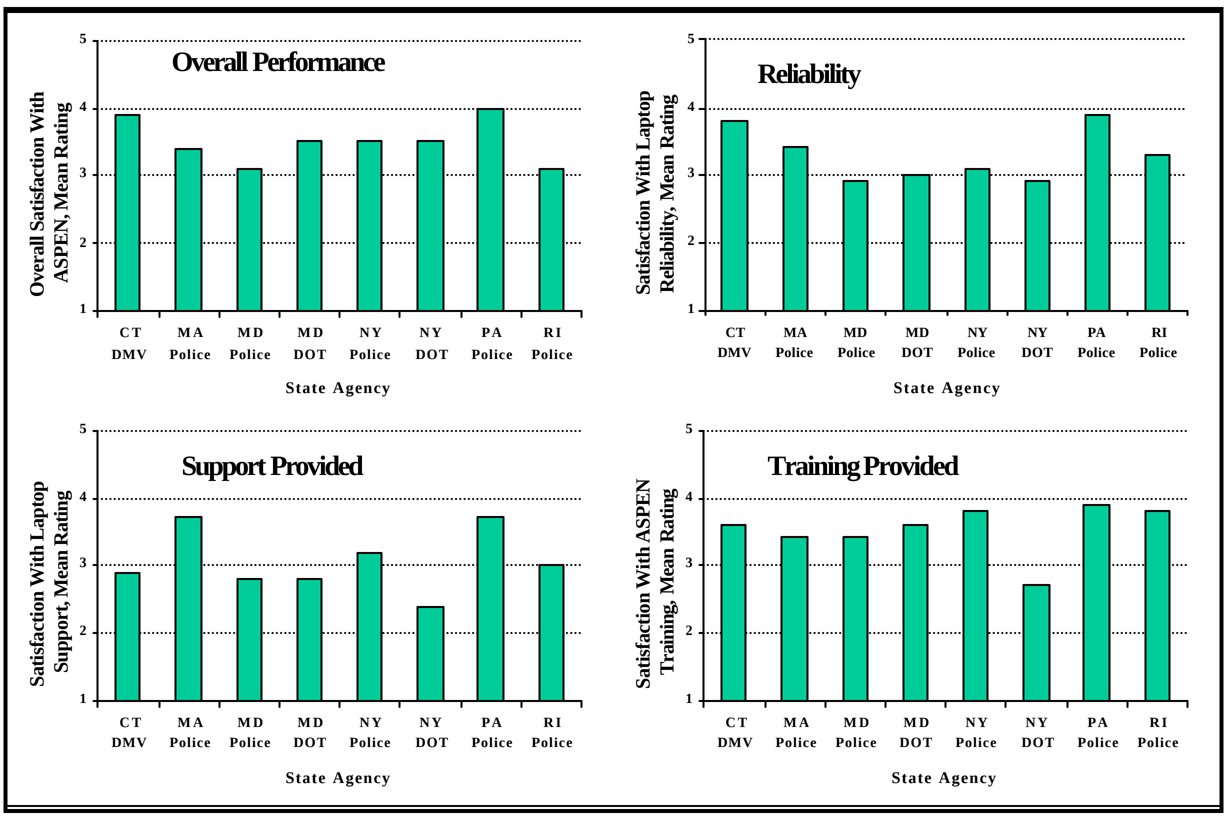

Figure 11. General Satisfaction with FOT Deployment

Figure A-12 summarizes the satisfaction ratings for the surveyed inspectors by state/agency group for components of the deployed hardware. As observed in the Figure, the average satisfaction ratings for the laptop screens were noticeably lower than the ratings for the keyboard and pointer device, especially in Connecticut and Rhode Island. This is likely due to a high prevalence of screen glare as reported during focus group sessions with the inspectors. The satisfaction ratings of wireless and landline modems were generally very high, with very few inspectors indication dissatisfaction (i.e., giving a rating below "3"). In-vehicle computer mounts were generally rated as satisfactory (a rating of either a "3" or a "4") with satisfaction with the portable printer and in-vehicle printer mount generally neutral (i.e., a satisfaction rating around "3").

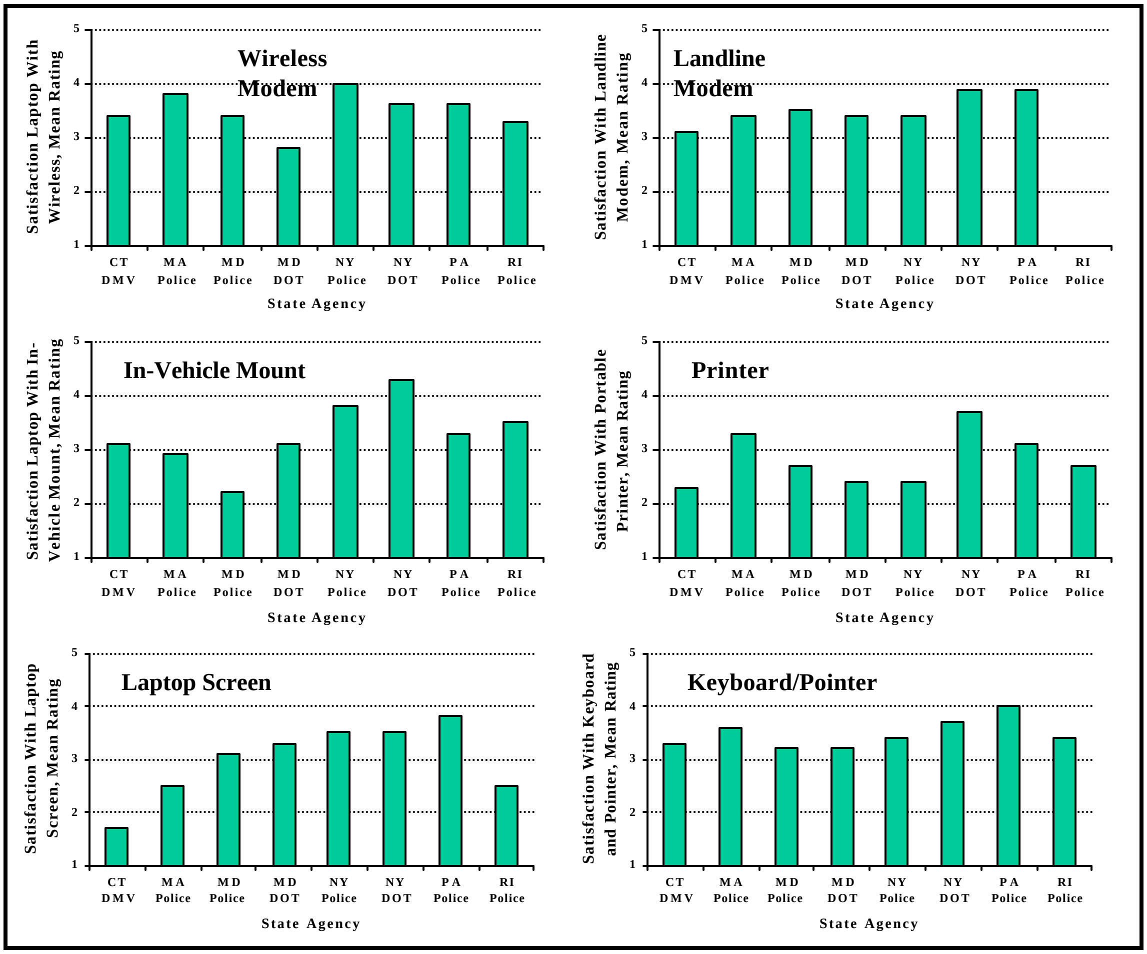

Figure A-12. Satisfaction with Deployed Hardware

The extent to which problems were reported by the surveyed inspectors is also a measure of the satisfaction with the overall system and with specific hardware and software. Although no technology is perfect, a problem that is encountered both frequently and by a large proportion of inspectors indicates a problem that could cause dissatisfaction among the ultimate users of the system, the motor vehicle inspectors. Because entering and transmitting inspection reports is perhaps the single most important utilization of the technology, the survey questionnaire was designed to collect information on problems that occur during the transmission of inspection reports.

Table A-3 summarizes the rate with which problems occurred during the transmission of inspection reports. Connecticut had a large number of non-responses; hence, the extent of any problems with the transmission there is not known. In Massachusetts, the combined percentage of those experiencing problems either "Almost Always" (8 percent) or "Frequently" (25 percent) was higher than in any other state/agency group. There appears to be no particular trend indicating a relationship between the use of wireless or landline modem and problem rate in transmissions.

Table A-3. Frequency (and Percentage) of Transmission Problem Rates by State/Agency Group

State/Agency	Frequency (percentage) of Inspectors Encountering a Problem Transmitting Data			
	Almost Never	Infrequently	Frequently	Almost Always
Connecticut DMV	NA	1 (NA)	NA	NA
Massachusetts Police	6 (25%)	10 (42%)	6 (25%)	2 (8%)
Maryland Police	5 (23%)	13 (59%)	2 (9%)	2 (9%)
Maryland DOT	5 (45%)	4 (36%)	2 (21%)	0 (0%)
New York Police	14 (30%)	22 (47%)	11 (23%)	0 (0%)
New York DOT	14 (52%)	11 (42%)	2 (7%)	0 (0%)
Pennsylvania Police	66 (57%)	36 (31%)	8 (7%)	5 (4%)
Rhode Island Police	3 (50%)	2 (33%)	1 (17%)	0 (0%)

Insufficient choices in violation codes and vehicle identifiers may be one of the problems encountered in entering inspection reports using the new technology. The percentages of inspections among the last 100 inspections conducted by the surveyed inspectors where those problems occurred are summarized in Table A2-1 of Attachment A2. For violation codes, Connecticut and Rhode Island appeared to have higher percentages than the other four states, although this difference may be due to the higher level of deployment and higher usage rates of the new technology in those two states. However, the percentages vary widely across inspectors in Connecticut and Rhode Island. On the other hand, insufficient choices in vehicle identifiers appear to be less of an issue, especially in Connecticut and Rhode Island.

Technical problems with entering inspection reports that forced the inspector to retype the report were not common occurrences, as seen in Figure A-13. The retyping rate was generally below 10 percent, except for Maryland and New York inspectors, where a quarter of the inspectors reported rates of over 10 percent. In one extreme case in Maryland, an inspector claimed to have retypes of all inspections due to technical problems.

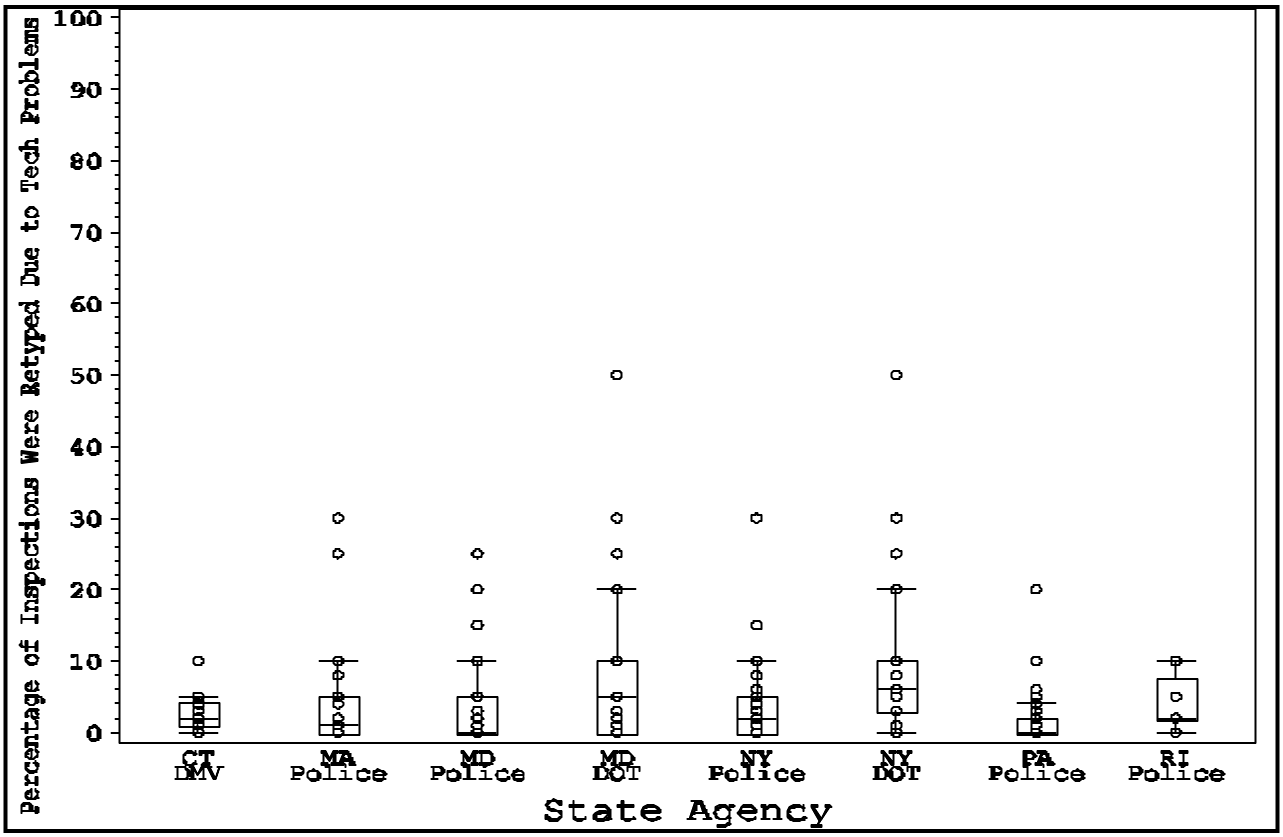

Figure A-13. Percentage of Inspections that were Retyped due to Technical Problems by State/Agency Group

Another potential indicator of satisfaction is the level of customization of the portable computers by the inspectors. In focus groups sessions, many inspectors indicated that they need to spend a great deal of time customizing the system so that they can use it efficiently. Therefore, a high degree of customization may indicate that the base system is not sufficient for the inspector. On the other hand, a high degree of customization may be indicative of higher satisfaction levels because the software had been more tailored to an individual (i.e., customization allows individual inspectors more flexibility and tailored resources which in turn increases satisfaction). Inspectors in Connecticut uniformly reported customizing ASPEN followed by 59 percent of the inspectors in New York DOT and 47 percent of the inspectors in the Pennsylvania Police. Approximately 30 percent of the surveyed inspectors in the Massachusetts Police, Maryland Police, and Maryland DOT reported that they had customized their ASPEN. Only 14 percent of the inspectors in Rhode Island reported customizing ASPEN.

3.4 Perceived Benefits

The surveyed inspectors were asked to indicate their agreement on a scale of one-to-five for a series of questions on the perceived benefits of the technology deployment. These benefits include: saving time needed to conduct and report an inspection, saving time specifying violation codes, providing more complete vehicle information, helping focus inspections on certain types of violations, helping the inspectors do their jobs better, improving safety on the road, helping identify high-risk carriers, and seeing that using computers to conduct inspections is better than the old process of using paper reports.

With the exception of the Maryland police, the surveyed Inspectors generally agreed that the technology saved overall inspection time and time specifying violation codes, especially in Connecticut and Rhode Island (see Figure A-14). Most inspectors in the state/agency groups reported very few ratings below neutral (i.e., “3”). However, the perception of an overall time savings is contradictory to other results of the survey. In particular, inspectors were asked to approximate the length of time needed to complete a Level I, II, and III inspection in good weather using ASPEN and using paper only. As seen in Figure A-15, the results of these approximations indicate that, on average, using ASPEN to conduct a Level I inspection actually would take longer to complete. Level II and Level III inspections appeared to take about the same amount of time regardless of whether ASPEN or paper would be used.

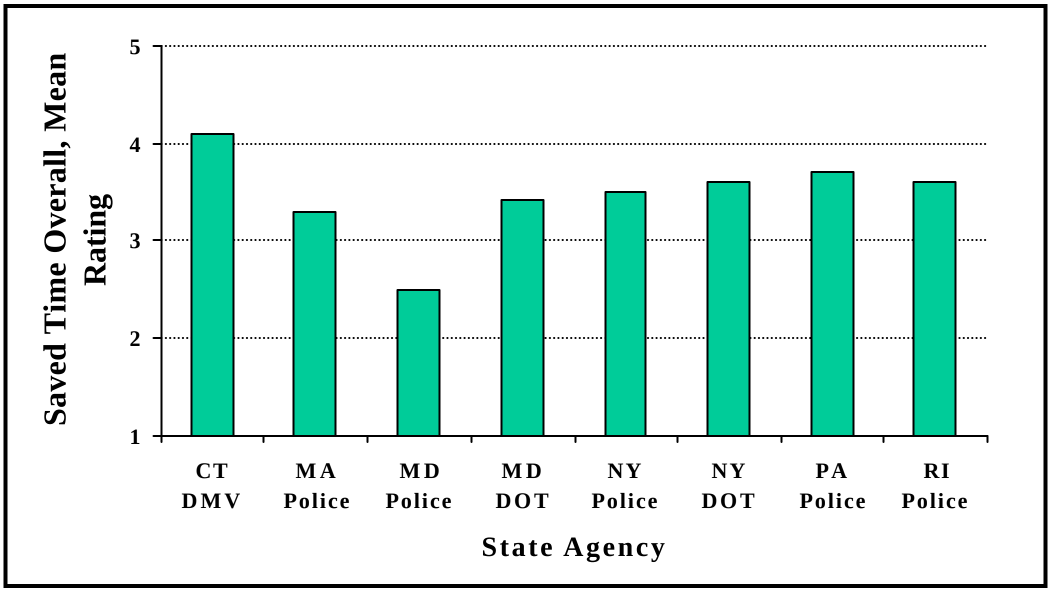

Figure A-14. Perceived Time Savings to Conduct and Report an Inspection

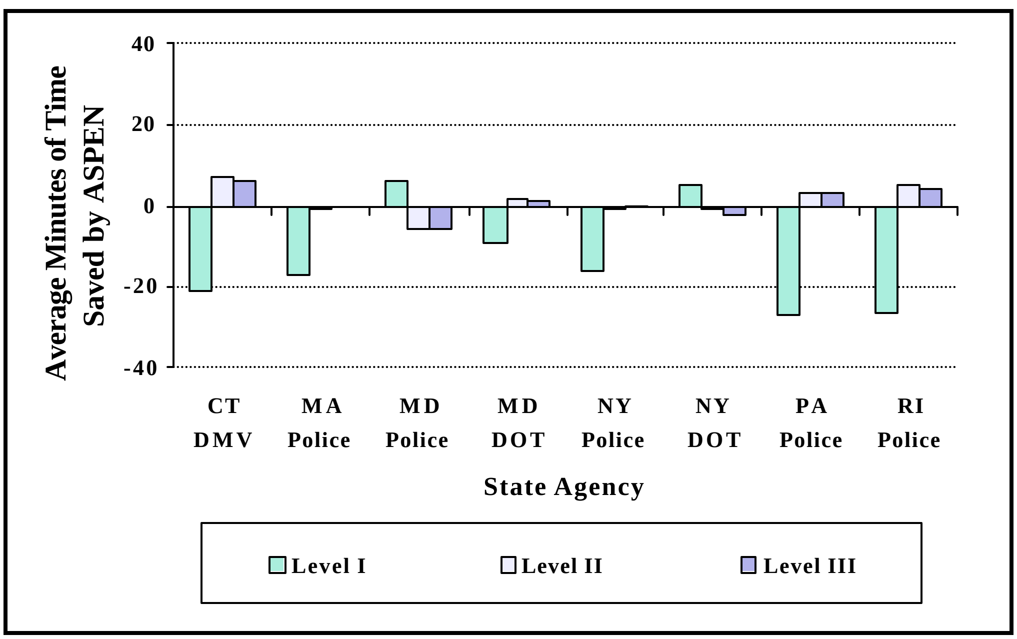

Figure A-15. Average Minutes of Time Saved

Another potential benefit of the deployed technology is that the ISS helps to identify high-risk carriers. On average, the surveyed inspectors indicated that they perceived that ISS was useful in identifying high-risk carriers (see Figure A-16). Further, as discussed previously a relatively large percentage of inspectors indicated that they used ISS. However, among the last 100 inspections, ISS was used in only a small percentage of cases to identify vehicles for inspection.

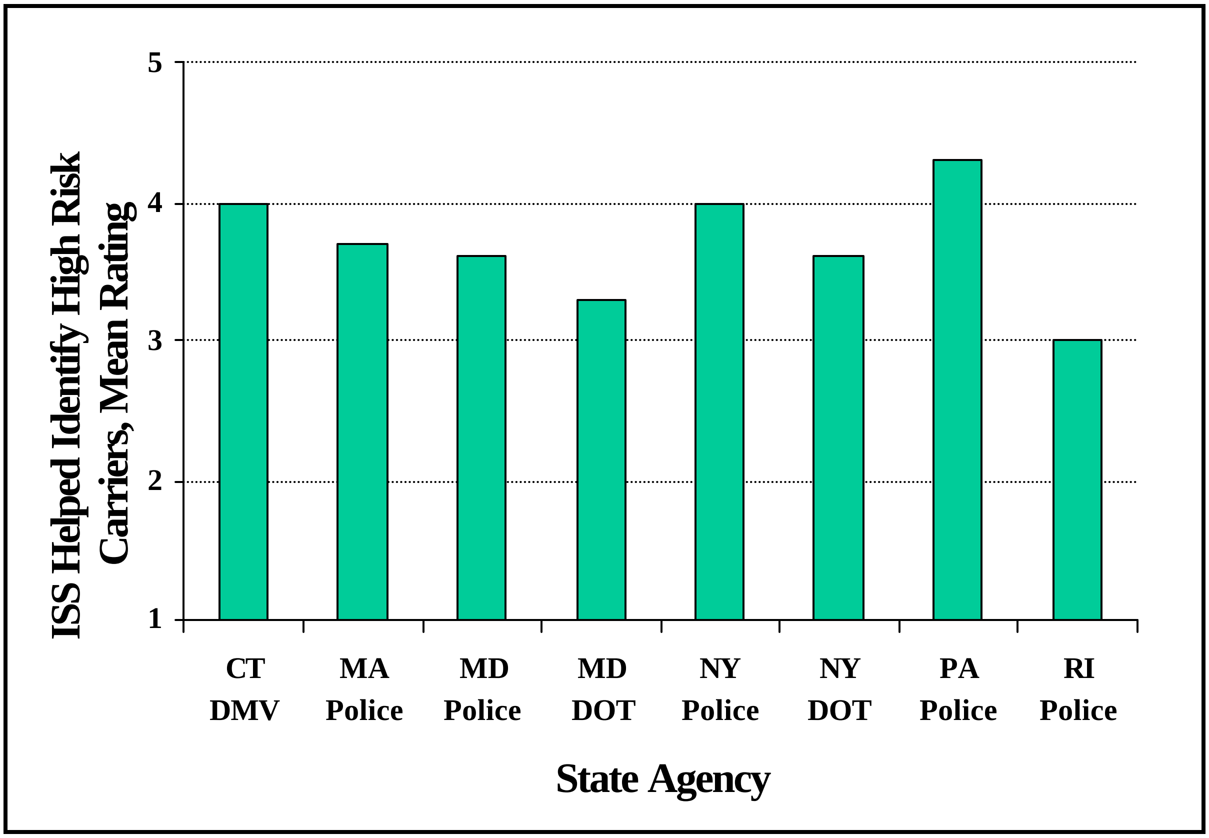

Figure A-16. Perceived Benefit of ISS to Identify High-Risk Carriers

Inspectors were also asked whether they agreed that deployment of the new technology produced certain types of benefits such as providing more complete vehicle information, helping to focus the inspection, helping the inspectors do their jobs better, improving safety, and whether computer assisted inspections are a better process than using paper. Figure A-17 summarizes the responses of the surveyed inspectors to these questions. The inspectors were generally in agreement that the technology provided more complete vehicle information and helped focus inspections, although there were proportionally slightly fewer inspectors who agreed or strongly agreed (ratings “4” and “5”) with these benefit claims than with the claims of time saving.

Inspectors in Connecticut and Rhode Island mostly gave ratings of agreement (i.e., a rating of a "4" or "5") that the new technology helped them do their jobs better, with general agreement from Massachusetts, New York, and Pennsylvania and more muted support from Maryland. There was less certainty whether the deployment improved safety on roads, especially in Maryland. Finally, the statement that using the computer was better than paper was seized upon strongly by Connecticut and Rhode Island, with a clear majority indicating strong agreement or agreement (i.e., a rating of "5" or "4"). In all other states except Maryland, most inspectors agreed (a rating of "4") or strongly agreed (a rating of "5") that using computers was a better process than using paper, and even in Maryland less than a quarter of the inspectors gave a disagreement rating (i.e., a rating below "3").

Figure A-17. Perceived Benefits of Having More Complete Vehicle Information, Helping to Focus Inspections, Helping Inspectors Perform Their Job Better, Improves Safety, and Is Better than Using Paper

In addition to the benefits listed above, the surveyed inspectors were asked in an open-ended question to indicate the single most important benefit from using the laptop. Most frequently, the surveyed inspectors indicated that the single most important benefit was the neatness or professional appearance of inspection reports when using the computer system as opposed to paper reports. Other comments noted time savings, accuracy, legibility, and the benefit of having ready access to prior inspection reports. Of all the responses in this category, 51 inspectors mentioned "neatness," and 28 mentioned "savings," usually of time or handwriting.

4.0 Conclusions

Over 370 motor carrier inspectors in six states were surveyed to capture information on the technology deployment and usage, satisfaction, and perceived benefits of the FOT. The FOT is in different stages in the six different state/agencies and the surveyed inspectors therefore provided valuable insight into the impact of deploying laptop computers to conduct roadside inspections at many different levels. Based upon the survey responses, the laptop computers and portable printers have become an integral component of how motor carrier inspections are conducted in the eight state/agency groups. Additionally, the inspectors did perceive some benefits of the technology including helping them perform their job better, improving safety, and helping to identify high-risk carriers. However, the surveyed inspectors also expressed some dissatisfaction with some of the deployed technology and the related support/training. In addition, the survey results also indicate that there are some areas (i.e., use of ISS to select vehicles for inspection, frequency of ASPEN data base updates, frequency of inspection report transmissions, etc.) where the application of the technology could be better performed.

Attachment A1:

Questionnaire

May 26, 2000

Attachment A1: Questionnaire

May 26, 2000

I-95 Corridor Coalition Survey of Motor Carrier Inspectors

I-95 Corridor Coalition

U.S. Department of Transportation
Federal Highway Administration

First, we would like to ask you some basic questions about yourself.

1. For which agency do you perform inspections? ____________________

2. How long have you been a qualified inspector? |__|__| Years |__|__| Months

3. Do you assign other inspectors to sites, shifts, or trucks (that is, are you a supervisor)? ❑ Yes ❑ No

4. What percentage of your work is conducting hands-on commercial vehicle inspections (that is, Level I, II, or III inspections)? |__|__|__| %

In the next set of questions, we would like to inquire about your background in using personal computers (PCs).

5. Do you currently use a personal computer with ASPEN to conduct motor carrier inspections? ❑ Yes ❑ No

SKIP TO QUESTION 11

6. How long have you used a personal computer when conducting inspections? |__|__| Years |__|__| Months

7. Before you began using ASPEN how often, if ever, had you used a computer (at home or at work)? **(✓ ONE BOX.)**

❑ Daily
❑ Weekly
❑ More than once a month
❑ Once a month
❑ Less than once a month
❑ Never

8. Besides ASPEN, how often, if ever do you use a computer at work other than to conduct an inspection? **(✓ ONE BOX.)**

❑ Daily
❑ Weekly
❑ More than once a month
❑ Once a month
❑ Less than once a month
❑ Never

9. Have you received formal training on how to:

	YES	NO
a. use a personal computer or Windows?...........	❑	❑
b. use ASPEN?..	❑	❑

SKIP TO QUESTION 11

10. Since you answered yes to 9b, how would you rate your satisfaction with the formal computer training you received on the use of ASPEN? **(CIRCLE ONE NUMBER.)**

VERY DISSATISFIED				VERY SATISFIED
1	2	3	4	5

11. On average, how many inspections do you carry out on a typical day of inspections in good weather? |__|__|__| Inspections per day

12. For each method of reporting results (ASPEN, paper) that you have used, approximately how long does it take you to do the following types of inspections (including reports) in good weather?

	Using **ASPEN**	Using **paper** only
a. **Level I**	___ Mins	___ Mins
b. **Level II**	___ Mins	___ Mins
c. **Level III**	___ Mins	___ Mins

13. Which of the following best describes the situations when you most often use ISS (Inspection Selection System)? (✔ **ONE BOX.)**

- ❑ Before inspection to select truck
- ❑ After selecting vehicle but before conducting inspection
- ❑ After conducting the inspection
- ❑ Other, please specify: ____________
- ❑ Not used

14. Which **one** method *best describes* how you transmit your reports to SAFER or AVALANCHE? **(✔ ONE BOX.)**

- ❑ Wireless connection
- ❑ Landline connection
- ❑ Paper reports
- ❑ Diskettes
- ❑ Give them to another staff person or officer to transmit
- ❑ Other, please specify: ____________

15. Do you, or does someone else, transfer and receive your inspection information electronically to SAFER or AVALANCHE?

- ❑ Me
- ❑ Someone Else → **Skip to Question 20**

16. How frequently are your results transmitted to SAFER or AVALANCHE? **(✔ ONE BOX.)**

- ❑ After each inspection
- ❑ Daily
- ❑ Weekly
- ❑ Less than weekly

17. If you send inspection reports directly to SAFER or AVALANCHE do you encounter problems connecting to these systems and transmitting data to them? **(✔ ONE BOX.)**

- ❑ Almost Always
- ❑ Frequently
- ❑ Infrequently
- ❑ Almost Never

18. How do you typically receive updates to ASPEN/ISS? **(✔ ONE BOX.)**

- ❑ Wireless connection
- ❑ Landline connection
- ❑ CD-ROM
- ❑ Diskettes
- ❑ Other, please specify: ____________

19. How frequently do you receive updates to ASPEN/ISS? **(✔ ONE BOX.)**

- ❑ More than once per day
- ❑ Daily
- ❑ Weekly
- ❑ Quarterly
- ❑ Less often than quarterly

20. Have you customized ASPEN (for example, added names of towns, trailer types, etc.)

- ❑ Yes
- ❑ No

We would like to get a little more specific about your inspection work and equipment use. Please answer the following questions about what happened in YOUR most recent (that is, last 100) inspections. If you do not know the exact numbers, provide an approximate percentage.

PER **100** INSPECTIONS

21. How many inspections were:

a. at fixed scale facilities? .... |__|__|__| / 100 inspections

b. at a nonfixed scale site such as a rest area? .... |__|__|__| / 100 inspections

c. involved stopping a moving vehicle at the roadside? .... |__|__|__| / 100 inspections

22. How many times did you fill out a paper inspection report instead of using ASPEN? |__|__|__| / 100 inspections

23. How many times did you team with another inspector to conduct the inspection? |__|__|__| / 100 inspections

24. How many times did you use the following software before, during, or immediately after the physical inspection? (*Please answer for each even if you never used the software.*)

a. ISS .... |__|__|__| / 100 inspections

b. PIQ (Previous Inspection Query) .... |__|__|__| / 100 inspections

c. CDLIS (Commercial Driver License Information System) ..... |__|__|__| / 100 inspections

d. NCIC (National Crime Information Center) .... |__|__|__| / 100 inspections

e. PC Miler .... |__|__|__| / 100 inspections

f. Some other software .... |__|__|__| / 100 inspections

Specify: ____

PER **100** INSPECTIONS

25. How many times did you use a PIQ ***before*** you selected a truck for inspection? |__|__|__| / 100 inspections

26. How many times did you check the ISS inspection score to help you ***choose*** a truck to inspect? |__|__|__| / 100 inspections

27. How many times have you had to use a violation code that was less precise than you wanted because the code was not included in the list? |__|__|__| / 100 inspections

28. How many times was the vehicle identifier insufficient to describe the vehicle? |__|__|__| / 100 inspections

29. How many inspections did you have to retype due to technical problems with your laptop (for example, your system froze and you had to shut down and reboot)? |__|__|__| / 100 inspections

Now, we would like you to rate various features of the laptop equipment. A list of issues you may wish to consider is provided (in parenthesis) with each feature to assist you with the rating, however note that the list is by no means definitive or complete. Please rate the features by *circling* a number on a scale from 1 (Very Dissatisfied) to 5 (Very Satisfied).

			VERY DISSATISFIED				VERY SATISFIED
30.	Overall satisfaction with the ASPEN system		1	2	3	4	5
31.	Laptop screen (visibility, color, size of screen, font size, sun glare)		1	2	3	4	5
32.	Keyboard and Screen Pointer Device (layout and position, size)		1	2	3	4	5
33.	Overall reliability of the computer (screen freezes crashes, error messages)		1	2	3	4	5
34.	Overall support for solving problems when using the laptop (on-screen help, help desk, technical support)		1	2	3	4	5
35.	Have you been supplied with the following (✓box)? If yes, please rate the feature.						
	a. Wireless modem (slow-downs, disconnects, connection ports)	❑ Yes ❑ No	1	2	3	4	5
	b. Landline modem (slow-downs, disconnects, connection ports)	❑ Yes ❑ No	1	2	3	4	5
	c. In-vehicle computer mount (no mount provided, lock-in mechanisms, position/ease of access)	❑ Yes ❑ No	1	2	3	4	5
	d. Portable printer (print quality, printing speed, paper jams)	❑ Yes ❑ No	1	2	3	4	5
	e. In-vehicle printer mount (lock-in mechanisms, position/ease of access)	❑ Yes ❑ No	1	2	3	4	5

The following are statements regarding the benefits of using ASPEN/ISS to conduct inspections. Please indicate how much you agree with each statement by circling a number on the scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

		STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
36.	Overall, saves time needed to conduct and report inspection	1	2	3	4	5
37.	Saves time specifying violation codes	1	2	3	4	5
38.	Provides more complete vehicle information.	1	2	3	4	5
39.	Helps focus inspections on certain types of violations	1	2	3	4	5
40.	Helps you do your job better	1	2	3	4	5
41.	Improves safety on the roads	1	2	3	4	5
42.	ISS helps to identify high-risk carriers	1	2	3	4	5
43.	Using computers to conduct inspections is better than the old process of using paper reports	1	2	3	4	5

Finally, we would like you to provide us with some general comments about the equipment. Please feel free to touch on any features of the laptop and any related equipment.

44. What do you think is the single most important benefit from using the laptop?

____

45. What 1 or 2 improvements would you recommend to make this system more useful to you in your daily work?

____

46. Do you have any other comments, concerns, or input that you would like to add?

____

Attachment A2:

Summary of Survey Responses

May 26, 2000

Attachment A2: Summary of Survey Responses

Table A2-1. Summary of Responses by Question and State/Agency Group

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q1. For which agency do you perform inspections?									
Number of respondents	22	28	73	41	49	28	121	8	370
Q2. How long have you been a qualified inspector? (years)									
Mean	10.2	8.8	6.2	5.2	4.4	7.1	6.5	4.8	6.4
Std Dev	6.0	4.5	4.0	3.2	4.0	5.3	3.9	3.9	4.4
25th Percentile	6.0	4.0	2.3	3.7	2.0	1.8	3.0	2.0	2.6
Median	9.5	9.9	6.0	4.3	2.3	6.5	5.0	3.3	5.0
75th Percentile	13.2	11.1	10.0	6.0	6.0	12.5	10.0	7.2	10.0
Q3. Do you assign other inspectors to sites, shifts, or trucks (that is, are you a supervisor)?									
Yes	8(36%)	3(11%)	23(32%)	8(20%)	2(4%)	4(15%)	24(20%)	2(25%)	74(20%)
No	14(64%)	24(89%)	48(68%)	33(80%)	47(96%)	23(85%)	97(80%)	6(75%)	292(80%)
Missing	0	1	2	0	0	1	0	0	4
Q4. What percentage of your work is conducting hands-on commercial vehicle inspections									
Mean	87.0	68.9	57.2	78.0	64.0	84.4	31.5	74.3	57.1
Std Dev	22.8	27.8	32.4	33.3	28.9	32.6	33.3	30.6	37.0
25th Percentile	75.0	50.0	25.0	80.0	40.0	96.5	10.0	70.0	20.0
Median	100.0	75.0	70.0	90.0	60.0	100.0	15.0	80.0	55.0
75th Percentile	100.0	99.5	90.0	100.0	90.0	100.0	40.0	100.0	99.0
Q5. Do you currently use a personal computer with ASPEN to conduct motor carrier inspections?									
Yes	22(100%)	28(100%)	49(67%)	41(100%)	48(98%)	27(96%)	120(99%)	8(100%)	343(93%)
No	0	0	24(33%)	0	1(2%)	1(4%)	1(1%)	0	27(7%)

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q6. How long have used a personal computer when conducting inspections? (Years)									
Mean	3.7	2.0	0.9	2.0	2.2	2.6	1.0	2.2	1.7
Std Dev	1.4	0.9	0.6	0.6	1.1	1.1	0.5	0.4	1.1
25th Percentile	2.8	1.5	0.5	1.5	1.7	1.5	0.7	1.9	0.8
Median	4.4	2.0	0.9	2.0	2.0	2.8	0.8	2.1	1.4
75th Percentile	5.0	2.0	1.0	2.0	2.9	3.5	1.0	2.6	2.0
Q7. Before you began using ASPEN how often, if ever, had you used a computer (at home of at work)?									
Daily	6(27%)	6(21%)	13(26%)	17(41%)	16(33%)	9(33%)	34(28%)	5(63%)	106(31%)
Weekly	7(32%)	7(25%)	11(22%)	7(17%)	16(33%)	6(22%)	38(32%)	1(13%)	93(27%)
More than Once a Month	1(5%)	3(11%)	3(6%)	3(7%)	1(2%)	2(7%)	10(8%)	2(25%)	25(7%)
Once a Month	0	2(7%)	5(10%)	1(2%)	5(10%)	0	7(6%)	0	20(6%)
Less than Once a Month	6(27%)	4(14%)	4(8%)	3(7%)	2(4%)	3(11%)	12(10%)	0	34(10%)
Never	2(9%)	6(21%)	14(28%)	10(24%)	8(17%)	7(26%)	19(16%)	0	66(19%)
Missing	0	0	23	0	1	1	1	0	26
Q8. Besides ASPEN, how often, if ever do you use a computer at work other than to conduct an inspection?									
Daily	19(86%)	7(25%)	11(22%)	19(46%)	24(50%)	13(48%)	79(66%)	3(38%)	175(51%)
Weekly	2(9%)	9(32%)	15(30%)	8(20%)	12(25%)	2(7%)	23(19%)	3(38%)	74(22%)
More than Once a Month	0	4(14%)	5(10%)	3(7%)	4(8%)	1(4%)	7(6%)	1(13%)	25(7%)
Once a Month	1(5%)	1(4%)	2(4%)	0	3(6%)	2(7%)	3(3%)	0	12(3%)
Less than Once a Month	0	4(14%)	4(8%)	0	5(10%)	1(4%)	4(3%)	0	18(5%)
Never	0	3(11%)	13(26%)	11(27%)	0	8(30%)	4(3%)	1(13%)	40(12%)
Missing	0	0	23	0	1	1	1	0	26
Q9. Have you received formal training on how to: a. Use a personal computer or Windows?									
Yes	17(77%)	20(77%)	12(26%)	19(48%)	42(88%)	21(78%)	111(94%)	6(75%)	248(74%)
No	5(23%)	6(23%)	35(74%)	21(53%)	6(13%)	6(22%)	7(6%)	2(25%)	88(26%)
Missing	0	2	26	1	1	1	3	0	34

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q9. Have you received formal training on how to: b. Use ASPEN?									
Yes	21(95%)	26(96%)	25(51%)	12(29%)	43(90%)	27(100%)	118(100%)	4(50%)	276(81%)
No	1(5%)	1(4%)	24(49%)	29(71%)	5(10%)	0	0	4(50%)	64(19%)
Missing	0	1	24	0	1	1	3	0	30
Q10. Since you answered yes to 9b, how would you rate your satisfaction with the formal computer training you received on the use of ASPEN?									
Very Dissatisfied	0	0	1(4%)	0	0	7(26%)	3(3%)	0	11(4%)
Dissatisfied	0	5(20%)	2(8%)	2(17%)	0	5(19%)	5(4%)	0	19(7%)
Neutral	12(57%)	10(40%)	10(40%)	4(33%)	14(33%)	9(33%)	22(19%)	2(50%)	83(31%)
Satisfied	5(24%)	4(16%)	9(36%)	3(25%)	22(52%)	2(7%)	60(52%)	1(25%)	106(39%)
Very Satisfied	4(19%)	6(24%)	3(12%)	3(25%)	6(14%)	4(15%)	26(22%)	1(25%)	53(19%)
Missing	1	3	48	29	7	1	5	4	98
Q11. On average, how many inspections do you carry out on a typical day of inspections in good weather?									
Mean	6.2	4.6	7.6	5.7	4.0	6.5	4.3	4.6	5.4
Std Dev	1.2	1.6	4.3	1.9	1.3	2.6	1.2	1.5	2.7
25th Percentile	6.0	4.0	5.0	5.0	3.0	6.0	4.0	5.0	4.0
Median	7.0	4.0	8.0	6.0	4.0	7.0	4.0	5.0	5.0
75th Percentile	7.0	5.5	10.0	7.0	5.0	8.0	5.0	5.0	6.0
Q12. For each method of reporting results (ASPEN, paper) that you have used, approximately how long does it take you to do the following types of inspections (including reports) in good weather? a. Level I...............Using ASPEN									
Mean	51.4	52.9	32.3	40.7	45.0	29.3	57.3	45.0	46.6
Std Dev	9.9	11.5	11.9	14.4	13.9	8.5	18.7	16.5	18.0
25th Percentile	45.0	45.0	25.0	30.0	40.0	20.0	45.0	30.0	30.0
Median	50.0	55.0	30.0	45.0	45.0	30.0	60.0	47.5	45.0
75th Percentile	58.0	60.0	40.0	50.0	55.0	35.0	60.0	60.0	60.0
Std Dev	18.8	19.9	21.5	22.2	19.0	21.9	18.7	9.3	19.9

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q12. a. Level I...............Using paper only									
Mean	30.8	36.0	36.8	31.7	28.9	34.1	30.2	18.5	31.7
25th Percentile	11.0	21.0	15.0	11.0	11.0	11.0	11.0	11.5	12.0
Median	21.5	34.0	34.0	22.0	22.0	26.0	21.0	14.0	22.0
75th Percentile	51.0	54.5	62.0	53.0	45.0	61.0	51.0	26.5	52.0
Q12. b. Level II.............Using ASPEN									
Mean	30.8	31.0	24.1	24.6	27.6	18.2	33.1	30.0	28.2
Std Dev	7.9	8.1	9.6	8.2	7.5	5.3	12.9	9.3	10.9
25th Percentile	25.0	25.0	20.0	20.0	25.0	15.0	25.0	22.5	20.0
Median	30.0	30.0	20.0	25.0	30.0	20.0	30.0	27.5	30.0
75th Percentile	35.0	35.0	30.0	30.0	30.0	20.0	40.0	37.5	30.0
Q12. b. Level II.............Using paper only									
Mean	40.1	29.4	17.9	26.8	23.6	18.5	35.8	33.6	28.7
Std Dev	9.3	6.1	6.2	10.3	10.8	7.5	13.8	9.0	13.1
25th Percentile	35.0	25.0	15.0	20.0	20.0	15.0	30.0	25.0	20.0
Median	36.0	30.0	15.0	30.0	20.0	20.0	35.0	30.0	30.0
75th Percentile	45.0	30.0	20.0	35.0	25.0	20.0	45.0	40.0	35.0
Q12. c. Level III............Using ASPEN									
Mean	20.9	20.8	17.8	16.6	21.1	18.4	23.8	21.3	20.6
Std Dev	5.1	7.9	9.1	6.5	7.6	12.0	9.9	7.4	9.0
25th Percentile	20.0	15.0	10.0	12.0	15.0	15.0	15.0	15.0	15.0
Median	20.0	20.0	15.0	15.0	20.0	15.0	20.0	17.5	20.0
75th Percentile	24.0	25.0	25.0	20.0	25.0	20.0	30.0	30.0	25.0

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q12. c. Level III............Using paper only									
Mean	27.1	20.9	12.2	17.8	17.8	14.2	27.2	24.3	20.5
Std Dev	10.3	7.2	4.5	8.1	6.3	6.0	13.3	6.1	11.3
25th Percentile	20.0	15.0	10.0	13.0	13.0	10.0	20.0	20.0	15.0
Median	27.5	20.0	10.0	15.0	18.5	15.0	25.0	20.0	20.0
75th Percentile	35.0	30.0	15.0	25.0	20.0	20.0	35.0	30.0	25.0
Q13. Which of the following best describes the situations when you most often use ISS (Inspection Selection System)?									
Before Inspection to Select Truck	17(81%)	2(11%)	22(43%)	3(12%)	4(9%)	3(13%)	9(8%)	1(14%)	61(20%)
After Selecting Vehicle but	4(19%)	12(67%)	26(51%)	21(84%)	36(80%)	13(57%)	78(70%)	5(71%)	195(65%)
After Conducting the Inspection	0	4(22%)	3(6%)	1(4%)	5(11%)	7(30%)	24(22%)	1(14%)	45(15%)
Missing	1	10	22	16	4	5	10	1	69
Q14. Which one method best describes how you transmit your reports to SAFER or AVALANCHE?									
Wireless Connection	22(100%)	0	3(5%)	0	1(2%)	15(54%)	0	8(100%)	49(14%)
Landline Connection	0	25(96%)	28(48%)	13(42%)	48(98%)	13(46%)	120(99%)	0	247(72%)
Paper Reports	0	0	9(16%)	0	0	0	0	0	9(3%)
Diskettes	0	0	6(10%)	1(3%)	0	0	0	0	7(2%)
Give Them to Another Staff Person	0	1(4%)	12(21%)	17(55%)	0	0	1(1%)	0	31(9%)
Missing	0	2	15	10	0	0	0	0	27
Q15. Do you, or does someone else, transfer and receive your inspection information electronically to SAFER or AVALANCHE?									
Me	22(100%)	27(96%)	20(29%)	8(20%)	47(96%)	27(100%)	118(98%)	7(88%)	276(76%)
Someone Else	0	1(4%)	49(71%)	33(80%)	2(4%)	0	3(2%)	1(13%)	89(24%)
Missing	0	0	4	0	0	1	0	0	5

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q16. How frequently are your results transmitted to SAFER or AVALANCHE?									
After Each Inspection	22(100%)	0	2(8%)	0	0	6(23%)	2(2%)	7(100%)	39(14%)
Daily	0	2(8%)	15(58%)	5(42%)	37(79%)	18(69%)	29(25%)	0	106(38%)
Weekly	0	19(76%)	7(27%)	6(50%)	8(17%)	2(8%)	54(47%)	0	96(34%)
Less than Weekly	0	4(16%)	2(8%)	1(8%)	2(4%)	0	30(26%)	0	39(14%)
Missing	0	3	47	29	2	2	6	1	90
Q17. If you send inspection reports directly to SAFER or AVALANCHE do you encounter problems connecting to these systems and transmitting data to them?									
Almost Always	0	2(8%)	2(9%)	0	0	0	5(4%)	0	9(4%)
Frequently	0	6(25%)	2(9%)	2(18%)	11(23%)	2(7%)	8(7%)	1(17%)	32(13%)
Infrequently	1(100%)	10(42%)	13(59%)	4(36%)	22(47%)	11(41%)	36(31%)	2(33%)	99(39%)
Almost Never	0	6(25%)	5(23%)	5(45%)	14(30%)	14(52%)	66(57%)	3(50%)	113(45%)
Missing	21	4	51	30	2	1	6	2	117
Q18. How do you typically receive updates to ASPEN/ISS?									
Wireless Connection	21(100%)	0	5(24%)	0	0	2(8%)	0	0	28(13%)
Landline Connection	0	0	13(62%)	9(100%)	0	0	2(3%)	0	24(11%)
Cd-rom	0	12(60%)	2(10%)	0	43(93%)	24(92%)	21(30%)	7(100%)	109(49%)
Diskettes	0	8(40%)	1(5%)	0	3(7%)	0	48(68%)	0	60(27%)
Missing	1	8	52	32	3	2	50	1	149
Q19. How frequently do you receive updates to ASPEN/ISS?									
More than Once per Day	0	0	0	0	0	0	1(1%)	0	1(0%)
Daily	0	0	3(13%)	1(9%)	0	0	0	0	4(1%)
Weekly	22(100%)	0	13(57%)	5(45%)	0	0	0	0	40(15%)
Quarterly	0	18(82%)	6(26%)	4(36%)	31(66%)	16(59%)	17(15%)	6(86%)	98(36%)
Less than Quarterly	0	4(18%)	1(4%)	1(9%)	16(34%)	11(41%)	96(84%)	1(14%)	130(48%)
Missing	0	6	50	30	2	1	7	1	97

Response	**CT DMV**	**MA Police**	**MD Police**	**MD DOT**	**NY Police**	**NY DOT**	**PA Police**	**RI Police**	**All**
Q20. Have you customized ASPEN (for example, added names of towns, trailer types, etc.)?									
Yes	22(100%)	9(35%)	18(28%)	11(28%)	24(52%)	16(59%)	56(47%)	1(14%)	157(45%)
No	0	17(65%)	47(72%)	29(73%)	22(48%)	11(41%)	62(53%)	6(86%)	194(55%)
Missing	0	2	8	1	3	1	3	1	19
Q21. How many inspections were: **a. At fixed scale facilities? (# per 100 inspections)**									
Mean	54.0	18.4	66.5	88.3	1.7	3.8	11.5	8.6	32.4
Std Dev	17.1	18.5	30.2	30.6	5.2	19.2	22.2	13.9	38.6
25th Percentile	50.0	0.0	50.0	100.0	0.0	0.0	0.0	0.0	0.0
Median	60.0	21.4	80.0	100.0	0.0	0.0	0.0	0.0	10.0
75th Percentile	60.0	32.8	90.0	100.0	0.0	0.0	12.5	16.6	60.0
Q21. How many inspections were: **b. At a nonfixed scale site such as a rest area? (# per 100 inspections)**									
Mean	33.6	27.4	9.5	4.8	65.2	78.3	47.7	24.9	36.9
Std Dev	12.8	18.6	16.9	21.3	29.7	37.5	33.2	15.8	35.6
25th Percentile	30.0	19.7	0.0	0.0	40.0	50.0	20.0	10.0	0.0
Median	30.0	25.0	0.0	0.0	75.0	100.0	50.0	24.3	25.0
75th Percentile	30.0	33.3	16.7	0.0	90.0	100.0	80.0	35.5	75.0
Q21. How many inspections were: **c. Involved stopping a moving vehicle at the roadside? (# per 100 inspections)**									
Mean	12.5	54.3	22.6	6.8	33.1	17.9	40.8	66.5	30.5
Std Dev	5.9	25.9	23.2	22.9	29.4	34.4	32.4	25.6	31.2
25th Percentile	10.0	33.3	5.0	0.0	10.0	0.0	10.0	43.6	5.0
Median	10.0	50.0	15.0	0.0	21.0	0.0	30.0	75.0	20.0
75th Percentile	10.0	75.0	33.3	0.0	55.0	4.8	70.0	90.0	50.0

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q22. How many times did you fill out a paper inspection report instead of using ASPEN?									
Mean	0.2	2.3	59.8	12.9	0.0	4.0	4.3	4.6	15.5
Std Dev	1.1	3.6	38.8	17.7	0.0	20.0	11.1	3.9	30.2
25th Percentile	0.0	0.0	20.0	1.0	0.0	0.0	0.0	1.5	0.0
Median	0.0	0.0	70.0	5.0	0.0	0.0	0.0	4.5	0.0
75th Percentile	0.0	5.0	100.0	15.0	0.0	0.0	3.0	7.5	10.0
Q23. How many times did you team with another inspector to conduct the inspection?									
Mean	7.0	12.3	64.4	64.8	12.8	12.0	11.2	7.4	27.8
Std Dev	8.2	20.5	34.6	25.3	21.7	30.1	19.8	4.8	34.8
25th Percentile	3.0	0.0	25.0	50.0	0.0	0.0	0.0	2.0	0.0
Median	5.0	4.5	80.0	60.0	3.0	0.0	3.0	8.0	10.0
75th Percentile	10.0	10.0	100.0	90.0	15.0	7.0	10.0	10.0	50.0
Q24. How many times did you use the following software before, during, or immediately after the physical inspection? a. ISS									
Mean	99.8	50.7	24.1	55.8	77.5	59.4	59.1	98.8	57.6
Std Dev	1.1	42.9	35.1	45.3	34.7	39.0	41.6	3.5	42.9
25th Percentile	100.0	5.0	0.0	0.0	70.0	20.0	10.0	100.0	10.0
Median	100.0	50.0	1.0	75.0	100.0	50.0	73.5	100.0	75.0
75th Percentile	100.0	100.0	40.0	100.0	100.0	100.0	100.0	100.0	100.0
Q24. b. PIQ (Past Inspection Query)									
Mean	89.3	8.5	8.9	10.8	4.8	17.4	13.2	87.5	17.7
Std Dev	10.2	20.2	17.7	23.6	14.5	27.9	27.7	31.5	31.9
25th Percentile	80.0	0.0	0.0	0.0	0.0	0.0	0.0	95.0	0.0
Median	90.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
75th Percentile	100.0	3.0	10.0	10.0	0.0	20.0	10.0	100.0	15.0

Response	**CT DMV**	**MA Police**	**MD Police**	**MD DOT**	**NY Police**	**NY DOT**	**PA Police**	**RI Police**	**All**
Q24. c. CDLIS (Commercial Driver License Information System)									
Mean	95.6	10.3	10.1	9.8	3.1	19.6	5.9	75.0	15.7
Std Dev	9.4	24.7	21.3	27.2	9.5	29.4	18.0	43.4	31.7
25th Percentile	95.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0
Median	100.0	0.0	0.0	0.0	0.0	1.0	0.0	100.0	0.0
75th Percentile	100.0	1.5	10.0	0.0	0.0	30.0	0.0	100.0	10.0
Q24. d. NCIC (National Crime Information Center)									
Mean	99.0	15.9	12.4	32.0	7.8	0.4	13.9	91.3	21.1
Std Dev	2.5	31.1	23.1	42.2	20.8	2.0	24.1	21.0	34.9
25th Percentile	100.0	0.0	0.0	0.0	0.0	0.0	0.0	95.0	0.0
Median	100.0	0.0	0.0	2.0	0.0	0.0	0.0	100.0	0.0
75th Percentile	100.0	20.0	10.0	80.0	1.0	0.0	20.0	100.0	25.0
Q24. e. PC*MILER									
Mean	33.3	12.4	22.0	22.3	24.7	22.0	20.0	15.9	21.5
Std Dev	25.9	12.2	22.2	22.5	18.1	17.7	18.9	30.4	20.4
25th Percentile	15.0	5.0	5.0	10.0	10.0	10.0	5.0	1.0	9.0
Median	25.0	10.0	15.0	15.0	20.0	20.0	10.0	5.0	15.0
75th Percentile	50.0	20.0	25.0	27.5	30.0	30.0	30.0	12.5	30.0
Q24. f. Some other software									
Mean	99.8	2.6	1.0	0.0	5.4	13.7	15.0	22.5	14.7
Std Dev	1.1	4.4	4.0	0.0	10.3	17.3	27.4	45.0	30.3
25th Percentile	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	100.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0
75th Percentile	100.0	5.0	0.0	0.0	10.0	20.0	20.0	45.0	10.0

Response	**CT DMV**	**MA Police**	**MD Police**	**MD DOT**	**NY Police**	**NY DOT**	**PA Police**	**RI Police**	**All**
Q25. How many times did you use a PIQ before you selected a truck for inspection?									
Mean	7.7	2.6	6.8	3.4	0.9	9.4	5.2	54.4	6.2
Std Dev	4.2	6.8	16.3	16.5	4.1	25.5	16.2	49.1	18.1
25th Percentile	5.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0
Median	7.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0
75th Percentile	10.0	0.0	5.0	0.0	0.0	0.0	1.5	100.0	5.0
Q26. How many times did you check the ISS inspection score to help you choose a truck to inspect?									
Mean	38.4	18.9	14.3	7.6	13.8	11.9	14.4	29.2	15.4
Std Dev	29.7	29.3	25.5	22.0	33.2	25.3	27.3	45.9	28.4
25th Percentile	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Median	27.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75th Percentile	60.0	30.0	20.0	0.0	2.0	0.0	10.0	75.0	15.0
Q27. How many times have you had to use a violation code that was less precise than you wanted because the code was not included in the list?									
Mean	40.8	23.9	12.7	29.1	16.3	19.4	19.8	43.8	21.1
Std Dev	33.6	20.1	18.9	33.5	15.1	17.9	16.8	28.6	22.5
25th Percentile	15.0	10.0	0.0	4.0	5.0	5.0	5.0	27.5	5.0
Median	25.0	20.0	5.0	15.0	10.0	20.0	20.0	40.0	15.0
75th Percentile	70.0	30.0	15.0	40.0	20.0	25.0	25.0	55.0	30.0
Q28. How many times was the vehicle identifier insufficient to describe the vehicle?									
Mean	24.8	20.8	7.5	11.9	15.1	21.6	12.2	12.8	13.8
Std Dev	26.0	24.4	11.3	11.1	21.0	27.6	16.8	13.4	18.8
25th Percentile	10.0	5.0	0.0	2.0	1.0	1.0	2.0	4.5	1.0
Median	14.5	10.0	5.0	10.0	10.0	10.0	10.0	9.0	10.0
75th Percentile	25.0	25.0	10.0	20.0	20.0	25.0	15.0	17.5	20.0

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q29. How many inspections did you have to retype due to technical problems with your laptop (for example, your system froze and you had to shut down and reboot)?									
Mean	3.0	5.3	3.5	10.9	4.0	9.3	1.6	4.1	4.3
Std Dev	3.2	9.1	5.5	14.2	5.5	10.9	2.8	3.9	7.7
25th Percentile	1.0	0.0	0.0	0.0	0.0	3.0	0.0	2.0	0.0
Median	2.0	1.0	0.0	5.0	2.0	6.0	0.0	2.0	1.0
75th Percentile	4.0	5.0	5.0	10.0	5.0	10.0	2.0	7.5	5.0
Q30. Overall satisfaction with the ASPEN system									
Very Dissatisfied	1(5%)	1(4%)	6(10%)	0	0	0	0	1(13%)	9(3%)
Dissatisfied	0	2(8%)	10(16%)	4(10%)	4(8%)	3(12%)	3(3%)	0	26(8%)
Neutral	4(19%)	12(46%)	24(39%)	17(41%)	21(44%)	10(38%)	20(18%)	4(50%)	112(32%)
Satisfied	12(57%)	7(27%)	17(27%)	17(41%)	20(42%)	11(42%)	63(55%)	3(38%)	150(43%)
Very Satisfied	4(19%)	4(15%)	5(8%)	3(7%)	3(6%)	2(8%)	28(25%)	0	49(14%)
Missing	1	2	11	0	1	2	7	0	24

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q31. Laptop screen (visibility, color, size of screen, font size, sun glare)									
Very Dissatisfied	9(43%)	4(15%)	7(12%)	0	0	0	1(1%)	1(13%)	22(6%)
Dissatisfied	9(43%)	10(38%)	8(13%)	9(22%)	8(17%)	5(18%)	10(9%)	3(38%)	62(18%)
Neutral	3(14%)	8(31%)	24(40%)	12(29%)	13(27%)	8(29%)	22(19%)	3(38%)	93(27%)
Satisfied	0	2(8%)	15(25%)	17(41%)	23(48%)	10(36%)	55(48%)	1(13%)	123(35%)
Very Satisfied	0	2(8%)	6(10%)	3(7%)	4(8%)	5(18%)	27(23%)	0	47(14%)
Missing	1	2	13	0	1	0	6	0	23
Q32. Keyboard and Screen Pointer Device (layout and position, size)									
Very Dissatisfied	0	1(4%)	4(7%)	3(7%)	2(4%)	0	0	0	10(3%)
Dissatisfied	1(5%)	3(12%)	7(11%)	6(15%)	4(8%)	3(11%)	6(5%)	0	30(9%)
Neutral	12(57%)	8(31%)	31(51%)	16(39%)	18(38%)	7(25%)	21(18%)	5(63%)	118(34%)
Satisfied	8(38%)	7(27%)	13(21%)	13(32%)	21(44%)	13(46%)	57(50%)	3(38%)	135(39%)
Very Satisfied	0	7(27%)	6(10%)	3(7%)	3(6%)	5(18%)	31(27%)	0	55(16%)
Missing	1	2	12	0	1	0	6	0	22

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q33. Overall reliability of the computer (screen freezes crashes, error messages)									
Very Dissatisfied	0	1(4%)	10(16%)	4(10%)	3(6%)	4(14%)	0	1(13%)	23(7%)
Dissatisfied	1(5%)	2(8%)	5(8%)	6(15%)	10(21%)	3(11%)	9(8%)	0	36(10%)
Neutral	5(24%)	10(38%)	31(50%)	20(49%)	16(33%)	14(50%)	27(23%)	4(50%)	127(36%)
Satisfied	13(62%)	12(46%)	12(19%)	10(24%)	16(33%)	6(21%)	48(42%)	2(25%)	119(34%)
Very Satisfied	2(10%)	1(4%)	4(6%)	1(2%)	3(6%)	1(4%)	31(27%)	1(13%)	44(13%)
Missing	1	2	11	0	1	0	6	0	21
Q34. Overall support for solving problems when using the laptop (on-screen help, help desk, technical support)									
Very Dissatisfied	1(5%)	1(4%)	6(11%)	4(10%)	0	9(35%)	1(1%)	1(13%)	23(7%)
Dissatisfied	7(35%)	1(4%)	9(16%)	10(25%)	6(13%)	4(15%)	7(6%)	1(13%)	45(13%)
Neutral	8(40%)	9(35%)	31(54%)	17(43%)	25(56%)	6(23%)	37(33%)	3(38%)	136(41%)
Satisfied	1(5%)	10(38%)	10(18%)	8(20%)	14(31%)	7(27%)	49(43%)	3(38%)	102(30%)
Very Satisfied	3(15%)	5(19%)	1(2%)	1(3%)	0	0	19(17%)	0	29(9%)
Missing	2	2	16	1	4	2	8	0	35

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q35. Have you been supplied with: a. Wireless modem (slow-downs, disconnects, connection port)									
Yes	22(100%)	7(28%)	9(14%)	6(17%)	1(2%)	16(59%)	11(10%)	8(100%)	80(24%)
N0	0	18(72%)	55(86%)	29(83%)	45(98%)	11(41%)	101(90%)	0	259(76%)
Missing	0	3	9	6	3	1	9	0	31
Q35. a. Rate wireless modem									
Very Dissatisfied	0	0	0	0	0	1(6%)	0	0	1(1%)
Dissatisfied	3(14%)	0	1(11%)	2(33%)	0	2(13%)	0	0	8(11%)
Neutral	10(45%)	2(33%)	5(56%)	3(50%)	0	4(25%)	5(50%)	4(67%)	33(43%)
Satisfied	6(27%)	3(50%)	1(11%)	1(17%)	1(100%)	4(25%)	4(40%)	2(33%)	22(29%)
Very Satisfied	3(14%)	1(17%)	2(22%)	0	0	5(31%)	1(10%)	0	12(16%)
Missing	0	22	64	35	48	12	111	2	294

Response	**CT DMV**	**MA Police**	**MD Police**	**MD DOT**	**NY Police**	**NY DOT**	**PA Police**	**RI Police**	**All**
Q35. Have you been supplied with: b. Landline modem (slow-downs, disconnects, connection port)									
Yes	16(73%)	18(82%)	25(39%)	18(51%)	46(96%)	23(88%)	101(89%)	0	247(73%)
No	6(27%)	4(18%)	39(61%)	17(49%)	2(4%)	3(12%)	12(11%)	8(100%)	91(27%)
Missing	0	6	9	6	1	2	8	0	32
Q35. b. Rate landline modem									
Very Dissatisfied	0	0	0	0	2(4%)	0	3(3%)	0	5(2%)
Response	**CT DMV**	**MA Police**	**MD Police**	**MD DOT**	**NY Police**	**NY DOT**	**PA Police**	**RI Police**	**All**
Dissatisfied	0	0	2(8%)	0	2(4%)	1(4%)	3(3%)	0	8(3%)
Neutral	14(88%)	10(56%)	11(46%)	10(67%)	19(42%)	5(22%)	19(19%)	0	88(37%)
Satisfied	2(13%)	8(44%)	7(29%)	4(27%)	21(47%)	12(52%)	49(49%)	0	103(43%)
Very Satisfied	0	0	4(17%)	1(7%)	1(2%)	5(22%)	25(25%)	0	36(15%)
Missing	6	10	49	26	4	5	22	8	130

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q35. Have you been supplied with: c. In-vehicle computer mount (no mount provided, lock-in mechanisms, position/ease of access)									
Yes	21(95%)	23(92%)	6(10%)	7(21%)	37(79%)	16(57%)	4(4%)	8(100%)	122(36%)
No	1(5%)	2(8%)	57(90%)	27(79%)	10(21%)	12(43%)	110(96%)	0	219(64%)
Missing	0	3	10	7	2	0	7	0	29
Q35. c. Rate in-vehicle computer mount									
Very Dissatisfied	2(10%)	3(13%)	2(33%)	0	1(3%)	0	0	0	8(7%)
Dissatisfied	3(14%)	5(22%)	1(17%)	1(14%)	2(6%)	0	2(50%)	1(17%)	15(13%)
Neutral	9(43%)	9(39%)	3(50%)	4(57%)	7(20%)	3(20%)	0	2(33%)	37(32%)
Satisfied	5(24%)	4(17%)	0	2(29%)	18(51%)	4(27%)	1(25%)	2(33%)	36(31%)
Very Satisfied	2(10%)	2(9%)	0	0	7(20%)	8(53%)	1(25%)	1(17%)	21(18%)
Missing	1	5	67	34	14	13	117	2	253

Response	**CT DMV**	**MA Police**	**MD Police**	**MD DOT**	**NY Police**	**NY DOT**	**PA Police**	**RI Police**	**All**
Q35. Have you been supplied with: d. Portable printer (print quality, printing speed, paper jams)									
Yes	22(100%)	25(100%)	24(38%)	27(77%)	46(96%)	27(96%)	113(98%)	8(100%)	292(85%)
No	0	0	39(62%)	8(23%)	2(4%)	1(4%)	2(2%)	0	52(15%)
Missing	0	3	10	6	1	0	6	0	26
Q35. d. Rate portable printer									
Very Dissatisfied	6(27%)	0	3(13%)	8(30%)	13(28%)	1(4%)	6(5%)	0	37(13%)
Dissatisfied	4(18%)	4(16%)	5(22%)	3(11%)	16(35%)	2(7%)	28(25%)	2(33%)	64(22%)
Neutral	11(50%)	11(44%)	10(43%)	12(44%)	7(15%)	7(26%)	42(37%)	4(67%)	104(36%)
Satisfied	1(5%)	8(32%)	5(22%)	4(15%)	7(15%)	10(37%)	28(25%)	0	63(22%)
Very Satisfied	0	2(8%)	0	0	3(7%)	7(26%)	9(8%)	0	21(7%)
Missing	0	3	50	14	3	1	8	2	81

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q35. Have you been supplied with: e. In-vehicle printer mount (lock-in mechanisms, position/ease of access)									
Yes	3(14%)	17(68%)	5(8%)	3(9%)	9(19%)	11(39%)	3(3%)	8(100%)	59(17%)
No	18(86%)	8(32%)	58(92%)	31(91%)	38(81%)	17(61%)	112(97%)	0	282(83%)
Missing	1	3	10	7	2	0	6	0	29
Q35. e. Rate in-vehicle printer mount									
Very Dissatisfied	0	4(24%)	1(20%)	0	3(33%)	0	0	0	8(14%)
Dissatisfied	2(67%)	2(12%)	1(20%)	0	1(11%)	1(9%)	2(100%)	2(33%)	11(20%)
Neutral	1(33%)	8(47%)	3(60%)	3(100%)	0	0	0	3(50%)	18(32%)
Satisfied	0	3(18%)	0	0	4(44%)	5(45%)	0	1(17%)	13(23%)
Very Satisfied	0	0	0	0	1(11%)	5(45%)	0	0	6(11%)
Missing	19	11	68	38	40	17	119	2	314

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q36. Overall, saves time needed to conduct and report inspection									
Strongly Disagree	0	2(8%)	12(19%)	4(10%)	2(4%)	1(4%)	2(2%)	1(13%)	24(7%)
Disagree	0	3(12%)	21(34%)	3(7%)	6(13%)	3(11%)	15(13%)	0	51(15%)
Neutral	2(9%)	9(35%)	17(27%)	13(32%)	11(23%)	8(29%)	24(21%)	1(13%)	85(24%)
Agree	16(73%)	9(35%)	9(15%)	13(32%)	24(50%)	11(39%)	46(40%)	5(63%)	133(38%)
Strongly Agree	4(18%)	3(12%)	3(5%)	8(20%)	5(10%)	5(18%)	27(24%)	1(13%)	56(16%)
Missing	0	2	11	0	1	0	7	0	21
Q37. Saves time specifying violation codes									
Strongly Disagree	0	2(8%)	7(11%)	1(3%)	1(2%)	0	1(1%)	1(13%)	13(4%)
Disagree	0	4(15%)	10(16%)	5(13%)	3(6%)	2(7%)	12(11%)	0	36(10%)
Neutral	1(5%)	6(23%)	23(37%)	12(30%)	10(21%)	7(26%)	18(16%)	2(25%)	79(23%)
Agree	15(68%)	11(42%)	18(29%)	16(40%)	27(56%)	14(52%)	55(48%)	5(63%)	161(46%)
Strongly Agree	6(27%)	3(12%)	4(6%)	6(15%)	7(15%)	4(15%)	28(25%)	0	58(17%)
Missing	0	2	11	1	1	1	7	0	23

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q38. Provides more complete vehicle information									
Strongly Disagree	0	1(4%)	6(10%)	1(3%)	0	0	0	0	8(2%)
Disagree	0	4(16%)	7(11%)	4(11%)	5(10%)	5(18%)	11(10%)	1(13%)	37(11%)
Neutral	10(45%)	10(40%)	20(32%)	16(42%)	24(50%)	6(21%)	22(19%)	5(63%)	113(33%)
Agree	12(55%)	9(36%)	23(37%)	14(37%)	16(33%)	13(46%)	54(48%)	2(25%)	143(42%)
Strongly Agree	0	1(4%)	6(10%)	3(8%)	3(6%)	4(14%)	26(23%)	0	43(13%)
Missing	0	3	11	3	1	0	8	0	26
Q39. Helps focus inspections on certain types of violations									
Strongly Disagree	2(9%)	2(8%)	9(15%)	1(3%)	0	0	2(2%)	0	16(5%)
Disagree	0	6(23%)	8(13%)	5(13%)	7(15%)	7(25%)	17(15%)	1(13%)	51(15%)
Neutral	8(36%)	8(31%)	29(47%)	21(53%)	24(50%)	10(36%)	34(30%)	4(50%)	138(40%)
Agree	10(45%)	9(35%)	11(18%)	12(30%)	16(33%)	9(32%)	46(41%)	3(38%)	116(34%)
Strongly Agree	2(9%)	1(4%)	5(8%)	1(3%)	1(2%)	2(7%)	13(12%)	0	25(7%)
Missing	0	2	11	1	1	0	9	0	24

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q40. Helps you do your job better									
Strongly Disagree	0	2(8%)	9(15%)	1(3%)	0	0	2(2%)	1(13%)	15(4%)
Disagree	1(5%)	2(8%)	10(16%)	4(10%)	4(8%)	3(11%)	7(6%)	0	31(9%)
Neutral	0	6(23%)	18(29%)	12(30%)	15(31%)	7(25%)	18(16%)	0	76(22%)
Agree	10(45%)	14(54%)	19(31%)	19(48%)	22(46%)	11(39%)	50(44%)	6(75%)	151(43%)
Strongly Agree	11(50%)	2(8%)	6(10%)	4(10%)	7(15%)	7(25%)	37(32%)	1(13%)	75(22%)
Missing	0	2	11	1	1	0	7	0	22
Q41. Improves safety on the roads									
Strongly Disagree	0	2(9%)	7(11%)	3(8%)	0	3(11%)	2(2%)	1(13%)	18(5%)
Disagree	1(5%)	5(22%)	13(21%)	5(13%)	2(4%)	2(7%)	12(11%)	2(25%)	42(12%)
Neutral	5(24%)	7(30%)	25(40%)	19(49%)	22(47%)	9(33%)	32(28%)	1(13%)	120(35%)
Agree	9(43%)	7(30%)	12(19%)	9(23%)	20(43%)	8(30%)	46(40%)	3(38%)	114(33%)
Strongly Agree	6(29%)	2(9%)	5(8%)	3(8%)	3(6%)	5(19%)	22(19%)	1(13%)	47(14%)
Missing	1	5	11	2	2	1	7	0	29

Response	CT DMV	MA Police	MD Police	MD DOT	NY Police	NY DOT	PA Police	RI Police	All
Q42. ISS helps to identify high-risk carriers									
Strongly Disagree	0	1(4%)	5(8%)	4(10%)	1(2%)	1(4%)	0	3(38%)	15(4%)
Disagree	1(5%)	2(8%)	2(3%)	5(13%)	3(6%)	5(18%)	1(1%)	0	19(6%)
Neutral	3(14%)	6(24%)	17(28%)	9(23%)	6(13%)	4(14%)	17(15%)	0	62(18%)
Agree	12(57%)	11(44%)	26(43%)	16(41%)	23(49%)	11(39%)	41(36%)	4(50%)	144(42%)
Strongly Agree	5(24%)	5(20%)	11(18%)	5(13%)	14(30%)	7(25%)	55(48%)	1(13%)	103(30%)
Missing	1	3	12	2	2	0	7	0	27
Q43. Using computers to conduct inspections is better than the old process of using paper reports									
Strongly Disagree	0	2(8%)	9(15%)	3(7%)	1(2%)	2(7%)	2(2%)	0	19(6%)
Disagree	0	3(12%)	9(15%)	1(2%)	1(2%)	1(4%)	7(6%)	0	22(6%)
Neutral	0	2(8%)	17(27%)	8(20%)	9(20%)	4(14%)	14(12%)	1(13%)	55(16%)
Agree	5(23%)	12(46%)	12(19%)	16(39%)	20(45%)	7(25%)	28(25%)	3(38%)	103(30%)
Strongly Agree	17(77%)	7(27%)	15(24%)	13(32%)	13(30%)	14(50%)	63(55%)	4(50%)	146(42%)
Missing	0	2	11	0	5	0	7	0	25

Table A2-2. Summary of Open-Ended Questions

Q44. What do you think is the single most important benefit from using the laptop?

State	Agency	Most important benefit from using the laptop
CT	Police	* Frees up paperwork
		* Speed/quality
		* Data integrity Insa report is neat and uniform across country, picklists ISS to identify HR carriers, PIQ's
		* Keeping all inspections consistent
		* Consistently more accurate data
		* Time
		* More accurate, concise reports, use of supplied programs has enhanced enforcement efforts
		* Provides a standardized, neat, easy to read inspection
		* Ease of access to all information available
		* Saves time
CT	DOT/DMV	* Saves time
		* Getting information quicker
		* Quick information, somewhat accurate 95% of time, saves handwriting
		* Speed, accuracy
		* Focuses me on correct information and proper and thorough inspection
		* Legible reports
		* More data and reports
		* Standard state-to-state format
CT	Other	* Saves time
CT	Missing	* Safety
		* Time savings
MA	Police	* Data gathering, statistics
		* Locate problem ?
		* Less paper work, neatness and accountability

* PIQ

State	Agency	Most important benefit from using the laptop
		* Less paperwork
		* Allows to go back to previous inspections of certain vehicles that you inspected to see if repairs were made
		* Neatness
		* Time saving and a professional looking report
		* Professionalism
MA	DOT/DMV	* Neatness
		* A disappointment. Now we no longer are tech specialists with CMV but we must be computer techs. We are tied to the computer with its limitations/restrictions. Another headache to contend with.
		* Helps to do the job better
		* Reproducing reports/records of inspections performed
		* Carrier profile (modem capability if it gets installed)
		* Neat inspection
		* Time saved
		* Able to read inspection form
MA	Other	* As a c-mock block
		* Convenient, concise, saves on paper and time
MA	Missing	* Neatness
		* Saves time, writing
MD	Police	* Neater, saves time reporting inspections to database
		* Accuracy of reports
		* Neatness and getting inspections into the system
		* Prevents error and omissions
		* I have no idea
		* We use the desk-top PC, very neat, quick forward to HQ
		* Convenience
		* Gives you more up-to-date information
		* Improves record retention
		* Record retention
		* Increased legibility of inspection reports

MD	DOT/DMV	* Neater, cleaner, more professional-looking reports * Inspections that you can read clearly

State	Agency	Most important benefit from using the laptop
		* Accuracy and neatness
		* Section codes/violations
MD	Other	* Convenience
MD	Missing	* Central records
		* Don't use enough to make a statement
		* PIQ's
		* Mobility
		* Easier to locate violation
		* Checking history and DOT number
		* It is portable and can be connected to SAFER or AVALANCHE any time
		* ISS
		* Portability
		* More info-neater
		* Unknown
		* Checking information
		* Reports are much neater
		* Legibility/speed
		* Legibility/speed
		* Reports are neat, clear & uniform
		* Legibility on reports
		* Carrier info. in computer
		* Motor carrier info. automatically in computer
		* Most of the time by using USDOT numbers, company name and address is already provided
		* Accuracy retention
		* Accuracy neatness-retention
		* Neatness & retention
		* Less support personnel for data entry
		* Easier to read print, recall info. and accuracy
		* Neatness, accuracy recalls
		* Neatness, accuracy recalls
		* Neatness of reports
		* Cut down on paperwork but the inspections will decrease in number
		* All writing is uniform, eliminates data entry
		* The laptop slows down my process of filling out T1 while conducting inspection

State	Agency	Most important benefit from using the laptop
		* Neat inspections
		* Saves time
		* Laptop is a lot faster than the mouse/keyboard separate from monitor
		* Easy to use
		* Clarity of report
		* Finding violation codes
		* Neater
		* Consistent; reports are uniform and clear
		* Time
		* Information storage
		* Quality of report
		* Saves time
		* Speed
		* Better able to read completed reports
		* Legibility-difficult to read many inspectors handwriting
		* Faster
		* A lot more legible
		* The report is legible and in an easy to read order
		* Clear and readable reports, gather info for future use
		* Makes inspections quicker, more professional looking, more uniform between states
		* Standardization
		* Portability
		* Time
		* Legibility
		* Neat reports
		* Makes reports neater & easier to read
		* Being able to check history & prior violation
		* Clarity of reports
		* Professional appearance, data transfer
		* Identifying high risk carriers
		* Seeing past inspection reports
		* Saves time
		* All information needed is right in the laptop
		* Less writing
		* Better accuracy with less paper work
		* More accurate & legible reports

State	Agency	Most important benefit from using the laptop
		* Return of important information
		* Neatness of reports
		* Neatness
		* Saves time
NY	Police	* Neatness of reports and archive feature
		* Clear concise reports
		* Time and neatness
		* Legibility
		* Inspection time, uploading and clarity
		* Clarity and consistency of reports and information available to inspectors at sites
		* Speed
		* Appearance of report and ease of uploading to system
		* Have access to lots of info at finger tip, quickly on demand
		* I never used paper, only laptop; it's fast, easier, and neatly printed
		* Instant sending of information
		* Real time inspections and use of PIQ easy of reporting
		* Uniformity in the inspection reporting procedure (electronically and printouts)
NY	DOT/DMV	* Reports that can be transmitted via modem
		* Eliminates penmanship problems and readability- ease of uploads and updates
		* Fairly compact, always have information on inspections on hand (archives) and PIQ helps a lot
		* Neat legible reports with recordability
		* Easy access to other programs and software
		* Almost instant access to semi correct and complete information(CDLIS)
		* More professional
		* Quick upload times to data bank
NY	Other	* Neat
		* Doing reports
NY	Missing	* Standardization to make database more accurate
		* Neat and legible reports
		* Neatness of reports
		* Everything you need is in the computer
		* No paperwork load and all reports on hand for copies

State	Agency	Most important benefit from using the laptop
		* Uploading- ease of reading the report
		* Time, ISS
		* Easier to download and update the federal system
		* Availability to check past inspections and PC*MILER
		* It is a quicker way of updating carrier safety data than through paper reporting
		* Reports completed and verified immediately, required/reported information format consistent, reports legibly printed
		* Accuracy/neatness in reporting
		* Reports are nice
		* Consolidates reference PC*MILER
		* Speed to get inspection results to AVALANCHE
		* Speed in reporting to AVALANCHE
		* Clear and concise report presentable
		* Uniformity between inspectors, carriers being able to read inspection sheet
		* Huge amounts of information, instantly
		* Ease of use. Print capability, violation identification, ISS help
		* Having all information right at hand
		* Better quality of inspections as well as reports
		* Has a lot of information
		* It has a lot of information at one source
		* Makes reports and legible
		* You can read report
		* Uniform and legible reports
		* Neat reporting-collection of data
		* Storage and retrieval of old inspections
		* Speeds up getting info to state and fed DOT when ASPEN works
		* More organized; less forms to carry
		* Speed over handwritten
		* Clear concise reports
		* Ease with reporting of reports to State and National computer
		* Faster, easier to read
		* Quicker uploads to SAFER
		* Speed, neatness
		* Time saving- neater printouts
		* Compiles a database
		* Speed, quality, and legibility of report

* Saves time, easier to read

State	Agency	Most important benefit from using the laptop
		* Saves time
		* In my case, it makes the reports legible
PA	Police	* Neatness, correction of errors
		* Resource availability
		* Once proficient, the speed of report preparation
		* Neatness, less paper, files/FMCR's, etc.
		* Speed of information
		* Time and being able to know what type of carrier (violators)
		* PC*MILER; I have found more hrs. of service violations in the last year than in the previous three
		* Saves time/convenience
		* Ease at retrieving info on carriers from previous inspections
		* Keeping statistics for record keepers
		* Having everything at your fingertips
PA	DOT/DMV	* Less items to carry with you-books, etc.
		* Potential to get carrier/driver info into system from inspection site by wireless transmission.
		* Report uniformity
		* The amount of time to complete as inspection
		* Everything you need (manuals) is right in front of you
		* Forwarding inspections faster. Via modem.
		* Neater report
		* Faster, easier, more complete, neat easy reference, no paper trail to maintain statistics
PA	Other	* The correctness of the reports and availability to read printed reports
		* Have prior inspections on hand
PA	Missing	* Access to information without all the manual & books
		* All info is in front of you
		* Better appearance
		* Gets info to data base faster
		* Easier report writing
		* Neatness of the reports
		* Quicker, neater
		* Ease of entering violations and completing inspections
		* Save time, retention of info for future use

State	Agency	Most important benefit from using the laptop
		* Saves time
		* The appearance of the report/violations-carrier info
		* In most cases it speeds up the inspection process. Makes finding the more "common" violation codes easier
		* Legibility of reports- nice print-out, eliminates copies.
		* Organization
		* Expediency in performing inspections.
		* Saves time, identifies risk carriers
		* ISS
		* Good record keeping. Truckers are impressed
		* Having the information at your fingertips
		* Professional; makes sure inspection complete, provides RDS tools
		* Instant access to carrier info
		* Saves time
		* Reports look neat
		* Reduces need to carry and leaf through individual manuals i.e DOS criteria, Federal regs., etc.
		* Expandability
		* Less paper; better record keeping
		* Time
		* Makes reports look more professional
		* You have a printed copy- my handwriting is terrible
		* Saves time
		* Much quicker access to information (i.e., Regs, OOS, previous insp. etc)
		* Facilitates inspections and ability to provide timely database info
		* Quicker and more thorough than paper system
		* Inspection selection system
		* A more professional report for carrier to read, easier to correct mistakes or changes
		* ISS system aids in determining to cite or warn for various violations.
		* Looks professional; PC*MILER
		* Fast information- wealth of knowledge at finger tips
		* A cleaner more organized report is prepared. (Better product)
		* Efficiency
		* Inspections available much easier and data sent easier.
		* Clear and complete and storage.
		* Better enforcement through access to more information
		* ISS; identifying high-risk carriers, also helps me to concentrate on known defects

* Neatness

State	Agency	Most important benefit from using the laptop

* Reports save time and are more professional
* Neatness/readability of reports; accurate violation code
* Organizing inspections
* Saves time- more professional-looking report.
* Neatness, accuracy and timeliness of information
* Efficiency, uniformity, and capturing of info
* Sending reports to ASPEN.
* Being able to recall inspection info wherever and whenever you need it
* Provides instant violation codes w/o having to look them up
* Ease of info, looks more professional
* Allows DOT to update and inform inspectors of company's continuing to run vehicle with violations
* Getting correct information to database
* Easier record keeping, more efficient past insp. inquires
* Verify driving hours with miles using PC*MILER
* Info. at fingertips rather than reference manuals, etc.
* Computer available for non-MCSAP duty
* Organization of performed inspections
* Having access to info on high-risk carriers
* More professional
* Everything (Regs., OOS criteria) is at my fingertips. PC*MILER and air miles is very helpful
* Clean professional report- count
* Keep reports organized and neat in appearance
* Neatness
* Neatness in reporting
* I am able to conduct inspections faster.
* PC*MILER
* Ability to review past insp for repeat carriers/carrier
* Knowing the history of previous inspection (if all carriers had DOT #'s)
* Reports are cleaner and more legible
* Speed and professional looking reports
* Professional looking reports
* It really is pretty neat! It keeps everything in one place and saves writing, IBM 3802 is a terrific unit
* Save time in completing inspections and the software is very helpful
* Laptop is more proficient and is much more professional
* Uniformity and neatness

State	Agency	Most important benefit from using the laptop
RI	Police	* Saves on writing cramps
		* DOT info/ISS score
		* Looks more professional
		* Quality of data
RI	DOT/DMV	* ASPEN
		* Easy to read, professional looking inspection report
RI	Other	* Speed, good to reference older inspections

Q45. What 1 or 2 improvements would you recommend to make this system more useful to you in your daily work?

CT	Police	* Out service brake calculator
		* Better screen
		* Anti-glare screen needed; printers not reliable
		* Better violation codes, screen visibility and backlit keyboard
		* Air card/screen to reduce sun glare
		* Touch screens more visible in sunlight
		* Screen/calculations for brake measurements /OOS
		* Improve screen, re-visit vehicle type codes and violation codes
		* Allow customization of all fields by user, fix DOB field to make it more user-friendly
		* 100% online access (no dead spots) customizable (numeric) violations; better mouse
		* To be able to tab into and type in all fields. Touch screens have too much glare in sunlight.
CT	DOT/DMV	* Screen glare in sun
		* Air card
		* Add brake measurement that could automatically list violation if out of adjustment
		* Add brake measurements that would automatically list violation if out of adjustment
		* More training and screen visibility (both day and night)
		* Keep upgrading

State	Agency	Most important benefit from using the laptop
		* Driver and vehicle info direct to NCIC for check and company for state check
CT	Other	* Improve screen visibility (reduce glare), add a numeric keypad to keyboard
CT	Missing	* Auto uploads needs a "no brake adjustment" warning when doing a level 1
		* To have system automatically check PIQ and CDLIS. You should not be able to exit level 1 inspection without putting in brake measurement.
MA	Police	* Improved state violations codes
		* Faster printer
		* More violation codes
		* Better mounts placement/all inspectors should have modems in order to check for license statewide and warrants
		* Better screen
		* Window tint to reduce screen glare
MA	DOT/DMV	* ASPEN
		* Get rid of it. We rely on it too much instead of ourselves. Productivity is down due to computer slowing process
		* Violation codes to be more precise
		* [Illegible comment]
		* Have codes (esp. HM) read like Title 49/easier to read screen in daytime
		* Safety TN mount
		* Need modem
		* Better screen
MA	Other	* Use paper inspection sheets
		* Wireless modem
MA	Missing	* More comfortable position in cruiser
		* More user friendly
MD	Police	* Eliminate glitch on final page regarding CVSA sticker screen freeze
		* ASPEN is not easy to use - too many lists - too "mouse-dependent"
		* Don't like touch-pad mouse
		* Larger laptop/larger screen

* To actually have some training on it
* Remove tables - allow type in for all areas

State	Agency	Most important benefit from using the laptop
		* Less scrolling to put in states and dates (i.e., DOB)
		* Taking a typing class to be a better typer
		* Easier interface
		* Better printers
		* Vehicle work stations
MD	DOT/DMV	* Direct access to web-based SAFER inquiries to get DOT/ICC#
		* A modem that would call company, alert OSS driver and vehicle
		* More training on it
		* Better printers
MD	Other	* Put it in the patrol vehicle
		* Get rid of it
MD	Missing	* Better printers, better ability to network
		* Everyone to have one
		* Provide a more reliable printer, a less space-consuming Braley box, provide computer maintenance
		* Computer mountings in vehicles
		* More computers and more training-not a 1 day class
		* More available to use
		* Don't use enough to make determination
		* Better quality equipment
		* More training
		* Do away with it
		* Unknown
		* Too many drop down windows; a lot of downtime
		* VEH mount
		* VEH mount
		* Better equipment with less down time
		* In vehicle mounts for laptops & printers
		* Mouse (ball on keyboard) is sometimes difficult to use
		* Violations listed need to be more specific
		* Need to put other forms into system: post-crash-PMS, etc.
		* Improve the lock up reinitialization
		* Improve the lock up reinitialization
		* Quality equipment in a more efficient manner

State	Agency	Most important benefit from using the laptop

* Sometimes computer locks up or will leave off letters of words
* Locks up sometimes
* Needs brighter screen to see outside with
* To receive some training/ let us take it out of the scale house
* Where you could type in the state or code of vehicle, etc.
* Designate and train someone specifically at each installation to handle problems.
* Eliminate the round printer button
* More trailer info & notes print on same sheet
* Glare free screen and be able to modify codes/violations more
* Include more truck & trailer makes
* Make keyboard & screen pointer larger to improve accuracy
* You should be able to type in a trailer make
* Correct the freq problem of getting error message when entering CVSA decal # into vehicle box on the final page.
* Letter violation codes identification
* Include more common semi-trailers
* Have more error messages when license no., vehicle info., or brake measurements are overlooked
* I would like to have formal training in how to use the ASPEN system
* Larger monitors
* System freezes during printing, needs to be more reliable
* Layout of computer at work site-training
* Be able to enter proper violation code manually & resolve the program glitches
* The Dell laptop needs a better mouse (like IBM laptops)
* Spell check, voice commands, Dell needs a better mouse
* Permanent mounting of equipment
* Quicker info. Response-CJIS, MVA response
* Have CJIS access and MVA
* Fix the lockouts
* Get bigger vehicles to put computer in
* Having laptops that can be permanently mounted in vehicles. Most people do not use them roadside because the printer

& computer have to be set up and taken down everyday, eventually causing problems at the connections.

* Quicker/easy to use
* More computers
* We need more computers; make sure that the equipment is of a better quality

NY	Police	* Make McRegis easier to use. I would love to use it, but find it too confusing * Make wireless modem capabilities universally available

State	Agency	Most important benefit from using the laptop
		* Better printer, have the brakes measurement pop up
		* Better printer
		* Do away with mouse requirement. Have some type of tab feature
		* Program added that would print out officer's uniform traffic tickets based on violation checked for citations issued-real time saver
		* Being able to directly type in violation sections and descriptions
		* Improve CDLIS and be able to get same info as NYPD or any other Police Agency
		* Less screen freezes/crashes
		* When you verify the report without brake readings it would tell you
		* Get me a dependable wireless modem for PID AND CDLIS
NY	DOT/DMV	* More ergonomic mounts for laptop and printer
		* Get away from mouse only control
		* Cell phone access and CDLIS in working order (only 1 cell phone for 5 vehicles) for contacting carriers
		* Have DOT pop up to directly populate fields
		* To test the complete system/laptop/printer/communications/switch boxes) before release to field
		* ASPEN more compatible to Windows 95
		* Make the system more user friendly such as being able to tab and enter info rather than drop down menus
NY	Other	* Better printer
		* More dependable, scanner copier
NY	Missing	* Simplify data storage so it is not easily lost, can be backed up better
		* Custom fit machine to inspector needs
		* Better communications equipment; more help with hardware and software problems
		* One person per truck; you need the room for printer, etc. With a computer, one breaks down you're both messed up
		* Communications
		* Help when needed- extra copies of programs-communications
		* More violation codes
		* Do away with most of the pop up menus
		* Get a printer that works
		* Wireless connection to NYSPIN for driver's license checks
		* Useful, patrol-oriented mounts for equipment, wireless MYSPIN connection for roadside use
		* Real time access to PIQ

* Improving workings of the printer
* To be able to check driver license when put into ASPEN by cellphone

May 26, 2000

State	Agency	Most important benefit from using the laptop
		* Return program so you can tab to next box, as opposed to having to click on each box
		* In the ASPEN software - violations section of the report: the need to click on so many fields, e.g., Veh, Cust or STD, then "Federal" then "violations"
		* Having a road mileage program that gives you a 100-mile radius from a designated point
		* Functional crash recovery. Panic does not work, never worked, and is completely useless!
		* Wireless modem, update computers
		* ASPEN needs to be improved to help stop loss of information when there is a problem or when laptop locks up
		* None
		* Wireless modem
		* Wireless modem in van
		* Get someone who knows what to do when it comes to software repairs and not delete everything
		* A direct line of communication from the field staff to the support/repair staff
		* Better printers; more input for local law fields
		* Improve brake adj box - its time-consuming, and also allow (2) out of adj. violations to be OOS
		* Whenever there is a problem w/ASPEN the whole thing shuts down. Other complete programs tell you there was an error then let you correct it and go on (WordPerfect, PC*MILER).
		* Faster PC, less computer freezes
		* Reminder on screen what color and tab to use for CUSA sticker
		* No input
		* Ability to type in fields where only pre-installed info is inadequate
		* Using tab to advance, instead of printer
		* Better printers
		* A better printer that accepts paper without stopping and jamming.
		* None
		* Improve printers
		* Bring back the drop down brake box for level 1"s
PA	Police	* Violations need to be better defined
		* Multiple printer batteries or in-car power converter mount system for hardware; cellular or sat. communications linked with ISS.
		* Veh. Mounting system, longer printer cords, protection from dirt, covers, etc.
		* Transmit info right away
		* Mounting tables for vehicles and a power invertor

* Type fields for DOB, etc. eliminate point & click for these fields, except for brake measurements
* Difficult to conduct post-accident inspections; will not accept violations without codes.
* Our dept. (PSP) could provide some type of equip. to house computer in vehicle.

State	Agency	Most important benefit from using the laptop
PA	DOT/DMV	* Wireless communications to run drivers & registrations
		* The option to manually enter violations without having to go through a general list to a sub list to the actual violation - this makes reports with multiple violations take longer than paper reports.
		* Access to driver's license and registration information
		* Mount for inside vehicle; eliminate some drop down menus, i.e., birth date
		* Glitches in ASPEN, more complete violation list. Better printers
PA	Other	* Have a shading device or a screen which shows up better in sunlight
		* Unknown at this time
PA	Missing	* Remove pop-ups
		* Speed up printing; allow greater data input from keyboard
		* Mounts in vehicle for printer & laptop
		* Be able to print out citations. Run registration & license checks
		* Better Printer
		* Wireless modem; extra printer cartridges
		* Mounts in the car; longer printer cable
		* More reliability with printer; wireless modem to check lic/reg.
		* Several blocks could be typed out; i.e., birth dates, Veh makes, etc. You waste more time spacing down or clicking on fixed screens; after a while it still isn't a "breeze"
		* Remove pop-ups; include warnings, i.e., past arrest/printer
		* Mounting of a more permanent system.
		* None
		* Some type of mount in vehicle
		* Printer able to be connected to car charger
		* Less default
		* In-car mounts, more user friendly printer
		* Non-coded defects for fatal accident investigation/online service
		* More user friendly when screen locks or crashes
		* In-vehicle computer and printer mounts
		* A permanently assigned vehicle with room to set up computer equipment without having to load and unload materials
		* More direct entry of info
		* A mounting system, better computer printer feeder (computer printer)

* Mount system in vehicle
* Computer and printer stands for vehicles

State Agency Most important benefit from using the laptop

* Printer batteries don't last as long as they should.
* Some of the drop down boxes are time-consuming (Driver DOB, OLN Reg, State)
* Ability to receive the timely database info, i.e., changes to high carrier and new carrier
* Make ASPEN more keyboard friendly
* Allow me to type DOB and other simple inputs without the drop boxes
* Allow more manipulation, allow more custom violations to decrease completion time of report itself
* Better printer, same type of mounting
* Remove drop boxes on states and towns include notes to be printed on reports
* Need a vehicle w/ mounts
* A battery adapter for the printer would be nice
* 1. Vehicle mounts 2. Wireless communication
* Allow to punch in DOB directly and state and have pull down , also mounts for computer and battery adapt for printer needed
* Computer mounts better- faster printer
* In-vehicle equipment mount; portable scanner/printer
* Download to AVALANCHE takes several attempts
* For ASPEN to let you type things in instead going to a window. For example brakes, DOB, violation
* Way to mount computer in car when needed
* Car mount system.
* Check boxes; eliminate pop-up screen for dates
* In-vehicle mounting tables - carrier unit w/ ASPEN
* Ability to delete codes to enter crash damage on report
* More reliable printer
* How to enter CVSA decals
* In-vehicle computer mount
* Provide a backup battery supply (i.e., extra battery) to printer
* Be able to type in carrier name too
* None
* Correct lockup problems
* Printer difficulty in feeding
* Vehicle I.D. number assist
* Issue mounts for computer and printer
* Work out software bugs (shutdowns, etc.) before putting in field
* Have a place to mount computer and printer in car
* Permanent mounting! Get rid of touch screen format
* Portable in-vehicle computer mount

State	Agency	Most important benefit from using the laptop
		* Easier download
		* ID high-risk carriers
		* Permit manual entering of DOB instead of drop-down box
		* Violation block- for local rules- turnpike-m instead of scan codes
		* I would have a full diagram of acdmm. Vehicle with parts and proper names for said parts
		* Good word processor program
		* Bad location for on/off switch on computer
		* Some type of mount system for the car. Computer/printer
		* None
		* Do away w/ pop-ups completely; make window size stable
		* Mandatory DOT #'s for CMVs; better printers with some kind of set-up for total package
		* Additional training, more scheduled time for MCSAP
		* Modem connection with SAFER system
		* Mount for vehicle, better printer
		* We need removable mounts for computer/printers for switching vehicles, 12 volt operation for computer and printer
		and get rid of "prompted" windows. "Prompted" windows slow process down; better to type all info
		* Having the ability to enter a carrier's name and come up with a carrier profile
		* Add an easy and reliable backup system so we would not have to retain paper copies
RI	Police	* To be able to actually put the violations in the way they are written in the general law
		* Some fields should be able to be entered (not pulled)
		* When advised of problems, ASPEN should be upgraded; I've been telling of the same problems for almost 3 years
		* Windows type system
RI	DOT/DMV	* Violation codes in ASPEN
		* Include more violation codes
RI	Other	* Better screens; areas for the road inspector to customize for violations

Q46. Do you have any other comments, concerns, or input that your would like to add?

State	Agency	Other comments, concerns, or input
CT	Police	* Get rid of PIQ passwords * Need the ISS with refresh capability now * Screen display glare * Develop a screen which increases visibility in strong sunlight * Non-glare touch screens are absolutely terrible in sunlight - replace them with readable touch screens * Touch screens visibility doesn't work if screen gets too warm; tab to enter info.; ability to increase volume level to hear voice activation * Should not be able to get out of level 1 inspection without entering the brake measurements.
CT	DOT/DMV	* Screen display glare * Screen visibility, i.e., sun light, glare, etc. * Screen visibility (sunlight) * Codes should more directly reflect regulation * Better screens * Backlit keyboard for night time use
CT	Other	* Should not be allowed to exit from level 1 inspection without completing brake adjustments
CT	Missing	* Touch screens need something done with the sun glare * Touch screens are extremely difficult to read due to glare
MA	Police	* Out-of-service for multi-brake adjustment violations (only allows one) * Warrants issued on non-compliant companies * Need modem
MA	DOT/DMV	* This is more of an adm/clerk benefit to save time than road trooper's time saver. More man hours are lost on trips to the HQ for computer repairs/supplies than is necessary. As for management tool, it is not good. No sheets to review only end of month reports. * Like the touch screen/dislike pop-up keyboards - they take too much time for states, birth dates, CVSA decal input

MA	Other	* Laptop has increased time spent trying to do inspections
MA	Missing	* Use windows format, design software for less crashes

State	Agency	Improvement recommended to the system
MD	Police	* Training on ASPEN, laptops, computers, et. al, needed badly with yearly refreshers, updates
		* ASPEN locks you out if the CVSA decal number is not entered just right - a major bug that has not yet been fixed
		* I think ASPEN is not practical for inspections
		* Enable close interface on location to reduce time loss
MD	DOT/DMV	* Progress
		* A screen that would or could print warning or zeroes
		* The system is way too cumbersome and impractical to operate in a vehicle. At a scale house, it takes 3 people to conduct an inspection in a reasonable amount of time
MD	Other	* Use paper inspections - it is much more efficient
MD	Missing	* Allow PIQ's for more than 45 days
		* Using the computer is a more official document
		* Moving set up still has not occurred
		* Using a shield that will allow the laptop to be used outside in direct sunlight
		* Give us some training
		* The ASPEN program takes too much time, the preferred method is handwritten
		* Use a tab key for every selection or arrow keys
		* ISS reports print too many copies in order to carry over 1 or 2 bits of data
		* ISS needs to be updated more often
		* 3rd generation and still same problems (pen base laptop PC) with the ASPEN program
		* The Dell Latitude laptop has been the best P/C so far
		* This system is the best system so far
		* Need more professional training
		* Yes-portable printers are not good
NY	Police	* Add "tagable" to brake choices box
		* Do away with daily "quotas" (insp. per day) let all inspections through due to time requirements; 4 to 5 insp. per day is very reasonable if you want good inspections on constant basis
		* The printer I am using is very unreliable
		* No
		* Faster printers

* Let each region set up computer and modem service to suit their own specific area

State	Agency	Most important benefit from using the laptop
		* I do like using the computer and its software for doing truck inspections. It's not easier for me, but it offers a much more accurate and timely reporting system, thus improving safety
NY	DOT/DMV	* I feel CDLIS is very important and should be in working order and updated
		* Do away with policy of putting in brake measurements when there are no violations
NY	Other	* Before setting everyone up and spending the funds on the equipment, use a test team or use different situations and locations
NY	Missing	* We tried in the past to add good information to the program, but ASPEN people put poor programs that didn't work and took no info
		* Purchase quality equipment, not the latest fad or the cheapest stuff. It would be nice if ASPEN would correct some of the faults we have reported to them
		* Too many people to talk to about your computer problems. You should only talk to the person that's going to fix them
		* Need supplies and repairs
		* It would help if vehicles were set up properly with communications and maintenance for computer and printer and hook-ups
		* No
		* My computer knowledge is very limited; I'm still learning the basics and haven't realized the full benefit of the computer/ASPEN system
		* No
		* Overall a good program
		* Need a more reliable computer
		* ASPEN/WIN 95 combination is a little buggy and often crashes when the screen saver comes on or the laptop suspends power. Other than that it's great
		* No
		* Direct communication line to the field
		* Voice activated software is out there and it works. More money for inspection upgrades
		* You should have better outfield people making up inspection program. Get some of the actual inspectors input like us !!!

* More reliable computers
* Need better printer and printer mount
* ASPEN is either working or down- no in between. Take 100 random inspections and have programmer enter them and he will know immediately where it could be made better. If user makes a mistake in ASPEN program, there is no way to recover; it all goes down
* None

State	Agency	Most important benefit from using the laptop
		* No
		* None
		* Efficiency of computer system
		* Computer is "down" too much. Work on improving efficiency
		* Sites could be improved upon with errors that are gated off and used on for inspections
		* No
		* Too much time down or busy when trying to connect
PA	Police	* Have companies listed in ISS or PIQ that are known for drug trafficking
		* Corrections to report/survey were made by this R.O.
		* Very good system
		* Given expensive equipment, but nothing to secure it in a usable fashion.
		* Printer goes dead really fast/power inverters would stop this!
		* Biggest problem- printing ask for 3 copies get 2 etc. causes laptop to lock up.
PA	DOT/DMV	* If all inspectors could be full-time and have their own vehicles, more time could be spent on inspection, and it would make our jobs better. (More inspections would be done.)
		* Overall a good system. Reports appear very professional. PC*MILER has been helpful in catching false logs due to drivers “shaving” hours on trips.
		* A program is needed to calculate log book hours.
		* Would like to have stand in car, plus a power pack for computer and printer
		* ASPEN worthy program, resolve minor glitches
PA	Other	* The laptop is great and used for other job-related reports
PA	Missing	* Should have a work station do wires & computers. A lot of time there are two men to a unit
		* Problems with CVSA
		* DC power adapter for printer
		* Improve violation list add 396.5 leaks-172.107? training MSDS/Guide book
		* Printer setup is poor, good quality when it prints- average of 1 error per job. Requires cancel job and try to reprint (i.e., "print drivers corrupted error With LPT1 port).
		* The computer has a keyboard for a reason. The keys are easier to use than relying solely on the mouse button. Screen saver for ASPEN would help

* No
* We need a better way to mount laptop in car
* No

State Agency Most important benefit from using the laptop

* Allow for accurate "carrier snapshot" in real-time (meaning in-car modem with access to current info)
* Include in-vehicle mounting for laptop & printer
* Due to infrequent use as part-time inspector, it is difficult to maintain proficiency in use of laptop
* A MLSAP vehicle set up to do MLSAP inspections
* No
* Back up batteries needed
* A DC adapter for portable would be helpful
* The computer is also used for patrol reports. It has made all my reports more professional, ESP, MLSAP
* I think it is a great system, I'm still learning the system but so far- very pleased
* Very useful equipment MLSAP has come along way!
* No
* The use of the computers for reporting is a positive step toward the future and the management of the data
contained within them
* No
* My laptop is the best thing since the invention of sliced bread
* I enjoy all the benefits that the laptop has given me
* I enjoy using the ASPEN program
* Our own cars, so equipment could be permanently fixed
* Approx. first 20 inspections will take longer than normal, but it will be safe.
* More problems being noted w/ newer software versions
* Fix AVALANCHE; it's either busy or doesn't work properly
* Initially the computer is a little slower method of reporting, but I feel the speed will increase with time. Overall
the computer is excellent
* Make the block consistent; either enter at block or enter a separate window, not either or at different blocks
* Printer in car is a royal pain to set up; cord too short
* I don't feel it's right for PA to require its inspectors to conduct 72 level 1 inspections. If you do not do
inspections on a full-time basis, it is hard to get 72 level 1's in. A lot of time you rush through an inspection
just to get a level 1 in
* None
* Do not have any modules available at this time. Would be nice to not have to reboot when changing default
printers, I use a variety and always change the boot use as pen and port printer
* More/better one-on-one computer training
* None at this time
* Mounts needed badly – too much fumbling around and awkward in patrol cars, or get us office trailers (heated)

		* Having a laptop computer is a great asset to inspectors conducting driver/vehicle inspections
RI	Police	* No, just improve upon the system so that the system is not constantly freezing

APPENDIX B:

QUALITATIVE RESEARCH REPORT: ELECTRONIC COMMERCIAL VEHICLE INSPECTION SYSTEMS

CJI RESEARCH

CORPORATION

Qualitative Research Report: Electronic Commercial Vehicle Inspection Systems

Focus Groups and Interviews with Commercial Vehicle Inspectors Concerning ASPEN, ISS, and SAFER in Connecticut, Maryland, New York, Massachusetts, Pennsylvania, and Rhode Island

Author: Hugh M. Clark

September 23, 1999

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Executive Summary

Inspectors in six states (Maryland, Connecticut, New York, Pennsylvania, Rhode Island, and Massachusetts, in order in which the sessions were conducted) were interviewed in small groups, or in a few cases individually. More than fifty inspectors participated. The interviews were qualitative. Where practical they were recorded and transcribed. All interviews were conducted by the author.

The utilization of ASPEN, SAFER and associated systems varies widely depending upon the computer equipment, the wireless equipment, and the scope of authority available to the inspectors. These in turn vary among the states because of various factors including the agency in charge, and the size and heterogeneity of the states.

Inspectors in all six states studied at the time of this interim report admit to having been apprehensive and somewhat resistant as the systems were introduced. However, with very few exceptions they now appear to be enthusiastic supporters. The often expressed mantra in Connecticut (where inspectors are armed, sworn officers) is even “You can take away my gun before I’ll let you take away my laptop!” When the inspectors were asked if they preferred paper, they all said, “no.” When asked about improvements they would like, only one inspector suggested reversion to any form of paper forms. Others suggested only improvements and extensions of the existing electronics, not reversion to paper systems.

Asked about primary advantages of the computerized information systems, the most frequently cited advantages were legibility and speed, not improved ability to clamp down on repeat offenders. The mention of speed refers to the speed of completing the paperwork, not the total turnaround time of the inspection. Program administrators see related advantages in that they rarely have to be concerned with data entry costs or errors (now a concern only when computer systems are down and the inspectors revert to paper). Given the near elimination of the data entry process, the total turnaround time for a series of inspections is shortened from the administrator’s viewpoint, though any given inspection may or may not be shortened.

The inspectors tend to feel that when the system is fully in place interstate and all units are wireless that there will be a noticeable effect on repeat offenders. Some inspectors see such an effect even now, but this is not the effect they tend to mention as the primary advantage of these systems.

It is true, of course, that in choosing respondents to participate in a focus group setting, administrators of the program influence the choice of respondents. It is therefore possible that the some of the group interviews reflect a somewhat more favorable viewpoint than a random sample would. However, among approximately fifty inspectors interviewed, it did not appear that they had been selected due to known bias in favor of the systems being studied. Many were openly critical of various details management decisions, though (with one exception) not of the “big picture” decision to go with the ASPEN system. Moreover, at active inspection sites, the author approached any inspector on-duty and spoke with many of them individually. In all there was no sense on the part of the facilitator (and author of this report) that the groups had a major bias.

Preface

In this report we discuss five topics, all from the point of view of the inspectors who were interviewed:

- Differences between and within states in adoption of these systems.
- Similarities among states in use of these systems
- Advantages and disadvantages as perceived by the inspectors using the systems
- Suggested changes in the systems
- Suggested topics for including in quantitative research to follow.

In arranging for the interviews and focus groups, the state authorities in each of the three states, and the agencies involved with the programs, were extraordinarily helpful. They not only arranged for appropriate meetings, but even brought the author to the several sites in question, providing needed introductions and expediting at each location, and in general going more than the proverbial extra mile to be cooperative and helpful.

Inspectors themselves spoke frankly and freely, providing a rather complete description of their use of these systems.

The author appreciates the effort they all expended for this project.

Introduction

The purpose of this report is to present qualitative information from commercial vehicle inspectors on their experiences with and attitudes toward SAFER and associated systems, prior to the development of a quantitative survey instrument for further evaluation. Six states are included. They represent a range of states at quite different levels of system adoption. They are, in order by the timing of the author's visit:

Maryland: Early in the adoption process with very incomplete adoption. Combination of paper and electronic reporting used. Wireless units due to arrive soon for one inspector in one agency. Other inspectors using only local data and occasional SAFER updates. SAFER, including PIQ, available, but only from separate desktops machines.

New York: All have laptops. Experienced with the systems, but only midway in statewide adoption for various reasons probably related to the sheer complexity and size of the state as well as the lack of CDPD coverage in large portions of the state. Wireless system had been tried but was an unsuccessful analog system. Current use is in general reliant on local data housed in the laptops because inspections are mobile and no hard wire contacts exist at inspection sites.

Connecticut: Advanced in utilization. All inspectors utilize impact resistant laptops with wireless connections at both fixed sites and for mobile stops. Many inspections conducted at fixed sites. Union Scale is the most sophisticated site with the greatest capacity to use SAFER to its full potential from screening through upload.

Pennsylvania: Statewide adoption. Laptops for each vehicle. No wireless at the time of the study. Uploads accomplished at home or barracks on land lines, and ISS updates by CD Rom distribution. Mounts for laptops are not provided and success at anchoring varies among vehicles. This is a problem because of the system used which is for the most part chase and stop, a method that requires some physical stability for the computer and printer.

Rhode Island: State police weight detail is only one handling inspections. All nine inspectors have wireless connections. Mobile sites are used where all trucks entering are weighed on portable scales. Most inspections are "chase." Density of state highways and small number of inspectors means that they feel they have more of a problem with violators diverting to other routes to escape inspection. SAFER uploads are done wireless.

Massachusetts: All have laptops. Cars and pick-ups used as their vehicles lack uniform mounts. No wireless yet. Mobile sites and chase used for inspections. Not all trucks are weighed. One team screens trucks visually for obvious faults, weighs only some of them (portable scales), and chooses some of those weighed for inspection by others. ISS is not used in screening. SAFER updates done from home.

The several levels of adoption and several differing geographies offer the opportunity to observe the attitudes of inspectors using the systems under varied conditions.

Acceptance and invention

At this stage in the adoption of these systems, the inspectors tend to be highly accepting of them and are looking forward to further refinements. Most inspectors initially resisted the change from paper to electronic reporting simply because they lacked experience. However, they now tend, with a few exceptions, to speak highly of the electronic systems and to rely on them.

One interesting commentary on their acceptance is the inventive remedies of several inspectors for specific problems they were having. Early on, a few inspectors trained themselves well enough that they could customize their location codes and other codes. Others developed mounts such as the plywood mount discussed elsewhere. Another office devised a long velcro strap that goes around the seat to firmly anchor his laptop. Another replaced a lost $39 touch-screen stylus with free wooden chopsticks from a local restaurant (all of the officers in his Massachusetts unit now have pair of chopsticks in their cruisers). Another office at his own expense had tint added to the glass in his pickup truck to make it possible to see the screen, while another devised a box to shadow the screen.

These adaptations of the system to the working environment are important indicators of acceptance. They also provide clues to several operational needs for mounts, inexpensive back-up stylus, and glare prevention.

Method

Most inspectors were interviewed in one of two settings - individually or in small focus groups. The method used was determined by the practicalities of conducting qualitative interviews without disrupting the work of the inspectors.

In Connecticut we spoke with central office personnel briefly to understand the way in which they provide support for the advanced systems they use. We then were provided a ride-along on a truck inspection, then taken to two inspection sites with contrasting characteristics, Middletown Scale and Union Scale. As their names imply, both are weigh stations as well as inspection sites. Middletown Scale is older and much less well equipped and automated. It has a single scale trucks pull across. Because the truck must stop to be weighed, the inspectors can look at them fairly carefully before selecting one for inspection. However, the ramp leading into the scale quickly fills with trucks which then begin to be backed up out into the travel lanes of the freeway, creating a dangerous situation. Consequently, when this occurs, the inspectors will rush trucks through without weighing them, or temporarily close the scale. This obviously limits the inspectors' ability to sample trucks as they would like.

At Connecticut's Union Scale the situation is quite different. There the facility has dual scales, including one weigh-in-motion scale. It also has a long approach. Thus, the trucks tend not to back up into the highway. Even if they did, the inspectors have a remotely controlled sign to direct trucks to the scales, so they can turn the flow on and off at will and do not have to rush a high volume of trucks through simply to maintain a safe traffic situation. This is a newer, more elaborate facility than Middletown, designed in a later era than Middletown when truck traffic had reached a much greater volume. The offices are larger and more suited to the computerization of records than the small observation area at Middletown Scale.

At Union Scale we spoke in a group format to all five inspectors on duty for that shift just as they reported for work. At Middletown, the observation area is so small there was no space for a group discussion. Instead, we spoke individually with five inspectors and spoke at length with the officer in charge of inspections in Eastern Connecticut.

In Maryland, one of the groups was conducted with four civilian inspectors and one sworn officer at the southbound weigh station of I95 at Perrysville, MD. These inspectors are from the Maryland Transportation Authority, part of the Maryland Department of Transportation (MDOT).

The other group was conducted in Linthicum Heights, the state headquarters of the Maryland State Police division in charge of commercial vehicle inspection. Four civilian inspectors of the state police participated as did their administrative coordinator of the SAFER program. One inspector from the Maryland Department of the Environment (MDE) also joined the discussion. Although he is employed by MDE, his inspection criteria are the same as those of the others. He has no special mandate to inspect for emissions, for example. He did say, however, that he may place slightly more emphasis on HAZMATs.

In New York, inspections are primarily mobile and occur in rest areas. The original plan was to visit two such sites. However, only one site was available on the observation day. The Director of Safety Program Evaluation accompanied the author to the site and provided a great deal of information about the New York program. The site itself was being operated by two state police officers and two NYDOT commercial vehicle inspectors. We spoke individually and at length to one state police inspector, and one NYDOT inspector, and observed their vehicles and data processing arrangements. Though this is an extremely small source of data for a complex state, it appears to represent a fairly common set of experiences. The primary element that was missed was the more advanced utilization of ASPEN, ISS, and SAFER in Long Island and in Westchester County.

In Pennsylvania, a training an update conference was being conducted in Harrisburg, a fact which meant that many inspectors would be gathering in one place and available for focus groups in an ideal hotel setting. This made it possible to interview 18 officers in focus group settings, and to record and transcribe the groups.

In Rhode Island and Massachusetts, all interviewing was individual at inspection sites with state police inspectors. Lead officers in both states arranged the location of sites that would be conveniently observed. Thus it was possible to observe Rhode island in the morning and Massachusetts in the afternoon.

Findings

How levels of deployment and related factors vary among states

One challenge in evaluating the effects of ASPEN, ISS, SAFER and related systems on commercial vehicle inspections is that their use varies with both individual characteristics of the inspectors, and with characteristics of the administrative systems in which they operate. The system variables include several factors:

- the nature of the administration implementing the system
- support services provided and how they are organized
- the breadth of authority wielded by inspectors in a given state or within a given agency within a given state which varies with agency missions and objectives
- the sites at which inspections are conducted (chase vs stationary, stationary-mobile vs stationary fixed)
- the type and configuration of the electronic equipment used, including both computing and wireless systems
- the physical characteristics of the vehicles and the mounts used for the laptops and printers
- the size and geographic complexity of the state.

Administration. Most of the states all assign inspection duties to more than one agency. In Rhode Island and Massachusetts the function is handled only by the state police. In Maryland the situation is most complex. Inspection responsibilities there are assigned to at least the three agencies included in the interviews, the state police, Maryland Transportation Authority, and the Maryland Department of the Environment. The lead agency in the ASPEN and SAFER programs is the state police. New York assigns responsibility to NYDOT and the New York State Police, both of which were interviewed. NYDOT is the lead agency. In Connecticut primary responsibility lies with DMV, though the state police also perform inspections. In Connecticut only representatives of the Connecticut DMV were interviewed.

Technical support functions. One difference among these states which may be important to their rate of successful adoption of the electronic systems is the technical support function. Asked what determined the relative success of Connecticut in adoption of these systems, both the Connecticut and New York respondents indicated they felt that the ability of Connecticut to assign a staff person full time to the process of technical maintenance and support of these systems was one important factor. Connecticut respondents also felt that the fact that the person in that technical support position had started his career as an inspector also made a significant difference to his success.

Massachusetts officers said they attributed much the program's success to one staff person who answers all of their questions and operating problems. As in Connecticut, they have a clearly designated person for technical assistance and they find him accessible.

New York has formal technical support, but it is shared with other DOT computer support functions. Other states use much less formal support systems, relying usually on the administrator or other program staff to provide the expertise needed.

Most inspectors lack previous experience with computer use, and receive scant training in handling Windows. Consequently minor events or procedures sometimes require consultation with more experienced users. Events such as system freezes in the midst of an inspection, or routines such as accessing a second program when the first is open,[1] become more serious if there is no central reference point to turn to.

Scope of authority. Inspectors' use of the several programs and databases associated with commercial vehicle safety inspections varies somewhat with the scope of their jurisdiction. Thus, for example, inspectors of the Maryland Transportation Authority are not sworn law officers, and thus the Transportation Authority inspectors we spoke with say they do not use CDLIS in conjunction with their vehicle inspections. On the other hand, inspectors in Connecticut's Department of Motor Vehicles are officers with full police powers in situations originating with a traffic or inspection stop. They regularly use CDLIS during an inspection.

The scope of authority relates not only to the way they use the software, but also to the way the agencies work together. For example, in New York, inspectors work in teams of NYDOT personnel and state police inspectors. The latter are intended to control traffic flow and issue citations as well as conducting inspections. Thus there is inter-agency teaming. In Maryland the process is similar, with inspectors relying on their sworn counterparts in the police force to handle enforcement of driver violations. In Connecticut, since all inspectors are sworn officers, they individually handle all aspects of the inspection and, if appropriate, ticketing. The same is true of Rhode Island, Massachusetts, and Pennsylvania.

Thus the extent of system use, and the extent to which it is helpful to the inspector, depend in part on the scope of authority of the inspector.

Intra-state differences. New York is substantially larger and more geographically differentiated internally than the other states except Pennsylvania. It has a Canadian border; it has greater differences between urban and rural areas; it has many large cities. In all these respects, its size makes it different from the other states. New York is therefore faced with somewhat different challenges related to adoption of electronic systems in general and SAFER in particular. For example, its northern border with Canada means that information related to provincial addresses is more important there than in Connecticut or Maryland. Its large cities result in greater statewide complexity of routes and commercial traffic as well as a wider diversity of local/regional trucking companies. Its

[1] This lack of Windows training may result from lack of resources, understanding of the need, or from ambivalence. One administrator commented that he felt that anything more than very rudimentary training in Windows would cause the inspectors to attempt too much customization, would spoil the uniformity of the program, and would tend to do more damage than good in terms of keeping the software running properly.

large geographic area also means that a very large number of inspectors use the systems. Additionally, a significant percent of the carriers in the state operate on an intrastate basis only and are not contained in the USDOT ISS data base.

Perhaps most important for SAFER in the short run is the sheer size of New York and its complex communications markets which cause difficulty for NYDOT in obtaining wireless commercial digital coverage which would effectively cover the entire state. This problem with digital coverage in New York is said to be a primary reason that it has not yet developed the wireless components of the systems. Analog service is available and was used briefly. However, we were told that lack of coverage, high expense, and other problems caused administrators to drop the analog system. “Other” problems were said to have included interference from radio transmissions of the New York State Police radios at each inspection site which caused static in the analog signal. Moreover, the analog service from Bell Atlantic was said to be highly expensive.

The DOT administrator in charge of the development and support of the systems says that in Westchester County and Long Island several vans are fully equipped with digital wireless connections through CDPD, and have furnishings which make their use quite efficient. The fact that CDPD service is not available statewide and that the analog service is unacceptable prohibits expansion of the wireless service until a digital system is available statewide. Consequently, most New York inspectors cannot use the PIQ system, make daily updates to SAFER, use CDLIS, or update their own ISS files. To address this concern, New York is using a grant from FMCSA to explore the benefits of Code Division Multiple Access (CDMA) telecommunications in Upstate New York, which is showing promise.

Massachusetts, although geographically less sprawling than New York or Pennsylvania, at the time of this report had no wireless system in place for the SAFER system. In the opinion of the officer in charge it is unlikely to have a system in the near future which successfully blankets the western part of the state, in part because of the terrain.

Connecticut has an advantage in this respect in that it is smaller and less complex, and wireless coverage is more complete -- though occasionally spotty in the eastern part of the state inspectors say. Maryland did not yet use wireless connections at the time of the interviews, and coverage was not an issue. (One system was due to be installed in the vehicle used by the Department of Environment inspector.)

Similarly, Rhode Island, compact as it is, is fully covered by wireless service.

The relative geographic complexity of New York also may be the reason inspectors there were more concerned about customization of jurisdictional fields in ASPEN. Inspectors encounter a great variety of jurisdictions as they move from inspection site to inspection site throughout New York. Inspectors say that local jurisdictions can be custom-entered in ASPEN so that the jurisdiction can be called up in a given field as the inspector completes an inspection form in ASPEN. The customization process, they say, is laborious but worthwhile. However, the inspectors we spoke with also complained that after such customization the process of updating to new versions of ASPEN overwrote such modifications, causing them to go through the same customization process again.

While the inspectors in New York were first to voice the concern because of the complexity of the state's geography, they were not alone in their concern. The problem was also mentioned in Massachusetts and Pennsylvania.

It is the more sophisticated users of ASPEN who are aware of this problem and complain about it. Therefore the author considers it likely that as inspectors in all the states become more and more familiar and confident with computer software, skilled at using it and adept at customizing their systems, the tendency to customize various field in ASPEN will increase. Consequently, the demand to carry forward these kinds of customizations is likely to increase.

<u>Inspection sites.</u> The sites and circumstances under which inspections are conducted vary widely. Among the sites visited, for example, Connecticut's Union Scale represents the high tech, high capital investment end of the continuum (Figure B-1), and the New York Glens Falls roadside rest area stop the low end in both respects. While all sites utilize inspector experience and observation to select trucks to inspect, the Union Scale site includes a systematic screening mechanism to select trucks for inspection. Vehicles are first pre-screened for further inspection at a weigh-in-motion (WIM) scale. The pre-screening is based on such variables as operating weight, excessive speed over the weigh-in-motion scales, apparent driver avoidance of the scales by half-straddeling, and an automated random selection process coupled with electronic signs directing drivers to a state scale queue or back to the highway. The vehicles selected in the pre-screening for a closer inspection are diverted by an automated signal onto a turn-back loop which brings them to a fixed scale where they are weighed more precisely than at the WIM scale. The stop also affords the inspectors an opportunity to examine the truck for inspection both visually and through ISS.

Figure B-1: Inspection shelter at Union Scale, Connecticut

In New York, at the Glens Falls site, in contrast, there is only a parking lot at a rest area with inadequate signage directing trucks through the site (Figure B-2). There is no weighing mechanism. A crew of

Figure B-2: An inspection site at Glens Falls, New York, showing a State Police cruiser and a NYDOT van, each parked next to the trucks being inspected. The vehicles are in effect mobile offices.

inspectors selects trucks by sight, seeking obvious violations, or, in the inspectors' more descriptive jargon, "a ragged truck." Not finding such a truck, they select one more or less randomly as they complete one inspection and are ready for the next. New York is undertaking an extensive program to upgrade many of its rest areas to facilitate safety inspections and expand commercial parking. For example, the I-87 Clifton Park rest area, 30 miles south of the Glens Falls rest area, was recently rebuilt. Electronic mainline signing now directs trucks into the site for inspections when in use. Lighting and electrical power for night- time inspection were also included as was office space for state police and NYSDOT safety inspection sites. Similar improvements are being incorporated into other sites as they are being upgraded.

One variant among sites is their ability to operate in adverse conditions. At most sites, inspections are limited by weather. An inspector performs varied numbers of inspections during a shift, depending on the proportion of Level One, Two, and Three inspections conducted. This will vary with several factors including the weather. In all the states studied most sites are not sheltered. In rain or in significant snow they cannot properly conduct a level one inspection, they say, because they cannot see well enough or determine whether water dripping from the rig represents rainwater or a cargo problem or mechanical violation. Moreover, they must use crawlers to get beneath trucks. Snow or rain obviously makes this difficult, slow and unpleasant. On rainy days, say inspectors, they do almost entirely level three inspections.

Similarly, in New York, with inspections occurring at rest areas, night hours make adequate conduct of level one inspections difficult simply because of lighting conditions. However in some cases, such as Union Scale, sheltered and lighted level one inspection facilities exist (Figure B-1) which should enable inspectors to provide more consistent ratios of inspections at all levels regardless of weather.

Middletown Scale, Connecticut (Figure B-3) and the Maryland scales at the I-95 southbound weigh station of I-95 at Perrysville represent more typical sites. There, lines of trucks file through the sites, crossing a single scale. A slowdown in the flow of trucks through the site can cause a dangerous backup of vehicles onto the highway itself. Consequently, there is pressure to maintain a rapid flow of vehicles, and lengthy selection processes -- more than a few seconds -- are not feasible. Trucks are selected by appearance of obvious violations and by random selection.

Figure B-3: Trucks lined up (left) to cross scale at Middletown Scale, Connecticut. Trucks at right will be inspected.

In Pennsylvania, Massachusetts, and Rhode island, most inspections are conducted by stopping trucks in motion rather than at weigh sites. However, sites are also set up in those states at locations which are rotated so that truckers find it difficult to predict and avoid the inspection sites. Figures B-4 and B-5 show sites in Massachusetts and Rhode Island. Both use mobile scales. In Rhode Island, every truck entering the site is weighed. In Massachusetts, trucks are visually inspected as they enter the site, and only those which appear to pose potential weight problems are inspected.

Figure B-4: Massachusetts State Troopers decide to weigh a truck entering a mobile site at a rest area in southwestern Massachusetts

The photograph of the Connecticut Union Scale site in a later section of this report shows the contrast between these *ad-hoc* sites and a high-tech fixed alternative. Certain aspects of the ASPEN system are more easily applied at a fixed site. However, states that use mobile sites do so to reduce the number of truckers who know to alter their routes to avoid fixed sites.

Figure B-5: State Police in Rhode island guide a truck over portable scales at a temporary inspection area

__Vehicles and computer mounts used by inspectors.__ The use of rest areas as locations for inspections in most of the states means that the inspectors' vehicles become their offices not only when they are making stops in motion, but also when they are working a full shift in one place (Figure B-6). Thus the nature of the vehicle and how usable the equipment is in the close and mobile environment of the vehicle is a significant issue.

Figure B-6: Like the sites in New York, Massachusetts sites tend to be rest areas without office facilities. These trucks await inspection.

Each state has a variety of vehicles as well as varied facilities for inspectors' use. In Maryland, Transportation Authority Inspectors often operate at fixed sites. Those we observed did not use police cruisers, but worked from an office at a weigh station. However, some Maryland State Police officers and Department of Environment inspectors involved with the program do use cruisers with laptops mounted.

New York assigns one van to a team of two NYDOT inspectors as described earlier. All NYSDOT inspectors have laptop computers to record safety inspection results. New York also assigns a laptop to the cruiser used by each state police officer who also works as an inspector. The laptops are generally placed on the seats for use. Some vans, the author was told, have shelving which serves as a mount and as a mobile office.

Connecticut assigns a cruiser with a wireless-equipped laptop to each individual Department of Motor Vehicles inspector. Even at fixed sites, the inspectors use these cruisers as mobile offices, parking them next to the trucks they are inspecting. The Connecticut Department of Motor Vehicles also provides, under subcontract, laptops and support to some state police officers who also are trained commercial vehicle inspectors. The cars are uniform, and all laptops (and printers) are mounted in fixed positions easily accessed by the inspector.

Pennsylvania uses Jeep Cherokees. Some officers complained that the Jeep lacked the power they needed, and that the laptop was very difficult to handle in the Jeep since they were not provided with mounts, and their typical stop involved a chase. One officer had constructed a plywood board he fixed to the seat with bungee cords so that the laptop (fixed to the board) could remain open and booted up.

Massachusetts uses a variety of vehicles, most often pickup trucks (Figure B-7). Rhode Island uses a variety of vehicles including Ford Broncos, a station wagon, and sedan cruisers. The variety of vehicles used means that it is difficult to mount the laptops in a standard way or to use standard hardware.

Figure B-7: Three vehicles uses in Massachusetts. Airstream mobile office. Trooper's pickup, and trooper's sedan cruiser.

Although they do not determine the success or failure of the ASPEN/SAFER program, computer mounts in the vehicles are an important issue because they affect the ease of use. The ability to mount the device varies with the transmission hump and with the police equipment console over it in a vehicle. It also varies with the type of vehicle. Obviously it is easier for a department to use uniform mounts, but this requires uniform vehicles.

Even when vehicles are fairly uniform, the equipment consoles may vary and mounts may or may not be provided (Figure B-8). In part this is simply a matter of the pace of acquisition and installation. It does not appear to be a matter of inspector preference, however. All of the inspectors we spoke with about the mounts preferred a fixed mount, especially if many of their inspections involved stopping trucks while moving.

Figure B-8 A typical mount in a trooper's cruiser in Massachusetts

Computer equipment used. Although all the states studied use laptop computers, the specific hardware varies considerably from state to state. In Maryland, at the time of the study, for example, the system appears to be less mobile than in New York or Connecticut. The inspectors in Maryland who work at fixed sites told us that they have been issued laptop computers (though fewer than one per inspector) but that they use them in their office or "shed" and do not carry them to the vehicle they are inspecting. Asked why they do not carry the laptop computers to the truck being inspected, they cite as one reason, the danger of dropping the machine and damaging it. Seeing the screen in daylight is also a problem. There are no wireless connections. Lap and desktop computers can be used with dial-up modems. However, not all inspectors have passwords and not all computers can be used to access off site databases. At one interviewing site (Weigh station at I95 in Perrysville, MD), the inspectors use their computers, and save the reports to disks, which the police sergeant in charge of the shift uploads to SAFER occasionally.

In Connecticut, each inspector is issued a laptop which is damage resistant – a feature displayed by local staff who unceremoniously threw one several feet across an office onto a concrete floor without damaging it. However, their laptops are also mounted on fixed platforms in their cruisers. Officers return to their cars to use them not because of fear of damage but because of better lighting, the desire to sit down to work, and the ability to simultaneously use the cruiser's radio. Also the laptop is connected to a printer also mounted in the vehicle.

In New York inspectors we interviewed work in pairs from a van – one van, two inspectors. Some of the newer vans have tables set up in them so that the atmosphere is like a mobile office. The van we saw at Glens Falls, however, was devoid of furnishings. The somewhat battered laptop was simply sitting unmounted on the passenger seat for use while standing outside of the truck. A bubble-jet printer sat on the interior van engine hood.

In Pennsylvania, Massachusetts and Rhode Island, hardened laptops are used (Figure B-9). The variability among them is in the mounting of the computers and in the use (RI) or non-use (MA and PA) of wireless communications at the time of the study.

Printers. Printers are an integral part of the electronic process. For mobile printing five of the states use bubble jets, generally portable Cannon BJ80s, while Connecticut uses dot matrix impact printers. Connecticut administrators say that the dot matrix printers are cheaper to operate since ink costs are high, and that by using multi-part NCR paper, they print once for several copies. The New York administrator feels that the bubble jets are less likely to have paper jams, are faster and more compact. Printer problems were not a major concern for the inspectors, although the printer adds one more element to the challenge of organizing the machinery, wires, and cables in the vehicles.

Figure B-9: An unmounted laptop in a trooper's cruiser in Massachusetts

Using ASPEN, SAFER, and related systems. While all of the inspectors use a core of services related to ASPEN, ISS, and SAFER, their use of these and related systems is not at all uniform. Any evaluation questionnaire should take into account that the inspectors in different states, within states in different organizations, and even in different parts of a state, define the functions of their laptops differently. All inspectors interviewed use a core of services consisting of accessing ISS information for every inspection, and completing forms in ASPEN. All receive updates of their ISS files from SAFER. How they use ASPEN and whether they use related programs, however, varies widely.

For example, in Connecticut, all inspectors say they run a PIQ on every inspection, while in Maryland they run such checks sporadically since they must be run from a separate computer physically distant from the laptops on which they use ASPEN. In New York the PIQs are not used at all in the systems observed during interviews since inspections are not conducted at fixed sites with dial-up connections and few mobile units are modem-equipped. (PIQ's may be used at those few New York locations in Westchester County and Long Island at which inspectors use fully wireless units.)

Similarly, CDLIS and PC Miler are used by some inspectors and not by others for various reasons having to do with the type of authority the inspector has (thus the need to use CDLIS) or with the mundane matter of knowing how to access PC Miler from within Windows while ASPEN is running.

UPLOADING TO SAFER. Another difference lies in the SAFER uploading process. For example, Connecticut inspectors upload to SAFER at least daily. Some Connecticut inspectors say they upload each inspection to SAFER immediately after each inspection. Since all are using wireless units, the process is simple and convenient for them. Rhode Island inspectors also upload frequently and for the same reason. Massachusetts inspectors say they update SAFER from home "...because the barracks are always too crowded, and you can't get a phone line." At least one trooper has installed a phone jack in his garage so that he can connect to the modem without removing the laptop from the mount in his cruiser.

In Pennsylvania the troopers are told to update SAFER regularly, at least weekly. However, their actual performance of this task is more uneven and tends to be less frequent than that. For example:

> *HC: When you take your inspections and download them and send them into the central computer system to update the national database. How often do you do that?*
>
> *Inspector: Sometimes once a week, sometimes longer. Sometimes there's people using that because the fax machine is on that, too. Sometimes it'll say 'unable to connect' for some reason and I'll just leave. They never made any kind of restrictions on it.*
>
> *Inspector: I try to do it at least once a month.*
>
> *Inspector: Almost every day because I take my computer home and use it for Internet and email. I'll just download it from home unless I didn't do anything the whole week.*

In Maryland, the inspectors we spoke with do not do the uploads themselves. They are handled instead by one officer who has appropriate passwords and who uses land lines, since none has a wireless connection. Moreover, many inspections are still handled by paper forms. In these cases, the officer in charge who is handling the updates must type the information into ASPEN or submit the forms for traditional data entry. It is not clear to the author what combination of methods is being used statewide in this respect during this transitional phase.

In New York, safety inspection data were typically uploaded in one of two ways. Those inspectors assigned Sierra wireless equipment would upload their results directly from the roadside either after the inspection if the vehicle was placed OOS or in groups once or twice a day. For all other inspections, the results were uploaded by both NYSDOT and State Police inspectors to the NYSDOT Avalanche System either from home or the office. Then NYSDOT uploaded the data to USDOT's MCMIS via SAFETYNET twice a week. Due to the lack of CDPD coverage in upstate New York, other technologies are being explored to permit wireless uploads in as many locations as can be done on a cost-effective basis.

ISS UPDATES. The several states also differ markedly in frequency and method of making updates from SAFER to ISS. In Connecticut inspectors download updates weekly through their wireless systems. Thus their ISS files are quite up to date. In the other states, the updates are sent on CD Rom from the state police to the field users quarterly. In Massachusetts we were told that the two most recent updates had been installed on their laptops in December 1998 and June 1999 -- a six month interval. Thus the changes that occur in ISS scores as fleets are updated or new violations are found are not readily reflected in the vehicle inspection scores stored in the local ISS files. In New York, the files were distributed somewhat more often than quarterly on a pilot basis and loaded by the inspectors themselves. It has since been determined that such an approach is neither practical nor cost-effective.

The differences in timing and method appear to affect the usefulness of the ISS files because circumstances of trucking companies and their vehicles change, sometimes rapidly. For example, inspectors in Maryland and Connecticut said that the spread of fleet leasing means that in a short period of time a trucker whose fleet was obsolete and experiencing many violations, may have a new fleet, rendering old scores obsolete. Such changes cannot be reflected without regular updating.

In both New York and Connecticut some inspectors perceived that not all inspections they had performed found their way into the ISS files even when they had uploaded them to SAFER. Whether this actually occurs or is a misperception of the process by a few inspectors is uncertain. If we assume that this may occur, how it could occur is another question. Connecticut issues intrastate US DOT numbers. At the time of this evaluation, only census information was downloaded during a carrier (ISS) refresh. States issuing US DOT numbers would not have the inspection (safety) information processed through MCMIS and the SAFESTAT algorithm. This may be one explanation for inspectors perceiving that their inspections were not “showing up” in the SAFER system.

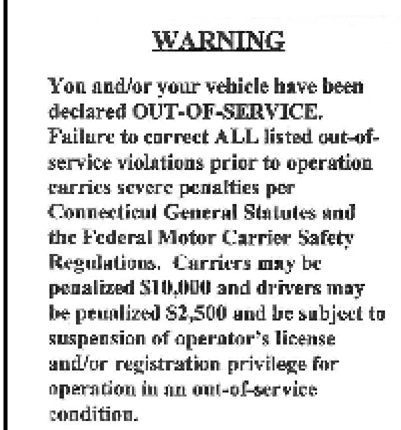
One might assume that an interim step in transmission to SAFER could be interfering with the prompt transmission of updates. However, in New York, the uploads go directly to SAFER, while in Connecticut they go first to Blizzard 32 in DMV’s East Hartford offices, and then to SAFER, but the transfer is automated and does not involve editing. Therefore, this explanation is highly unlikely. Yet two inspectors in Connecticut and one in New York perceived a problem.

An NYDOT administrator interviewed for this study found it unlikely that such an omission could occur if the inspection had been properly uploaded to SAFER -- an opinion in which the author concurs based on observation of the system. (Connecticut administrators were not asked about this because of the timing of interviews.) Consequently we hypothesize that this will be found to be a problem of inspector perception or problems in uploading the inspections to SAFER, rather than a fundamental system problem. However, based on these inspectors’ experiences, the matter should be examined further.

PIQ. In all three states inspectors report that when they have used PIQs, they have very few “hits.” Some inspectors point out that this is likely to change with time as the uploads to SAFER increase and as more states develop full reporting systems complete with wireless connections. Thus they regard the lack of hits as a temporary phenomenon.

The PIQ process is used in different ways in the several states. In Connecticut a PIQ is run at each inspection in part because it is so convenient to do so. In New York PIQs are not being used because wireless connections are lacking, and there are no hard wire connections available to do a PIQ since the sites are mobile. In Maryland the PIQ may be used if there seems to be an important reason to run it, and if the land-line computer connection is available.

Information from a PIQ can potentially be helpful in dealing with repeat violators or in stopping “jumpers” – those who leave an inspection site in violation of an out-of-service order. This can occur if an inspection is entirely mobile, or if an inspection station closes before a truck is properly repaired. In such cases in Connecticut, operators are given a warning notice (Figure B-10). However, this does not always stop a trucker from violating the out-of-service order.


WARNING

You and/or your vehicle have been declared OUT-OF-SERVICE. Failure to correct ALL listed out-of-service violations prior to operation carries severe penalties per Connecticut General Statutes and the Federal Motor Carrier Safety Regulations. Carriers may be penalized $10,000 and drivers may be penalized $2,500 and be subject to suspension of operator's license and/or registration privilege for operation in an out-of-service condition.

Figure B-10: Sample warning of penalties for operating under an out-of-service condition

The effectiveness of the PIQ as a tool for screening trucks to identify repeat violators is limited by the fact that of the hundreds of thousands of trucks eligible for inspection, only a relative few can be inspected. Therefore, the odds that a truck has been inspected at all in the 45-day period covered by the PIQ are very low. The probability of finding a truck that had not only been inspected, but also has been taken out of service but has not been repaired is exceedingly low.

In spite of the low percentage of all commercial vehicles that are inspected, more “hits” would occur if updates to SAFER were occurring daily at most inspection sites and if the PIQ were used to screen vehicles. This is not the way the PIQ is being used at present. Until more states are fully connected to SAFER through wireless connections, this will remain the case.

In Maryland, the inspectors at three major inspection sites which weigh several thousand trucks per shift, report having had a total of only two “hits” through the PIQ process since the inception of SAFER. Given the low hit rate, they say they have stopped routinely submitting PIQ’s as they did when first involved with SAFER since it seems to “waste their time.” Instead they rely entirely on ISS. While they say they use ISS during each inspection, MDOT inspectors say they use a PIQ during an inspection only if the “truck looks ragged.” Besides the fact that they feel the PIQ wastes their time, their access to the SAFER files accessed by a PIQ is limited. Unlike the Connecticut and New York inspectors whose vehicles house their computers and are parked next to the trucks being inspected, the Maryland inspectors at the two sites visited work from a workroom which they refer to as “the shed.” They say it is “very inconvenient to use SAFER because you have to leave the truck and go back to the shed and run the query, and you should not be out of visual contact with the driver.”

Nevertheless, inspectors reported having found one case in which a trucker was selected for inspection at random or because of obvious violation. His vehicle had previously been inspected in one state and taken out-of-service. Yet the driver was operating in an out-of-service condition.

The use of a PIQ varies, therefore, with both the attitude of the inspector and the physical ease of carrying it out. The attitude of the inspector seems to vary with experience. So few hits are experienced that until the system is more widespread and updates more regular, there will be a risk of abandonment due to frustration.

Carrying out an inspection. The author was provided an opportunity to observe an inspection conducted as a random stop in East Hartford, Connecticut. Inspector Sgt. Don Bridge (who also handles training on the mobile data terminals and any enforcement-related software programs for Connecticut DMV) stopped the first truck he noticed on a city street when he noticed that the truck had expired Massachusetts plates.

He spoke with the driver, obtaining his license and registration, and had the driver move the truck to a safe location in a large parking lot a mile from the site of the initial stop. While driving to the parking lot with the trucker ahead, he radioed for a check on the truck registration and driver information.

At the parking lot, he entered the DOT number, and found basic information on the truck ownership. Inspection value was marginal. He then ran a PIQ and found no record of recent inspection.

He again spoke with the driver, requested a log book, and asked about the expired tags. The driver, a local delivery trucker, denied knowing he needed to keep a log book. He also said that the registration had been sent in but an updated plate had not yet been returned to him.

Sgt. Bridge began entering data for the report into ASPEN. He also ran CDLIS on the driver's record finding numerous speeding violations. He also connected with NLETS, and found that no pending registration showed. To solve the conflicting information, he also messaged his base radio room concerning the out-of-date registration, asking if in fact it had been updated and was pending. Investigation by the staff there revealed that the renewal had been received, but had not been acted upon because certain taxes relating to the truck lease were unpaid. This information was received on a screen via email.

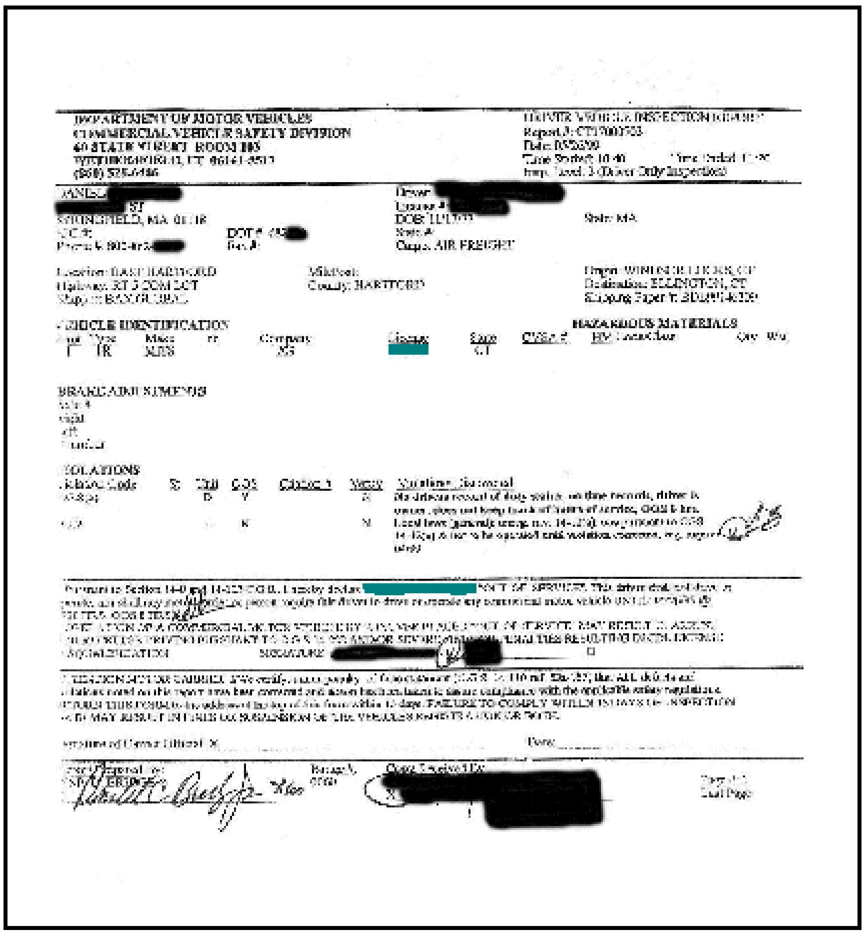
He continued entering vehicle registration data using the laptop keyboard and a stylus with the laptop's touch screen feature.

Finally, Sgt. Bridge had the driver open the cargo bay for a quick visual check. Completing that, he printed two copies of the inspection report, and had the driver sign the report. The truck was taken out-of-service, and the driver was given eight hours to get the vehicle registered and to begin keeping a log book.

To complete the process, Sgt. Bridge compressed the file and sent it to Blizzard 32, a process requiring only a few seconds.

The process took approximately one hour. Normally, if he were not demonstrating the system and solving an unusual problem such as the conflicting registration information, it would require 30 to 40 minutes, he says.

A copy of the report, with names hidden, is shown in Figure B-11. (Copying processes rendered edges illegible) Note that this was a level three inspection. Level one inspections would be similar except that they would be more detailed concerning the truck. Because the inspector must get under the truck, notes have to be taken and the results transcribed. In Maryland, several inspectors told us that they team up for these inspections. That is, one inspector will use a crawler or pit to get under the truck, and will call out results to another who takes notes which are then entered into ASPEN or onto a paper form. They say that working in teams speeds a level one inspection.



DEPARTMENT OF MOTOR VEHICLES
COMMERCIAL VEHICLE SAFETY DIVISION

Driver: [redacted]

State: MA

Cargo: AIR FREIGHT

County: HARTFORD

VEHICLE IDENTIFICATION

HAZARDOUS MATERIALS

VIOLATIONS

Figure B-11: Copy of a report issued in Connecticut using ASPEN and related systems during a routine stop of a commercial vehicle with expired registration.

Maryland inspectors describe their level one processes:

> *Inspector 1: You can do it with two inspectors doing it by table top inside within 30 minutes. He* (i.e., pointing to inspector 2) *gets everything done underneath while I collect the writing. After that, whichever guy that's going to put it in the computer leaves. Then the one that stays with the truck does the walk around and then the inspection. Then he has the truck come all the way around and park. By that time, the guy entering it into the computer is just about done, if not already done, unless there's a lot of defects or something. Then the one doing the inspection comes up and tells him a few more things that he has. The inspector on the computer enters them. They he prints the form. Then he has the guy sign the paper and leave.*
> *HC: Under the paper-based system, did it also take two inspectors?*
> *Inspector 3: Yes, we did it the same way.*
> *HC: Now,* (asking inspector 4) *do you handle it the same way?*
> *Inspector 4: No, I use paper for a level one.*
> *HC: So, you still fill out the paper form?*
> *Inspector 4: Yes. On a level one. I have a form. I go out there and put the DOT or the ICC down. I'll take the guy's license and truck information. I'll take the information off the trailer and write it on there. I'll take his shipping papers and everything. I'll ask him his 800 number and if he's empty, I'll write where he's been or where he's going. Then I'm done and I'll leave. I have everything I need. The other inspector stays and does the inspection.*
> *Inspector 3: Anyway, you can't see the screen outside. It glares too bad from the sun.*
> *Inspector 4: We use paper because of the time on it. We can finish a level one inspection in 15-20 minutes. If we enter the information on a laptop, we have to go inside because that's where the laptops are, and a lot of the guys don't have typing skills so it takes time. So, we use the laptops basically for level 2's and 3's. Once you get all the information, you can go inside and enter the information.*

In short, the utilization of the systems varies widely among the states and even between inspectors within a state. Part of the variation can be explained by the physical set-up of the equipment and inspection sites, and some more by the sheer amount of time inspectors have been using the system, becoming accustomed to it.

Similarities among the states in the use of ASPEN, ISS, and SAFER

We have shown that the various software components related to commercial vehicle inspections are used in different ways depending on location and other factors. There are more similarities than differences in how the basic components (ASPEN and ISS) are used, however.

ISS scores are used as a "tool" to supplement observation. The inspectors say they trust the ISS scores as a guide. They frequently describe the scores as a "useful tool." They generally find them to be accurate. Exceptions do occur, however, when a company makes a fleet change (increasingly common in an age of fleet leasing) or a policy change in safety. For example, inspectors said:

> *HC: So, you see some that are very accurate and others are contrary. Is experience teaching you to distrust or trust the score?*
> *Inspector 1: I'd say 'trust.'*
> *Inspector 2: They're kind of interesting! There are some carriers will be word for word what it says in the history block.*
> *Inspector 3: I'd say trust, but it's not gospel!*
> *Inspector 4: I don't pay a whole lot of attention to it.*
> *Inspector 5: I don't either. If I see a truck and I want it, I inspect it regardless of what rating it says.*
> *Inspector 6: It could be a '99 truck coming over and the company could have a history of brakes suspension on its vehicles, but you know this one is a '99 truck and chances are that those violations don't exist on this vehicle.*
> *Inspector 7: It's not very accurate all the time. A carrier may come up with a high rating, which is a bad score. It may come up with a 90 and be a brand new vehicle.*

ISS is not usually used to screen trucks, although there are exceptions. It is usually used as a supplementary piece of information helpful in targeting the inspection. ISS vehicle inspection scores and related information are generally used as a "tool," or guide to what to look for in an inspection rather than as a device to screen trucks for inspection. Screening in any event could work only at fixed sites with a flow of manageable flow of trucks. However, many of the inspections are conducted at sites such as Middletown Scale (CT) where the flow of trucks is too fast to allow time for screening. Many others, perhaps most, are roadside pull-over stops at the roadside as in Pennsylvania, for example, which are dependent on visual observation by the officers, and not on an ISS score. Two officers said this:

> *Inspector: I work in two counties where there's no rest areas or scales or signs. What we do is usually go to a location where it has a wide enough berm, we'll do a systematic stop of trucks or go by the looks if there's an obvious violation. Doing an inspection usually is in the course of stopping ... and stops it by a violation or a truck that looks like it's going to have several violations.*

Inspector: That's pretty much how I do it. I'll sit in some conspicuous place that's very visible. When I see a truck that looks ragged, I'll step out into traffic and pull them over.
HC: But you're looking for an apparent violation?
Inspector: Yes.

Most inspectors say that it would be impractical to use the ISS vehicle inspection scores to screen and select trucks for inspection, thus targeting them to the worst offenders. Instead, they say they generally select trucks by a combination of a roughly "random" selection process, and a visual check of the trucks to determine likely violations. In most cases, the "random" process is random only in the sense that the inspector will choose the next truck coming through the inspection site at the time he or she completes the previous inspection and is "ready for another truck." At that time the inspectors say they will scan in the incoming line of trucks and wave over either the next in line for inspection, or the truck that a quick visual scan suggests could have the worst violations among the several trucks near the head of the incoming line.

At that point, with the truck driver notified he is to be subject to inspection, and the truck parked, they will use the ISS vehicle inspection score (Figure B-12). Most inspectors say they use the score and associated detail before they begin their inspections to guide them in what to look for. Some say they use the score to help gauge the level of the inspection they will conduct. A lower inspection score may thus result in their conducting a level three inspection only, while a high score may result in a level one. The details offer a guide on what to pay special attention to.

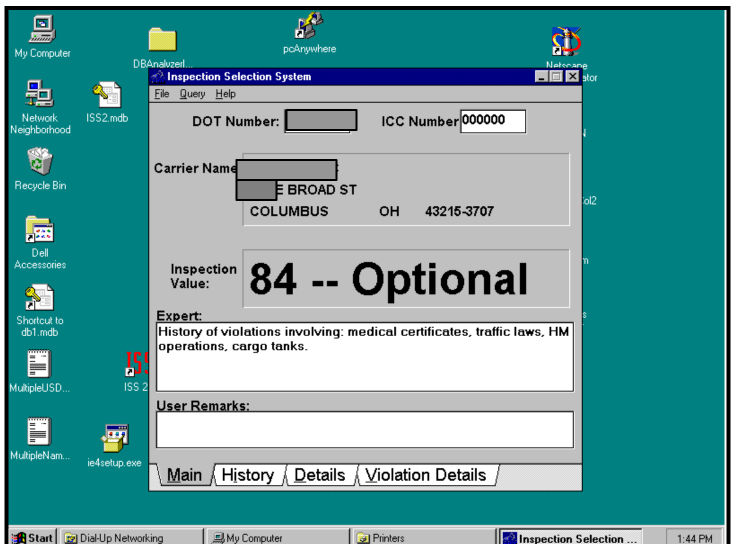


Figure B-12: An ISS Score in ASPEN

While this method seems to be used most often, there are exceptions. In general the Rhode Island inspectors we spoke with tended to say they use the ISS score *after the inspection* to double check their own work. One commented that if the ISS report showed a history of similar violations, it might make the difference between his giving a warning or a ticket as a result of his own inspection. Also, one Connecticut inspector said he specifically does not use the score before the inspection because he wants to take a completely fresh and unbiased approach to each inspection.

There are logistical barriers to using ISS for real-time screening. In Maryland the computers in use for ISS at the site we visited are physically separated from the observation booth. While another system could be installed in the weigh station observation booth, the supervisory staff feels that it would be impractical for inspectors to wait there to use it for purposes of screening. He therefore believes that additional staff would be required to add screening capability. Moreover, the flow of trucks past the scales is fairly rapid and it would be impractical to obtain a DOT number, enter it, and judge the score without causing back ups of traffic across the scale. A similar problem occurs at the Middletown Scale in Connecticut. Any slowdown of trucks over the scale results in a line of trucks becoming backed up into the highway, creating a traffic hazard.

In New York, with its rest-area approach, screening would have to be done from a laptop in a van in the approach to the rest area parking lot. This was tried early in the program, but discarded because it caused truck traffic to back up dangerously onto the highway. The same situation exists in the other states studied when they are operating in rest areas. The possibility of using ISS to screen is even more limited in those states which rely mostly on moving stops. For example, although we observed inspections in Rhode island only at a rest area, the officers say that 80 percent of their inspections involve stopping moving trucks. This method is also dominant in Pennsylvania and Massachusetts.

Logistics are not the only reasons for not using vehicle inspection scores for screening. In Maryland, as we have said, ISS is rarely used for screening, inspectors say. However, two of the State Police inspectors indicated that "others they knew" did use it in to screen occasionally. They and their Transportation Authority peers expressed a reluctance to use the system for screening or to be identified as doing so not only for logistic reasons, but also because of concerns about such a process being labeled discriminatory profiling. One indicated that there had specifically been an order not to use the system in this way. Others appeared uncomfortable with this subject and reluctant to discuss it.

Maryland Transportation Authority inspectors were openly skeptical of the use of SAFER for screening since it would, they say, require additional personnel to do the screening. One commented:

> *We would have to hire a clerk-typist for each shift to do the screening, and even then you couldn't do every truck. But instead of hiring a clerk-typist, or one for each shift, I'd rather have them hire another inspector so we could inspect more vehicles.*

This concern was not uniform, however. Massachusetts authorities commented, for example, that they had "...no probable cause problem." However, it is simply not practical to use ISS scores for screening there because of the nature of the stops and the sites used. Troopers there typically spend four days a week "on the road" making stops as needed, and one day a week at a mobile site located at a rest area or other site for the day.

Special case of Connecticut's Union Scale. Union Scale, a fixed weigh and inspection station in Connecticut, provides an exception to these practices. At that site, inspectors have advantages resulting from the layout of the site and the equipment available to them.

Union Scale is a large site with a long approach and two scales, one of which is a weigh-in-motion (10 MPH) scale (Figure B-13). A computer-controlled screening mechanism initially selects trucks for further examination as they pass over the

Figure B-13: Union Scale (Connecticut). Truck labeled *"Penn's Best"* moving left to right is in the weigh-in-motion lane, and may either be sent back to highway or diverted onto the fixed scale and considered for inspection. Trucks in foreground are approaching the fixed scale. When trucks stop there, an inspector in the building will generate an ISS inspection score.

weigh-in-motion scale diverting some of them to be examined further. Not all of these will be inspected. But, the initial sampling creates a pool of trucks for further screening with very little need for human intervention. The diverted trucks proceed to a second scale for further weighing and visual scrutiny. As they approach and stop, an inspector can physically see the truck approaching at slow speed. He or she at that point also has a desktop computer at hand, is in a position to see the DOT number, and need not worry about impeding the flow of truck traffic through the inspection site while checking an ISS listing. Inspectors say that the vehicle inspection scores can help determine which they will inspect and the level of detail with which they will inspect it. One inspector, for example, said:

> *Inspector 1: Generally, at the fixed location (I.e., at the scale) we look at the value itself. Anything generally 85 or above we will inspect. If it comes up with a rating of 90 where less than three inspections have been done on that carrier, we'll do an inspection on it.*
> *HC: Is that your own criteria or is that everybody's?*
> *Inspector 1: Oh, we pretty much all do that usually. But it depends on the vehicle, too. That* (the vehicle inspection score) *is just one piece of information that you use. You don't base everything on that. It's just added to the information that you already have.*
> *Inspector 2: Obviously, if it has an obvious defect, we're going to inspect it.*

Union Scale in Connecticut is the only site observed in this stage of the study with such a high level of automation and inspector support. Even other fixed sites such as Middletown Scale (also in Connecticut) are less automated. Also the approaches tend to be single lane without the diversion lane used at Union Scale, thus creating a need to move trucks through the site too quickly to make use of an ISS score for screening feasible (Figure B-14).

Figure B-14: Trucks lined up to cross the scale (far right) at Middletown Scale (Connecticut) The trucks must stop at the scale momentarily. In busy periods they back up to the highway, creating dangerous conditions, and requiring the inflow of trucks to be halted. Trucks cannot realistically be halted long enough on the scale for inspectors to run ISS checks for screening purposes.

Using ASPEN.

ASPEN is used in a fairly uniform way among states and agencies (Figure B-15). In all the states except Maryland, the laptop computer is left in the inspector's vehicle. Vehicle registration, log book, and other documentation are taken to the inspector's vehicle and entered there.

For Level One inspections, data on brakes, and other technical information obtained by measurements, is jotted down in a notebook and then entered when the inspector returns to his or her computer. The inspectors do not take the computer to the truck being inspected. Seeing a laptop screen in the cruiser is difficult, but seeing it at truck-side would be impossible. Also, it is both impractical and unnecessary to maintain printer and modem connections out of the vehicle.

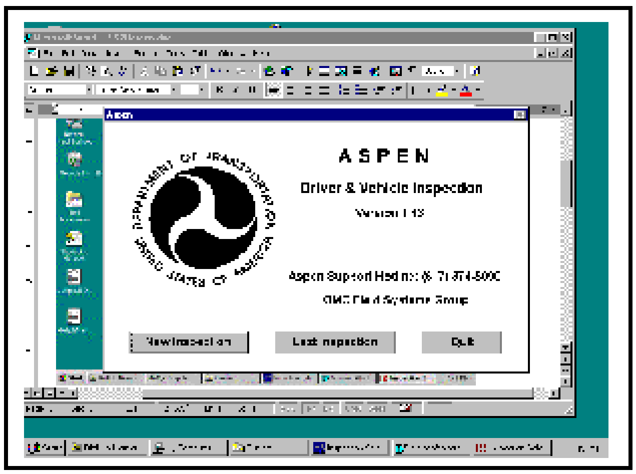


Figure B-15: ASPEN opening screen

Moreover, in New York and in Maryland, the laptops are not "hardened" shock resistant machines, and could be damaged by constantly moving them. In Connecticut, Massachusetts and Rhode Island, the computers are constructed in a way that resists damage from weather or dropping. But even in Connecticut there seems to be no reason to take the computer out of the vehicle to record results since working in the cruiser is more comfortable and provides shelter from sun, wind and rain. In Maryland, the inspectors interviewed are not mobile but work in fixed sites from desks. Thus their laptops really function as desktops, since they leave them in their offices, entering results from notes rather than bringing them to the trucks or using them in cruisers.

There are exceptions. In Maryland, several inspectors said that they still use paper forms (see Figure B-16 in next section for a similar Connecticut form) for level one inspections, and use their laptops only for level two and three inspections.

Using SAFER and associated queries and updates

We have already pointed out that SAFER is subject to substantial variation among the states in how it is used primarily because of differences in the extent of wireless communication, but also because of differences in how the updating process is organized. SAFER updates themselves are handled more quickly and regularly when the inspector has a wireless connection on his or her own laptop, as in Connecticut.

When, as in all states except Connecticut and Rhode Island, the inspector has to borrow an office to use a land line and a dial-up connection, there is always the potential for difficulties with making the connection, and uncertainty regarding when the inspector can get around to it. When, as in Maryland, there is a mixed use of paper and electronic reporting, and delegation of responsibility for uploading, there are likely to be delays.

Consequently, as wireless service expands, the up-to-date status of the data available to an inspector running a PIQ will improve markedly.

Advantages and disadvantages of ASPEN, ISS, and SAFER compared to paper inspection systems

All but one inspector observed or included in the interviews feel that the computerization of the inspection process represents a significant improvement for them. It makes their work more efficient, they say, and their actions more effective in the long run. Thus to the bottom line question, "Are you better off with or without the computer systems" the answer is a nearly unanimous reply: "We are much better off with them, and would not give them up." The often expressed mantra in Connecticut (where inspectors are armed, sworn officers) is even "You can take away my gun before I'll let you take away my laptop!"

The one exception is an inspector in New York who continually has problems using his laptop. Another inspector attributes the problems the latter inspector experiences to his computer resistance and poor training, describing how he becomes angry at the hardware/software and resists using it. [2] Only one inspector (who happened to be encountered in Pennsylvania) angrily denounced the system as impossible to understand, and disadvantageous compared to paper.

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[2] The desirable extent of training is a matter on which there is disagreement between one or more inspectors and key support staff in Albany. The most vocal inspector wants training for all inspectors in the operating systems (Windows and sometimes DOS). The key administrator believes that training in ASPEN is essential, but that anything beyond that will tend to lead to individual attempts to customize systems and to problems being introduced because of that.

Most inspectors, however, after initial resistance, like their new venture into computer-based inspections. What do the inspectors consider the major advantages of the systems and what do they consider the aspects that could be improved?

Advantages. Inspectors generally cited three things as the primary advantages of the computer systems, and several other things as related advantages:

- Saving time in certain aspects of the inspection,
- Legibility of the reports
- Efficiency, and effectiveness of the total process.

A glance at the paper form (next page) used in Connecticut, in comparison to the screen from ASPEN shown above illustrates the inspectors' point. In effect ASPEN organizes their responses and makes the entire form highly uniform and legible. Inspectors say that the drop down menus provide predefined responses, reducing error on such things as violation codes.

Note that the advantages cited by virtually all inspectors involve immediate impacts, and not global or long term effects such as long term improvement in highway safety. Asked about this, they tend to say that the systems are too new, and the interstate use of them too uneven for them to notice a major improvement in truck safety yet. Some inspectors do express guarded optimism that in the long run, as more inspectors are fully equipped with wireless equipment and use the updates regularly, there will be a systemic effect. But most see the impact in immediate and personal terms – how it affects the way they do their own jobs.

It was less unanimous, but some inspectors cited these advantages also:

- The comprehensiveness of the several systems to provide a complete picture of the vehicle, the driver and the trucking company.
- Greater uniformity of reports among states and among inspectors.
- Greater credibility of reports with trucking companies.

One trooper in Massachusetts commented that one major advantage of the system to his is that it *"...provides a context for the inspection."* *"For example,"* he said, *"a lot of times if a driver is missing a medical card, or other papers, he will say he forgot them, but if you look at ASPEN and it says the company has a history of that kind of violation, you know where he is coming from and you've got him. When we were using paper, you didn't have that."* When other inspectors say that the system provides them a "tool," this is essentially what they are saying – it provides a context they previously did not have.

Example of paper and electronic forms. In considering the advantages of the systems, it may be useful to visualize the way data is entered in the paper format and in the ASPEN format. An example of the Connecticut inspection form is presented in Figure B-16. An example of one of the seven separate ASPEN tab/screens is shown in Figure B-17.

It is easy to see simply by looking at these formats why inspectors say that the use of ASPEN helps them keep reports legible and consistent, and helps them remember to complete all fields. Of course, the ASPEN screen shown is only one of seven screens while the paper form shown represents all information needed.

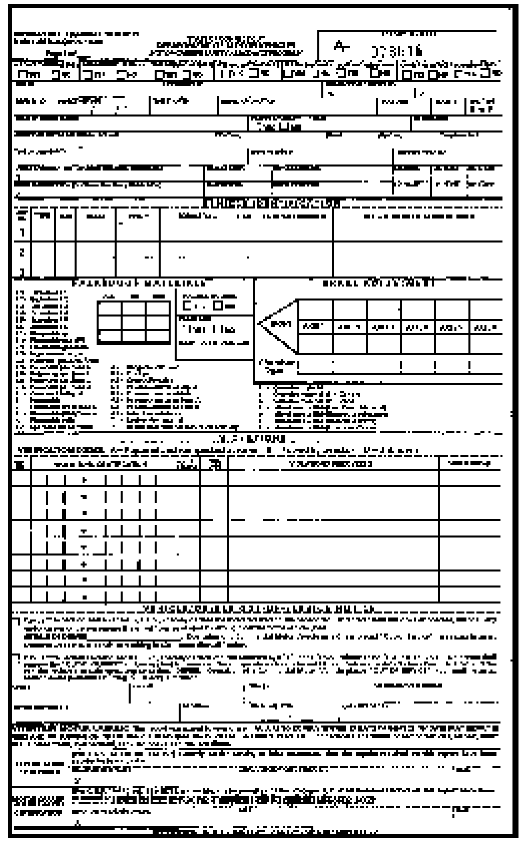

Figure B-16: Example paper form for recording inspection information.

Nevertheless, one can see that the information is organized for the inspector in a way that will make the completion more usable by others and in some ways more efficient than paper.

The following exchange among several Connecticut inspectors illustrates most of the attitudes:

> *HC: Now were all of you working as inspectors at a time when it was done by paper?*
> *All: Yes.*
> *HC: If you had to name one advantage of the electronic system over paper, what would you say?*
> *Inspector 1: Speed*
> *Inspector 2: Yes, it's easier to get the codes because then otherwise (i.e., with paper forms) you have to look them up which takes a lot more time.*
> *Inspector 3: Definitely. Being able to run CDLIS on a driver. Carrier information coming up by just entering an ICC or DOT number.*
> *HC: You're saying that CDLIS access saves time? Back in the paper system, did you take the time to call in…?*

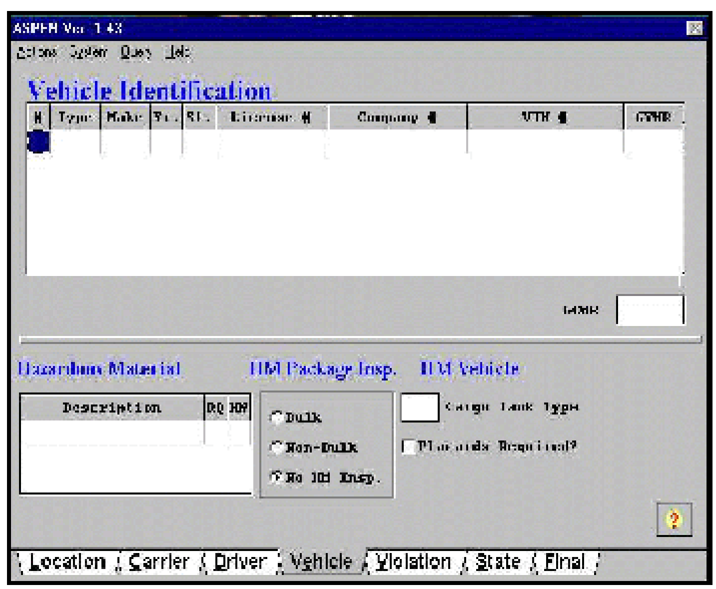

Figure B-17: Example ASPEN data entry screen.

Inspector 3: We didn't get a history. We just got lots of warrants and suspensions.
HC: Is it helpful to get more?
Inspector 2: Sure. Some things show up on CDLIS that don't show up on suspension check.
HC: You all said the primary advantage is speed. How much of an advantage is that? On a given level one inspection, are you saving 10 minutes, 15 minutes?
Inspector 4: I'd say 10-15 minutes.
Inspector 2: If you look at that paper inspection and looking up all the codes….
Inspector 3: You're getting more true information than you are off the paper forms. But, there were no paper jams, or computer freezes when we were using paper.
Inspector 2: It might just balance out. But you're waiting for the information….
Inspector: The information is now more accurate and you can do more with it. You can see that someone's having trouble with his log book. It's another tool.
Another Inspector: There's four more checks we're doing now that we weren't doing on paper…PIQ, CDLIS, NCIC, and ISS. You're getting a lot more information now.
HC: And that's worth it to you?
Inspector 1: Absolutely.
HC: It's not more hassle than it's worth?
Inspector 1: Oh, no.
HC: The bottom line is you don't want to go back to paper?
Inspector 3: NO! It's legible. You can read it. I was the last one who wanted to go to computers. But now that we're on it, you can't do anything without it. You'd have to pry it out of my hands. It's a great tool.

These kinds of remarks were repeated with slight variations at all sites. To the degree that Connecticut is farther along in terms of adoption of the systems, and to the degree that its inspectors have broader authority, the perceived advantage of comprehensiveness is greater there than elsewhere. However, even in Maryland where inspector authority is quite limited and the system is very new and still novel this exchange occurred:

HC: The fundamental question of this whole thing is whether you are better off with or without this system?
Inspector 1: I didn't like it at first.
HC: Why not?
Inspector 2: Change. I suffered to try to find the switch to turn it on.
Inspector 3: Some people still want to use the paper forms because they don't want to commit to the change.

HC: Did anyone have computer skills before this? (One inspector indicates he had a home computer, and another some training. The other five had no exposure.)
HC: How about typing skills?
Inspector 3: These two fingers can type pretty good!
Inspector 5: At first I didn't like it, but I like the computer now. I can do a level one and a level 2 just as quick. I can do a level three faster than he can write down a 3. A level one written should take 20-25 minutes to get all the information. What's another 5-10 minutes when you can read it and you don't have a trooper trying to decipher through. [He is referring to the need for a trooper to examine the form for certain violations police must follow through.]
Inspector 3: I like it because if you left anything out, it will tell you and it won't allow you to print the inspection. If you miss anything, it will report what you missed.

Specific advantages as perceived by the inspectors

<u>TIME SAVING.</u> Time saving is most notable, they say, in completing the inspection forms in ASPEN, and selecting the proper violation codes. Previously inspectors would have to consult large printed volumes if uncertain about a code. Or, if they wrote down a code on the paper form from memory they would sometimes miss an important decimal extension modifier. This would not be caught until data entry, and would at that point cause confusion, delay, and a need for corrections. Under ASPEN, however, legal references (codes) describing the violation in legal terms appear in a drop-down menu, eliminating those kinds of errors. This is not to say that inspectors find the system flawless. Their suggestions for improvement are discussed in the next section of this report.

Time is also saved when the system completes information about a company ("populates the fields"), thus freeing the inspector from having to enter it.

Inspectors were quick to point out that they did not save time immediately upon beginning use of the computerized systems. Very few had either typing or computer skills as the program was introduced. Yet a major part of their newly redefined job skills depended upon computer and typing skills. With generally good humor, however, they said they had mastered enough skills to handle the completion of forms in ASPEN and related programs.

There is also some disagreement among inspectors regarding the time savings. Some say it saves time (about 10 minutes on a Level Three inspection) on a net basis. Others say that the added inspection capabilities such as PC Miler and CDLIS actually increase total duration of an inspection. However, the consensus is that the process is more efficient, and that certain components take less time. They also feel they obtain much more information in a given period of time. For example, previously trucker inspection history was simply not available. Now it is. This "deepens" the inspection, they say.

Thus what they initially call increased "speed" may in reality be an improved ratio of time to the amount and accuracy of information gathered and recorded. Inspectors may be able to complete more components within each inspection (e.g., entering driver and truck information on the forms, checking violation codes, etc.) and complete these steps more accurately in the same amount of time. This would result in increased information efficiency while the number of inspections performed in a given amount of time remains the same.

<u>LEGIBILITY.</u> Inspectors were also unanimous that the system improves the legibility of reports. Handwritten reports prepared by some inspectors are notoriously difficult to read, and cause unnecessary difficulties for later enforcement action. Typed, printed reports are more effective, inspectors say, because they are more legible to other inspectors and to the courts when inspections are involved in legal proceedings.

<u>EFFICIENCY.</u> Inspectors say that they "do a better job" because of the computerized systems. For example, they say that the ISS system, by providing a partial history, enables them to better target the specific, repeated weaknesses of a company, adding pressure on it to reform. Such history was unavailable in a paper-based system except by word of mouth, or review of many files. Thus, ASPEN/ISS provides them for the first time with accurate history during an inspection.

Having the history relates to efficiency because it allows them to concentrate on certain aspects of the inspection. For example, one inspector said:

> *HC: How do you use the ISS inspection value?*
> *Inspector: Usually there's the printed information written underneath it like 'violation for brakes, medical, drugs' whatever. Then you stick that in the back of your head when you do your inspection and you key in on those items.*

Efficiency is also said to increase because the systems are perceived to be error-resistant. For example, many fields in an inspection report must be completed or the program will not allow the form to close. While this has drawbacks in some cases (noted in the following section) it is regarded in general as an improvement over the paper system.

<u>COMPREHENSIVENESS</u>. Some of the advantages are derived from related programs, not from ISS, SAFER or ASPEN themselves. For example, the program "PC Miler" enables inspectors to quickly check the validity of time-distance notations in the driver's log. Having CDLIS available on line (for those who use it) enables them to gather information on driver history more quickly than a radio interaction, is more secure, and does not require note-taking.

UNIFORMITY. Most inspectors had not seen reports from other states which use computerized systems. Consequently, uniformity among reports, while desirable, was not considered a major current advantage, However, one inspector said this:

> *HC: One of the objectives of this system is to increase uniformity among the states. Do you think it's having that effect?*
> *Inspector: Yes. I've gotten inspections from other states that drivers have handed to me and they're almost identical to ours now. It's laid out the same as ours. I've seen them from Maryland and California and other states. This is going to make it easier to understand and use them everywhere.*

CREDIBILITY. A few inspectors reported that they felt there is somewhat greater credibility of the computer-printed reports with the trucking companies. They felt that this would increase as the use of such systems increases. This belief is based on the idea that the comprehensive record keeping in the databases would result in better oversight of vehicles. Violations which had been overlooked in systems which were uncoordinated between states would be more likely to be identified. As this inability to escape detection becomes apparent to the trucking company, the credibility of the inspectors' reports would increase and with it the actions of truckers to bring vehicles and drivers into compliance.

This was the opinion of only a few inspectors who tend to take a more thoughtful view of their procedures. For most inspectors the advantages were shorter term: saving time, being more legible, being more efficient.

Hardware: perceived need for improvements

The praise inspectors heap on the systems does not mean they are uncritical of all aspects. Three specific improvements are sought in the hardware configurations:

SCREEN Current laptop screen technology is far from ideal for use in sunlight. Even with high quality active matrix screens, visibility can be low under bright conditions. Some inspectors say they have developed makeshift shades. One New York inspector changed colors on his screen to maximize visibility for his color-blindness. But the change appeared to the interviewer to have had the additional effect of contrasting enough with sunlight to make the screen more visible. It is difficult to exaggerate the importance of dealing with this problem. The screen on a bright, ideal day for full inspections, is very difficult to read. Troopers in Massachusetts were actually observed moving their cars to different angles relative to the sun to change the light on their mounted laptops. For a quick increase in inspector satisfaction and productivity, tinting the windows, shading the screen, and obtaining glare resistant high-intensity screens would qualify as one of the top three or four inspector priorities.

DAMAGE RESISTANCE Maryland inspectors indicated a concern with damaging their computers by using them outside. The unmounted machine observed in New York sitting on the seat of a van was literally patched with tape. The other states use hardened Panasonic computers which can be handled quite roughly without damage, and use mounts in the cruisers to fix the laptops in position, reducing the danger of equipment damage still farther.

WIRELESS CONNECTIONS Wireless coverage was not being used in Maryland, Massachusetts, Pennsylvania, or most of New York at the time of the study. In Connecticut, the coverage is fairly complete, but signal strength is very low in some areas especially in Eastern Connecticut. In Rhode Island, coverage is complete and all systems are wireless.

Software: perceived need for improvements.

While the ASPEN software is seen as a boon, some inspectors now accustomed to it have identified areas they believe could be improved.

CODES Although the drop down violation code list is preferred for speed over the paper manuals that had to be used previously, a common complaint of inspectors was the lack of codes in the drop-down for specific conditions they had to report. The original list was apparently so long that using it in a software package was impractical, and some codes were dropped. On occasion this means that the inspector will have to use a generic code and add notes rather than be specific about a violation. This compromises the validity of the report, and may, inspectors say, cause problems in court action. Moreover, the notes they make to explain the specific violation within a generic category are not carried forward to the ISS update so that the value of the inspection in building a history is diminished.

Several inspectors said this lack of coding options is particularly true of HAZMAT violation codes.

One exchange on this topic was as follows:

> *HC: If you think through your typical inspection, are there any other operational problems you run into?*
> *Inspector 1: Hazardous materials codes not being in the computer database.*
> *HC: Do you specialize in HAZMAT?*
> *Inspector 1: I'm certified in HAZMAT as we all are. In order to maintain certification, we're required to do a certain number.*
> *HC: Are codes missing besides HAZMAT?*
> *Inspector 2: Yes. There are a couple of regular federal codes that are not in there as well.*
> *HC: So what does that force you to do when those codes aren't in there?*
> *Inspector 2: You'll have to cite their reference and then reference back to the correct code.*
> *HC: So use a more generic reference?*
> *Inspector 2: Yes.*

In other conversations, other inspectors maintained that there were many more than one or two codes they regularly need to use which are not in the database of codes. For example, a Massachusetts inspector said that while they use Federal Regulations, often a truck or driver is violating a state law also (he gave the examples of required chock blocks, speeding, or certain Federal Codes such as code 396.5b for an engine oil leak or 396.7 for unsafe operation) but lacking a specific code or the ability to add such a code, they have to use the more generic code 392-2 which does not really describe the problem, he says. Thus, when SAFER receives the information, the system or other users really do not know the nature of the violation.

Yet building in codes to cover every conceivable situation in the drop down list would be impractical. One solution might be to branch the drop down list into broad categories, with only the broad categories visible in the initial drop-down list, but greater detail easily accessible at a second layer.

WARNING OF INCOMPLETE FORMS. Maryland inspectors said that one advantage of the electronic systems is that they tend to prevent the inspector from leaving the form incomplete. Paradoxically, some inspectors in Connecticut said that while that was true, it failed to prevent closing of a level one inspection if the inspector had neglected to complete the brake report section. (In this, the Connecticut inspectors flatly contradicted the Maryland inspectors. The systems may be slightly different or some other unknown factor may have caused the respondents to provide divergent accounts of how the software performed.)

One conversation with Connecticut inspectors was as follows:

> *Inspector 1: There's a lot of little things. Sometimes on a level one inspection, you'll write down all the brakes on your pad or wherever and you'll forget to type them on the report and you're able to exit out and complete a level one inspection without adding any brake records. But if you forget to drop the carriers zip code, the program won't allow you to finish it.*
> *Inspector 2: The brake one is the big one. It'll stop you for other minor things, but not the brake one!*
> *HC: Any other field that it won't let you out?*
> *Inspector 1: The zip code. I don't know what else.*
> *Inspector 3: Driver information won't let you out.*
> *Inspector 1: Brakes have to be documented on a level one inspection. Nothing else does. That's like a key thing. That's the difference between a level one and a level 2. You shouldn't be able to exit out without that information.*
> *Inspector 4: Sometimes you need to leave things out.*
> *HC: You're saying in some cases, it's justified?*

Inspector 4: Yes like with the VIN numbers, or if you had to put a registration plate number in and the vehicle was unregistered and didn't have one, how would you get out? What would you do?

The inspectors concluded that for their operational needs there may be times when a field should be left incomplete because otherwise escaping the program would require falsification with a dummy value. They indicated that brakes ought to be a mandatory field on a level one inspection, while other blank fields ought to have at least a warning or unknown value option.

ACCESSING RELATED PROGRAMS THROUGH ASPEN. Access to programs through ASPEN was mentioned several times as a desirable improvement. For example, Maryland inspectors would prefer to access PC Miler on their laptops directly through ASPEN. They say that today they are unable to do that. Other inspectors suggested that CDLIS ought to be accessible through an ASPEN sub-menu, probably "Driver." In short, they would prefer to use ASPEN as an organizer of all the information systems they are using.

A related comment was made by one inspector:

Inspector: If you'd put the National Criminal Identity Check right into the ASPEN program, and if you could run CDLIS from the driver screen in ASPEN that would be nice instead of having to exit out. You have to get out of one program and run. I mean you can leave the inspection running, but you have to get off that screen and start the other program.

TICKET WRITING. Maryland inspectors pointed out that if the system would prepare the ticket for them when one had to be issued, it would further speed the process and increase accuracy and legibility. We understand that this is intended in the new version of ASPEN. Inspectors in the other two states agreed that this would be advantageous.

CUSTOMIZATION OF FIELDS. ASPEN offers ways to customize certain fields, including, apparently, jurisdictions. The process was said to be cumbersome, but worthwhile. New York inspectors were particularly concerned with customization of jurisdictions. The change several inspectors in several states said they would like in this respect would be to preserve their jurisdictional customization upon loading a new version of ASPEN. Today, they say, they may spend hours customizing various fields (of which jurisdiction is the most complex) but any upgrade writes over the past file, causing them to have to go through hours of work to re-customize from scratch.

While New York inspectors were most concerned about this, one or more inspectors who were among the more sophisticated users in each state except Maryland mentioned it. As all troopers gain confidence in their manipulation of the programs, more and more customization can be expected, and the objection to this shortcoming will become worse.

On the other hand, if code retention is not possible, perhaps it would be possible to create add-in databases of local jurisdictions to be added when an update is made.

<u>CANADIAN POSTAL CODES</u>. New York and Connecticut inspectors pointed out that they sometimes had difficulty entering Canadian postal codes, and no effective way to check on a Canadian postal code when one is missing from registration or other information. Yet, they apparently cannot complete the form without a code.

<u>PC MILER</u>. PC Miler is used to double-check log entries. Logs showing coverage of long distances in a short time suggest falsification and a lack of required sleep. Inspectors say they use the program heavily for this purpose. They also say that their examination of logs often involves the driver showing receipts at specific locations, especially receipts which are time-stamped. Often these receipts will be tollbooth receipts, they say. However, PC Miler apparently does not provide milage for a tolbooth as a point of origin. They would like this added.

They also point out, however, that with increasing automation of toll collecting, through programs such as EZ Pass, that this source of paper-trail is beginning to pass from the scene, and they wonder how to replace it.

<u>TRAINING.</u> Training for ASPEN is said to be adequate in all three states. However, the training is very basic. Most of the inspectors know little or nothing about PCs when they begin with ASPEN. Thus when a computer freeze occurs, or they need to access a program outside of ASPEN, they are sometimes baffled how to proceed. There was surprisingly little complaining about this, perhaps because the inspectors did not want to admit to having such problems in front of their peers. To judge from the comments of the few inspectors who are reasonably expert, the problem is common and ought to be examined in the survey.

A composite of exchanges illustrates:

> *Inspector 1: I'm pretty comfortable in terms of ASPEN. That's okay. It's WordPerfect where I have my problems. I get into WordPerfect and I have a different program in my home computer, so nothing works the same. You go into the office and ask the computer guru, but he talks 10 times faster than you can learn it. You tell him you're having trouble and he explains it to you…..then you don't have any idea what to do.*
> *HC: Why do you use WordPerfect in this context?*
> *Inspector 1: To write reports. If we make an arrest, we have to write a report.*
> *HC: A report might be a couple of pages long?*
> *Inspector 1: Prosecutor reports. They are about 2 pages at the most.*
> *Inspector 2: When I use Word Perfect, I have to shut the whole system down and then start it up agin to get to it.*
> *Inspector 3: A lot of the guys don't have home computers or any experience. Just about everyone who works here is brand new to*

computers when this whole ASPEN thing started. I went and took a course on my own in DOS and Windows. But some of these guys don't have a clue what to do if they freeze the system, so they might just lose a whole inspection or part of it, and have to shut down and start again.
HC: By the way, does everybody agree that learning and using ASPEN is fairly simple?
All : Yes.

Another group of inspectors described their training and suggested changes in it:
HC: What kinds of things were missing from the training that would have been helpful?

Inspector: Maybe if he would've done maybe a dozen inspections with different scenarios.

Inspector: We did do practice inspections, but just enough to get your feet wet.

HC: How long did the training last?

Inspector: 3 days.

HC: Okay, 3 full work days.

Inspector: Actually about 2 ½.

Inspector: I think we went over stuff we didn't need to be doing. I remember when we got those computers at the conference; I knew nothing about computers. I was just trying to keep up. In about the last half a day, we actually did the inspections and then it was a lot easier. Once we went out and did a few, it was all right. I don't know what we were doing!

Inspector: We should've done the inspections first. The inspection itself isn't difficult at all.

HC: Does everybody agree?

Inspector: I agree.

Inspector: I agree. More inspections, too.

HC: Any live inspections?

Inspector: No. But we need more scenarios.

Inspector: It would be helpful if somebody took on an overhead and put down an ICC or DOT number and then just give you list of violations and punch in all the necessary information and give you all the real information to work with and scrap it later. Then you'd sit there and practice with the violations and everything. You can't hurry that up, especially for the guy that knows zilch about computers.

Heavy training in DOS and Windows would perhaps represent a problem for the system administrators because it could lead to excessive customizing and consequent difficulties in installing updates or system upgrades which are based on the assumption of uniform standards. Moreover, it was not possible to determine very well the extent of the need. However, it appears that some minimal additional training might be desirable, and that the need ought to be studied further in the survey.

Other suggested enhancements

NOTES. The only advantage most inspectors said that paper has over the electronic systems is space for notes. On paper forms, they say there is no real limit, while in ASPEN the notes fields are quite limited.

Inspector 1: The note section is too small. You get so far and then it stops and won't let you type anymore. It needs to be a bigger block. Paper is better in that sense.

Inspector 2: thing I'd like to see added is notes. If you want to print the notes, it's a separate sheet if you want the driver to sign it. It's a separate sheet. So, the driver could actually take that sheet and toss it. That note section should be part of the ASPEN section.

Inspector 3 : You really would want to have 2 options. If you wanted to put it on the notes on the same page or if you want to keep it discreet from the carrier, you could still have it on a separate page.

AUTOMATION OF INSPECTION CRITERIA. Inspection of brake characteristics might be able to be automated somewhat, one inspector believes:

Inspector: As long as they're going to fix that (referring to another suggested change in ASPEN) *, there's maximum adjustments on a brake that should be in there. A lot of us have that committed to memory, but if it's already in there…sometimes you have to go back in and look it up. You just documented that it's 2 ¼ inches, and, say a type 30 chamber. That should come up that it is a violation already because it is a violation.*

HC: So once you put the measurements in, you want it to figure out the ratios and tell you that it’s a violation.

Inspector: Exactly.

What should be included in a follow up survey?

As always this qualitative research has raised many more questions than it has answered. Approaches to using the inspection systems vary with several important factors. Thus the central organizing principle of the survey should probably include several broad areas as outlined below.

Inspector characteristics are known at an aggregate level. Thus if the questionnaires can be identified with individuals or even agencies, we will know many things about the inspector and need not ask them. Certain inspectors have broader authority than others, depending on their state and their agency. The states differ in their types of equipment and system completeness. Thus if the questionnaires can be individualized, known institutional characteristics need not be asked.

Though there are eleven general question areas shown below, they can be conceptually grouped into only four when the survey report is prepared: (1) Inspector characteristics; (2) inspector behavior with the systems; (3) inspector attitudes toward the systems; (4) potential improvements.

Specific question areas include at least the following:

- **Inspector characteristics:** Institutional factors
  - State,
  - Agency,
  - Level/breadth of police powers,
  - Nature of equipment (shared, mobile, etc)
  - Status of wireless connection (existing, pending, future),
  - Reliability of connection throughout geography inspector covers,
  - Assignment of a cruiser, van, or fixed site to the inspector.
- **Inspector characteristics:** Personal factors
  - Prior computer experience
  - Duration in service as an inspector
  - Rank
  - Current assignment (i.e., nature of site or sites where inspector conducts inspections)

- **Inspection basics:**
  - To what extent are they still using paper inspection forms?
  - Are they using paper for some inspections and electronic reports for others?
  - Do they use one or two inspectors for a level one inspection?
  - In your most recent 100 level one inspections, what was the average elapsed time spent for a single inspection?

- S Of their most recent 100 inspections of any level:
  - How many were at a fixed weight-check and inspection station?
  - How many were conducted in other multi-purpose sites such as rest areas or parking lots?
  - How many involved stopping a moving truck?

- **How do the inspectors use the systems?**
  - S For example, do they use ISS to screen trucks before final selection or only after selection to inform themselves prior to the inspection but not to screen? If they had a facility and staff that allowed use of inspection scores to screen, would they want to use them?
  - S Do they use a PIQ on every inspection, on some, or none, and why?
  - S In 100 uses of a PIQ in inspections, how often do they find:
    - A previous inspection?
    - An out-of-service violation

- **SAFER:** How often do they upload to SAFER, and how is the upload handled (by whom using what facilities?).
  - S If they have wireless, do they upload after each inspection, or do they wait until repairs have been made?
  - S If they lack wireless, do they have a regular dial-up site at which they update SAFER?
  - S Do they find the wireless and the dial up processes reliable, or do they have problems with either, especially connecting through the dial-up?
  - S If they turn inspections over to others to upload into SAFER, is that someone of their own agency or an allied agency?
  - S If they turn inspections over to others to upload into SAFER, is that done regularly or not? If regularly, is it done daily, weekly, or how often?

- **PIQ:** How do they use the PIQ feature?
  - S Of 100 inspections, how often, if ever, do they find a hit on a PIQ?
  - S Of 100 inspections, how often does a PIQ reveal an out-of-service incident?
  - S Do they consider it valuable or potentially valuable?

- **ISS:** How often are their ISS files updated and by whom?
  - S Same essential series that applies to SAFER – who does it, how often, with what degree of ease or difficulty?

- **Using their computers:**
  - S What computer problems do they encounter? For example, in 100 inspections they perform, how frequently, if ever, do they experience:
    - A system freeze?
    - A lack of listing for the company sought?
    - Other problem?

    - To what extent, if at all, do these kinds of problems cause them to lose all or part of an inspection?
  - Using their system software:
    - Do they access related programs including CDLIS, PC Miler, NCIC, WordPerfect, and perhaps others?
    - How often, in 100 inspections, do they use related programs, including CDLIS, NCIC WordPerfect, and PC Miler?
    - How do they use specific programs – run them from a tab in ASPEN or from a different window, or shut down one program and start another?
    - Have they customized their systems? If so how?

- **Perceived system effects**
  - Strengths and weaknesses
    - What are the strongest aspects of the systems?
    - What are the weakest aspects of the systems?
  - Time / information ratio – two basic dimensions of change
    - Does use of ASPEN and related computer systems save you time, take more time, or make no difference in the total duration of a Level One or Level Three inspection?
      - How much time in minutes?
      - Under a paper system, how long did it take?
    - Does use of electronic information systems change the amount of information you can use and/or report in your inspections?
      - (For report, express as two axes. Elapsed time may not change much, but information level is likely to increase)
    - Are you seeing any change in trucker behavior because of these systems (unlikely at this point)?
  - Time / thoroughness / accuracy ratios
    - For a given 30 minutes spent on an inspection, has thoroughness of your inspections (catching everything) stayed the same, increased or decreased?
    - Has the eventual accuracy of your report (e.g., correct addresses, names, violation codes and other details) stayed the same, increased or decreased?
  - When violations you record become involved in legal proceedings:
    - Are there advantages or disadvantages to the electronic forms compared to paper?
    - In 100 such cases, how many times has the result been to strengthen your case?

- **Targets for improvement**
  - In 100 inspections, how many have codes that accurately and adequately describe the violation, how many only vaguely describe it, and how many are simply lacking altogether?

- S If you use wireless, in 100 inspections, in how many do you have to move to a different location before you can connect?
- S If you could add one feature what would it be?
- S If you could alter or improve one feature of ASPEN, what would it be?

- **Attitude. On rating scales, how do they rate the following:**
  - S The advantages and disadvantages of paper vs electronic systems on various dimensions including:
  - S Accuracy of information from ISS (Vehicle Inspection Score) of problems to look for with a trucker
  - S How often do you find a high inspection score and yet a nearly flawless truck (or vice versa), and why does this occur?
  - S Ease of use
  - S Speed of overall inspection
  - S Adequacy of codes to describe violations / need to use generic codes when you need a more specific code
  - S Speed of certain components of the inspection (see text),
  - S Accuracy of the inspection report
  - S Legibility of the report
  - S Impact of the report on the court and on the trucker
  - S Overall effectiveness of their job using these systems
  - S Adequacy of the combination of their training, front office support, and peer support to handle the specific challenges they have had in:
    - Completing reports
    - Dealing with computer operating problems
  - S Attitude toward the direction of change. For example, "if inspection data systems keep changing the way they have changed in the past three years, rate how effective will they be for you to use two years from now?"

If supervisory level personnel can also be surveyed, some key impacts to study involve overall system efficiency. For example, to what extent has centralized data entry been eliminated? To what extent did paper forms have illegibility and violation code errors that caused delay or other problems?

APPENDIX C:

CONNECTICUT SCREENING ASSESSMENT STUDY (SUPPLEMENTAL ANALYSES)

APPENDIX C: CONNECTICUT SCREENING ASSESSMENT STUDY RESULTS (SUPPLEMENTAL ANALYSES)

1.0 INTRODUCTION

The CVISN Model Deployment Initiative (MDI) is designed to implement the primary CVISN user services in ten participating states to demonstrate their technical and institutional feasibility, costs, and benefits, and to encourage further deployment. Improved safety of commercial motor vehicles is one of the ultimate objectives of the CVISN MDI. However, measuring the direct impact of any technology or process change on safety (quantified by numbers of accidents, injuries, or fatalities) may not be possible for several reasons. For example, accidents are very rare events, and it is not likely that the change in the number of accidents observed during the period of the evaluation will be statistically significant, even if there is a real change in safety. Another reason is that any observed reduction in accidents, fatalities, or injuries might be attributed to other factors (e.g., anti-lock brakes, changes in traffic patterns, etc.).

Therefore, our primary approach to evaluating the safety impacts of CVISN is to measure its impact on the processes that it is expected to most directly affect. In particular, we plan to measure changes in screening effectiveness at sites where CVISN technologies are deployed. To that end, this study attempts to measure changes in screening effectiveness (defined below) at sites where new technologies and/or new information are made available to inspection and enforcement staff at the roadside. Specifically, we will compare the rate at which vehicles representing "high-risk" carriers are inspected at specific sites with the corresponding rate for vehicles representing non-high-risk carriers, and assess whether these rates change as a result of the deployment.

Efforts in Connecticut on the evaluation of CVISN are being coordinated with efforts on the evaluation of the SAFER Data Mailbox (SDM) and the safety-related field operational tests (FOTs) of the I-95 Corridor Coalition CVO Working Group. The SDM is one of the mechanisms by which Safety Information Exchange is achieved at the roadside. The reader is referred to the evaluation plans for the CVISN MDI (July 1998), SAFER Data Mailbox FOT (March 1999), and the I-95 Corridor Coalition Safety FOTs (March 1999) for detailed descriptions of the activities undertaken for each evaluation. Most of the key results from the Connecticut Screening Assessment study were presented with the findings related to Goal Area 1 in the main part of the report. This appendix presents supplemental analyses that support and extend the findings.

2.0 APPROACH

Three different tests were conducted to measure the value brought to the screening process by CVISN. The first was a retrospective analysis of screening performance. Screening performance was monitored and compared against major deployment milestones, such as the deployment of laptops and releases of upgrades to Aspen and ISS. The second was a comparison of the screening procedures conducted by the Connecticut Department of Motor Vehicles and the Connecticut Department of Public Safety (DPS). Both agencies use the ASPEN/ISS systems, but with different protocols and priorities. The goal of this second test was not to measure how well each agency conducts its respective duties. Instead, the test was conducted to establish the degree to which the two organizations use the CVISN and, by comparison, measure the value provided by CVISN. The third test was a comparison of the SAFER Data Mailbox configuration used in Connecticut with the configurations used in other states, with emphasis on the ability to target high-risk carriers at the roadside. A separate evaluation of the SAFER Data Mailbox system is also being conducted. However, the SDM is a component of CVISN, and the extent to which the SDM assists enforcement staff in targeting high-risk vehicles at the roadside will be documented as part of the CVISN evaluation.

2.1 Retrospective Analysis

The first test was a retrospective analysis of screening performance. Connecticut is well ahead of most other states in the exchange of safety information at the roadside. In fact, they have been using ASPEN/ISS at the roadside for several years (to varying degrees). Connecticut already uses ISS to make screening decisions because they believe that it helps enforcement staff identify vehicles from high-risk carriers. To measure the value of the technology, it would have been ideal to run an experiment consisting of a side-by-side comparison of screening performance with and without the technology. However, because the users already recognize the technology as an integral part of their roadside operation, it was not reasonable to temporarily suspend its use – just for study purposes. For this reason, a retrospective analysis was used to measure the impact of ISS over time, noting changes in the system's functionality and level of deployment.

Inspection results from the past several years were extracted and traced against the ASPEN/ISS deployment history in the state. We identified the carrier (and possibly unit number) for each inspection conducted over this time period. The location was also identified, along with other information that could be used to identify the type of screening that was performed. Each vehicle inspected was assigned a safety rating that could be used to judge the effectiveness of the screening process. The goal was to focus inspections on the highest-risk carriers using the highways.

Specifically, we planned to use the SafeStat motor carrier measurement system, developed by the Volpe National Transportation Systems Center, to rate carrier safety performance. SafeStat (Safety Status Measurement System) is an automated, data-driven analysis system that is designed to incorporate current on-road safety performance information and enforcement history with on-site compliance review information in order to measure the relative safety fitness of interstate motor carriers. The system provides the Federal Highway Administration's (FHWA) Office of Motor Carriers (OMC) with the capability to continuously quantify and monitor the safety status of motor carriers, especially unsafe carriers. This allows OMC enforcement and education programs to efficiently allocate resources to carriers that pose a high risk of involvement in accidents.

Over time, the level of CVISN deployment has increased. Not only has the percentage of inspections conducted using ISS as a screening tool increased, but ISS is constantly being improved. In addition, the deployment of SDM has increased the access to safety data at the roadside through the PIQ (previous inspection query) tool, which is being used more and more in Connecticut during inspections to check for recent violations. The interfaces have improved and the information behind the interface has been made more complete and up-to-date. The deployment history in Connecticut was documented, identifying key milestones. Screening effectiveness, in this case measured as the proportion of inspections conducted on high-risk carriers, was monitored over time and compared against these milestones.

2.2 Comparison of Different Operating Scenarios

An important goal of the CVISN evaluation is to compare screening performance under different "configurations" of deployment. This is important because, in practice, no two scenarios are exactly alike – due to differences in layout, procedure, technology, or other factors. In Connecticut, we characterized and monitored screening operations at four weigh scales: Greenwich, Danbury, Middletown, and Union.

In Connecticut, two agencies conduct motor carrier safety inspections: the Department of Motor Vehicles (DMV) and the Department of Public Safety (DPS). The DMV is primarily responsible for enforcing motor carrier safety, and the DPS is responsible for ensuring that motor carriers obey legal weight limits. These objectives affect the approach these organizations take to the screening/inspection process. Differences in their processes, as well as differences in layout, equipment, and traffic composition were documented to determine whether they were related to differences in screening performance.

This was a prospective analysis. In addition to comparing inspection data, we could characterize the traffic stream at the sites selected. Where possible, we compared the safety ratings of trucks in the following subpopulations:

- mainline truck traffic,
- trucks entering scale,
- screened trucks, and
- inspected trucks.

By identifying vehicles in each of these subcategories, we could also estimate the proportion of "high-risk" carriers that were chosen for inspection. This is in contrast to the retrospective analysis, which only allowed estimation of the proportion of inspections that were conducted on high-risk carriers.

This test documents and compares differences in the screening *processes* and determines whether these process differences are related to differences in the types of vehicles selected for inspection.

2.3 Comparison of SAFER Data Mailbox Configurations

The SAFER Data Mailbox project consisted of developing a centralized database that would provide mobile enforcement units with access to real-time data that describes the safety rating of the motor carriers whose vehicles they are inspecting. A specific goal was to catch drivers that have violated out-of-service orders. This system includes two distinct components: adding data to the database, and conducting queries on the database. The participating states differ somewhat on how these components should be implemented.

This test documents the differences between the configuration being deployed by Connecticut and the configuration supported by FHWA for the Eastern States Coalition. This is mainly a qualitative discussion of the functionality differences. Several quantitative aspects of the SDM deployment in Connecticut were measured as part of this study and the SAFER Data Mailbox evaluation (such as timeliness, proportion of vehicles with previous inspections, and the impact of PIQ results on inspection outcomes). However, a quantitative comparison of performance measures was not yet possible given the status of the other participating states. Two key components that were evaluated are the ease of implementation/deployment and the functionality of the systems (e.g., interstate communications such as e-mail).

Because Connecticut enforcement leadership was convinced that the deployed SIE technologies helped their roadside staff conduct their jobs more efficiently, they wanted their inspection staff to use them whenever possible. Therefore, inspectors participating in the Connecticut study used the SIE technology throughout the study period. Alternatives to simple “with/without” test methods were used to measure the impact of the technologies in Connecticut.

3.0 RESULTS

To perform the three analyses presented in the previous section, data were collected in the field, historical data were obtained, and interviews were carried out with inspectors and agency personnel responsible for the management of inspection programs. Field data were collected by observing the inspection operations of two different agencies at four different sites in the winter and spring of 1999. The two agencies who conduct motor carrier safety inspections are the Department of Motor Vehicles (DMV) and the Department of Public Safety (DPS). The four facilities that were observed were Union, Greenwich, Middletown, and Danbury. Data included observation from over 10,000 vehicles entering these weigh stations, recording their DOT numbers and license plates where possible, and recording their path through the facility. Historical data consisted of the results from over 58,000 inspections conducted in Connecticut between October 1995 and June 1999.

Data analysis consisted of comparison of screening results across the four facilities and two agencies over time, and taking into consideration the differences between facilities and agencies in ISS deployment over time. Figure C-1 shows the layout of each of the four facilities. Table C-1 compares the four facilities with regard to various characteristics, including truck traffic volume, the number of inspections, and screening methods.

Table C-1: Connecticut Inspection Station Characteristics

Station	**Union**	**Greenwich**	**Danbury**
Location	POE, I-84 WB	POE, I-95 NB	POE, I-84 EB
Volume	350 trucks/hour	485 trucks/hour	215 trucks/hour
1998 Inspections	4100	1200	1300
Traffic Management	All mainline traffic enters sorter WIM ramp	Continuously opened/closed to manage queue and staff resources	
WIM Screening	- Height, weight - Distant visual inspection from scale house	- Weight - Quick, up-close inspection from WIM booth	No WIM screening
Static Scale Screening	ISS1/ISS2 on scale house computer	ISS1 on scale house computer	No computer screening (Sometimes laptops from cruisers are used)

The sections that follow present the results of the three analyses presented in the previous section. Analyses for both the retrospective analysis and the comparison among different operating scenarios included an assessment of the proportion of inspections that were made of vehicles within different risk categories. Because the analysis of changes in screening effectiveness over time can be considered a comparison among different operating scenarios, the results of all analyses addressing screening effectiveness are presented in Section 3.2.

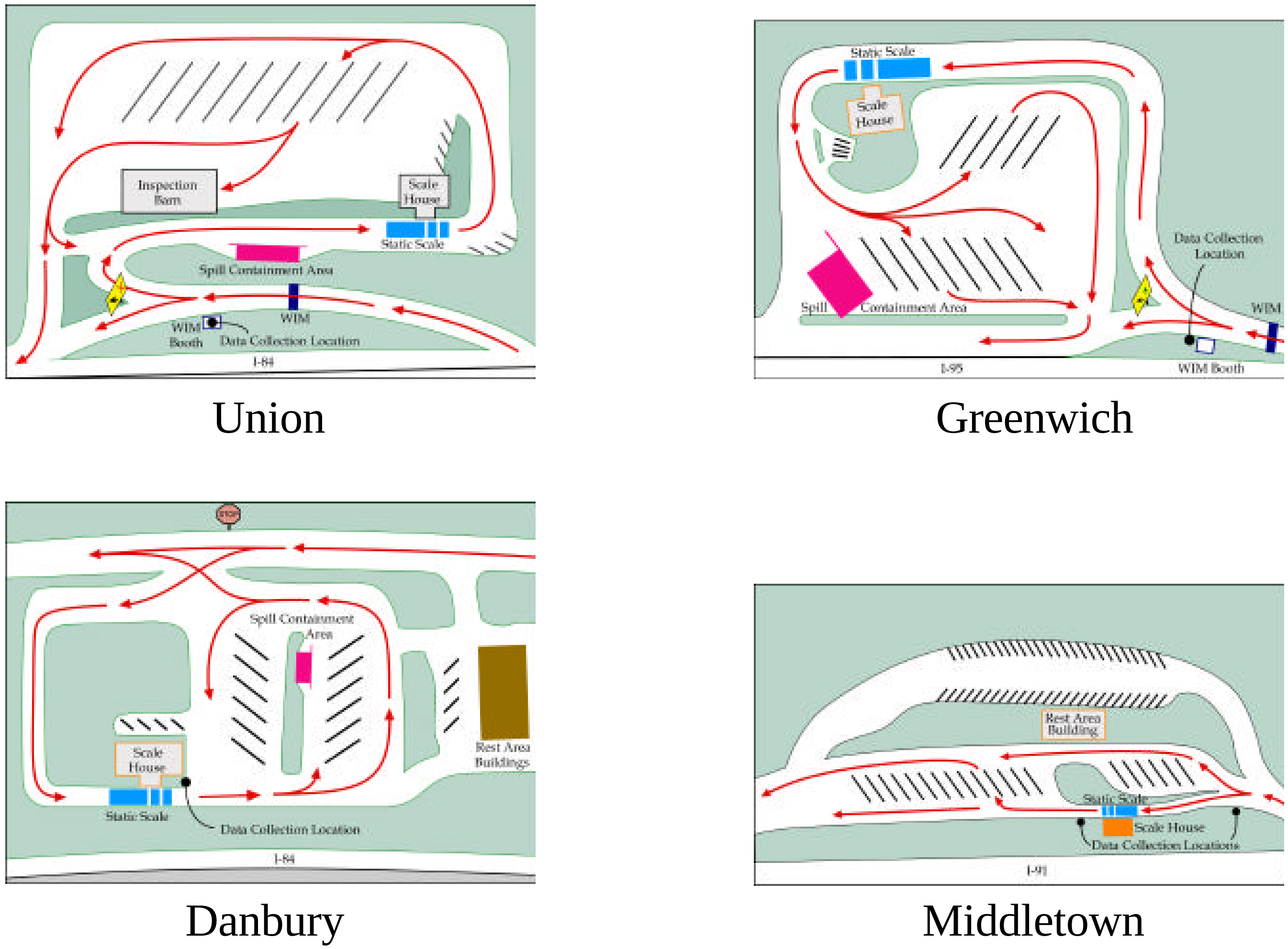

Figure C-1. Schematic Diagrams of the Four Connecticut Facilities

3.1 Retrospective Analysis

The historical inspection data collected from the state of Connecticut was divided into three deployment phases based on the degree to which the inspection selection system (ISS) was deployed. The three deployment phases considered in this analysis are:

- Phase 1: June 1996 to May 1997
- Phase 2: June 1997 to May 1998
- Phase 3: June 1998 to May 1999.

During Phase 1, the DMV utilized ISS while the DPS did not. During Phase 2, the DPS made the transition to the use of ISS. In Phase 3, both the DMV and the DPS had full access to ISS technology. During all three phases, only Greenwich and Union utilized ISS for screening, while Middletown and Danbury did not. ISS was incorporated into the ASPEN system for the processing of inspection data once a vehicle was selected for inspection, regardless of scale location, for all enforcement personnel equipped with a laptop computer. The DMV and DPS performed inspections at all four sites during all three phases, with one exception: there were no DPS inspections at Union during Phase 1. Table C-2 summarizes the pattern of ISS deployment over time in Connecticut. Note that the Connecticut Roadside Screening Study used carrier—not vehicle—safety results from the ISS. That is, if a vehicle was inspected on the basis of an ISS report, it was because the carrier (which is responsible for the vehicle's safety) has a history of safety problems. Similarly, a vehicle was classed as having insufficient data because the carrier that the vehicle represented (not the vehicle itself) had insufficient safety data in the ISS.

Table C-2: Deployment of Inspection Selection Systems in Connecticut by Agency and Inspection Site, 1996 to 1999

		Did the Agency Use ISS?		Did the Site Have ISS?	
Phase	Dates	Department of Motor Vehicles	Department of Public Safety	Greenwich and Union	Middletown and Danbury
1	June 1996 to May 1997	Yes	No	Yes	No
2	June 1997 to May 1998	Yes	Transition	Yes	No
3	June 1998 to May 1999	Yes	Yes	Yes	No

In order to compare the screening performance of a site or agency with and without ISS, an experiment should be designed that has the agency select vehicles for inspection with ISS and then without ISS (or vice versa). Such an experiment was not performed in Connecticut for a specific agency in a specific time period. However, for specified periods of time, Table C-2 shows that we did have a basis for comparing sites with and without ISS by comparing sites and agencies within the three phases.

One of the objectives of the retrospective analysis was to compare the screening effectiveness, measured as the proportion of vehicles from high-risk carriers inspected, by enforcement operation with the implementation of ISS to those vehicles from high-risk carriers inspected without the implementation of ISS. Such a comparison also falls under the objectives of the analysis comparing the screening effectiveness under different operating scenarios. Thus, the comparison of the proportion of high-risk carrier vehicles inspected with and without ISS deployment is given in the subsequent section.

3.2 Comparison of Screening Effectiveness Among Different Operating Scenarios

The SafeStat motor carrier measurement system, developed by the Volpe National Transportation Systems Center, was used to rate carrier safety performance. SafeStat (Safety Status Measurement System) is an automated, data-driven analysis system that is designed to incorporate current on-road safety performance information and enforcement history with on-site compliance review information in order to measure the relative safety fitness of interstate motor carriers. The system provides the Federal Highway Administration's (FHWA) Office of Motor Carriers (OMC) with the capability to continuously quantify and monitor the safety status of motor carriers, especially unsafe carriers. For the screening analyses, the carriers were divided into three risk categories: high risk (HR), medium/low risk (ML), and insufficient data (ID).

The primary objective of the analysis was to compare the proportion of inspected vehicles that were high-risk with and without ISS deployment. A secondary objective was to look at the population of vehicles other than high-risk vehicles, giving attention to vehicles that could not be assigned to a risk classification due to insufficient data. The purpose of this second comparison was to compare the proportion of non-HR, inspected vehicles that had "insufficient data" with and without ISS deployment. The secondary objective is important to consider because ISS gives high priority to inspecting carriers with a bad safety record, as well as carriers with little historical data.

The purpose of evaluating the insufficient data selection efficiency on only non-HR vehicles is best illustrated with an example. Table C-3 illustrates a hypothetical scenario where 70 inspections are performed with and without ISS. Clearly, the HR efficiency has improved threefold with use of ISS (30 versus 10 vehicles). It would appear at first that no change has occurred in the ID efficiency, as in both cases 10 vehicles out of 70 inspections have insufficient data. If use of ISS really did not improve the chance of selecting ID vehicles, however, we would have expected the 20 extra HR inspections to have come proportionately from the MR/LR and ID categories, resulting in about 33 MR/LR and 7 ID vehicles. Since the additional HR inspections came entirely from the MR/LR group, we should conclude that CVISN is indeed successful at targeting ID vehicles more efficiently. The correct comparison is of the ratio of ID inspections to non-HR inspections with ISS (10/40 = 0.25) to the same ratio without ISS (10/60 = 0.17).

Table C-3: Hypothetical Inspection Data to Illustrate The Reason for Evaluating Insufficient Data Efficiency on Only Non-High Risk Vehicles

	HR	MR/LR	ID	Total
Without ISS	10	50	10	70
With ISS	30	30	10	70

Figure C-2 illustrates the two-stage statistical model used to achieve the primary and secondary objectives. First, the proportion of all screenings that are high-risk vehicles is estimated, and then the probability of screening a vehicle with insufficient data given that it is not a high-risk vehicle is estimated. These proportions can be estimated for various combinations of agencies, sites, phases, and ISS usage. As a result, this approach allows us to compare the proportions of high-risk and insufficient data vehicles between sites and agencies.

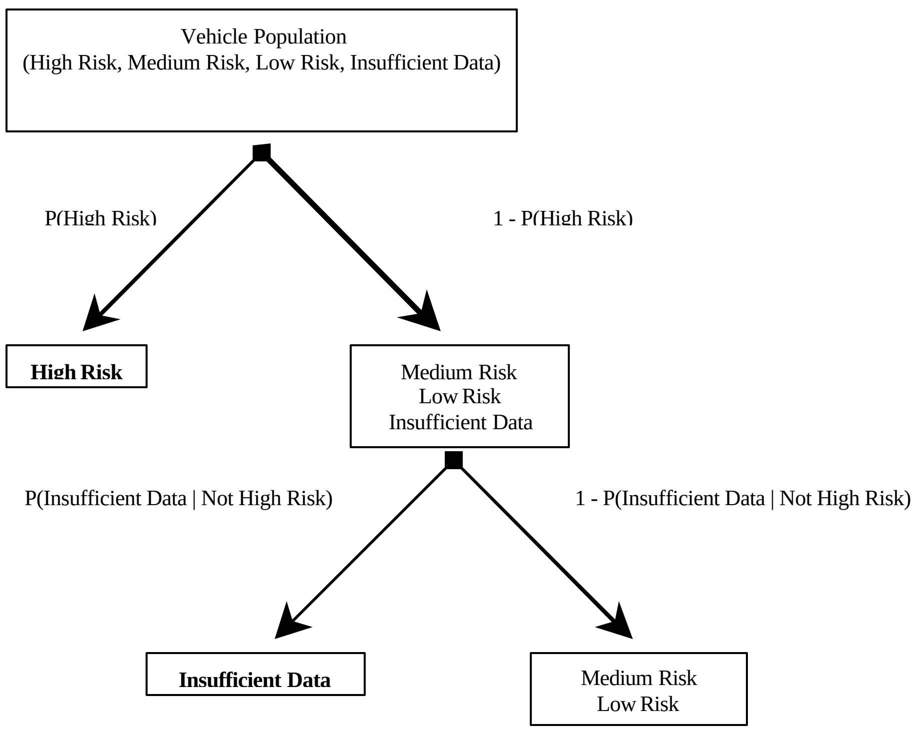

Figure C-2. Two-Stage Model for Vehicle Risk Distribution

Two analyses were performed in order to assess, primarily, the efficiency of ISS in selecting high-risk vehicles and, secondarily, the efficiency of ISS in selecting vehicles with insufficient data. The first analysis compared the screening efficiency of sites with and without ISS during Phase 3 alone. Three subpopulations were considered in this analysis: pooled over DMV and DPS, DMV only, and DPS only. The second analysis compared the screening efficiencies of the two agencies within each of the three phases as a surrogate for a comparison of ISS usage versus non-ISS usage. This analysis was done within the ISS sites only. Again, three subpopulations were considered in this analysis: Greenwich, Union, and pooled over Greenwich and Union.

3.2.1 Comparison of Screening Effectiveness of ISS and Non-ISS During Phase 3

The first analysis compares Union and Greenwich (ISS sites) with Middletown and Danbury (Non-ISS sites) during Phase 3 only, with inspections performed by the DMV and the DPS pooled together. Phase 3 data were used because during this phase both agencies were able to make best use of ISS. Roadside data collection allowed us to characterize the SafeStat makeup of the vehicle populations passing by each site. Thus, all comparisons are controlled for the baseline composition of the trucks in the population.

The two-stage model in Figure C-2 was employed. The first stage estimated the proportion of vehicles from HR carriers in the inspected population and in the population in general. The second stage estimated the proportion of vehicles from ID carriers in the non-HR inspected population and in the non-HR population in general. Thus, we were able to estimate the probability that an inspected vehicle is from a high-risk carrier relative to the population. The “high-risk inspection efficiency” is defined as

$$P(HR \mid inspected) \div P(HR \mid population).$$

For example, at Union, an estimated 5.11 percent of vehicles in the population were high-risk. However, 430 of the 4,036 (10.65%) inspections were of high-risk vehicles. Thus, Union’s high-risk inspection efficiency was 10.65 percent ÷ 5.11 percent = 2.08. The inspection selection process at Union resulted in twice as many high-risk carriers than would be expected if the selection were purely random. Similarly, the “insufficient data inspection efficiency” is defined as

$$P(ID \mid not\ HR\ and\ inspected) \div P(ID \mid non\text{-}HR\ population).$$

For example, at Union, an estimated 16.25 percent of vehicles in the non-HR population had insufficient data to assign a risk classification. However, 706 of the 3,606 (19.58%) inspections of non-HR vehicles were of vehicles with insufficient data. Thus, Union’s insufficient data inspection efficiency was 19.58 percent ÷ 16.25 percent = 1.21. The inspection selection process (among the non-HR vehicles) at Union resulted in 20 percent more insufficient data carriers than would be expected if selection were purely random.

Table C-4 illustrates the estimated risk distributions for the inspected sub-population and the whole population and the estimated inspection efficiencies for each site (inspected ÷ population). Table C-5 provides comparisons of efficiencies between ISS and non-ISS sites. The results of the same analysis for inspections performed by the DMV only may be found in Tables C-6 and C-7. Similarly, Tables C-8 and C-9 present results for the DPS only. The proportion of HR, ID, and ML vehicles were estimated by classifying all vehicles that entered the station during a three-day period, while the inspected proportions were obtained over the entirety of Phase 3, which accounts for a larger number of inspected vehicles than vehicles in the population. Note that the population data are identical for all analyses; only the inspected sub-populations change with the agency.

A consistently statistically significant result is that Union had a greater HR inspection efficiency than Danbury. While a greater proportion of Danbury inspections were of HR vehicles, these vehicles were drawn from a population with a greater proportion of HR vehicles. After adjusting for population differences, inspectors at Union had about twice the efficiency of inspectors at Danbury for selecting HR vehicles.

Looking at DMV inspections only, an additional significant result is that Danbury (a non-ISS site) had a greater ID inspection efficiency than Union (an ISS site). When a selected vehicle was not HR, Danbury did a better job of at least selecting a carrier with insufficient data in order to increase the amount of information for that carrier. For DPS inspections only, Greenwich (an ISS site) had a significantly higher ID inspection efficiency than Middletown (a non-ISS site).

Table C-4. Inspection Efficiency by Site and ISS Usage in Connecticut (Pooled over DMV and DPS)

Site		HR	ID	ML	Total	Total (Non-HR)	P(HR)	P(ID | Not HR)
Union	Inspected	430	706	2900	4036	3606	10.65	19.58%
	Population	181	546	2815	3542	3361	5.11%	16.25%
	Inspected ÷ Population						2.08**	1.21**
Greenwich	Inspected	108	363	731	1202	1094	8.99%	33.18%
	Population	62	190	774	1026	964	6.04%	19.71%
	Inspected ÷ Population						1.49**	1.68**
ISS (Union and Greenwich)	Inspected ÷ Population (Weighted Average [1] of Union and Greenwich Efficiencies)						1.94 [2]	1.32 [2]
Danbury	Inspected	158	219	879	1256	1098	12.58	19.95%
	Population	37	45	297	379	342	9.76%	13.16%
	Inspected ÷ Population						1.29	1.52**
Middletown	Inspected	83	178	705	966	883	8.59%	20.16%
	Population	11	41	208	260	249	4.23%	16.47%
	Inspected ÷ Population						2.03*	1.22
Non-ISS (Danbury and Middletown)	Inspected ÷ Population (Weighted Average [1] of Danbury and Middletown Efficiencies)						1.61 [2]	1.39 [2]

[1] Each site's efficiency is weighted by the proportion of the total inspections performed at that site. For the Insufficient Data Efficiency, the total is the total number of non-HR inspections.
[2] No measure of statistical significance is associated with these figures as they are pooled across analyses.
* Significantly different from 1 at the 0.05 level.

** Significantly different from 1 at the 0.01 level.

Another inference that may be drawn from Analysis 1 is an assessment of how well each agency made use of ISS. The ISS High Risk Efficiencies for the DMV and for the DPS were 1.17 and 1.16, respectively. (See Tables C-7 and C-9) Thus, the two agencies similarly improved their efficiency in selection of high-risk vehicles through use of ISS. The ISS Insufficient Data Efficiencies for the DMV and for the DPS were 0.84 and 1.18, respectively. It seems, therefore, that use of ISS has decreased the DMV's and increased the DPS's efficiency in choosing vehicles with insufficient data for a risk classification among the vehicles left over after selection of high risk vehicles. As footnoted in Tables C-7 and C-9, these efficiency estimates do not have associated levels of statistical significance. They are provided here as an additional qualitative comparison. They were obtained by taking weighted averages of within site efficiencies.

Table C-5: Comparison of Inspection Efficiencies between ISS and Non-ISS Sites in Connecticut (Pooled over DMV and DPS)

Comparison (ISS vs. Non-ISS)		Ratio [1]	P-value
HR Inspection Efficiency	Union vs. Danbury	1.62 *	0.0126
	Union vs. Middletown	1.03	0.9355
	Greenwich vs. Danbury	1.15	0.5360
	Greenwich vs. Middletown	0.73	0.3714
	Union/Greenwich vs. Danbury/Middletown	1.21 [2]	N/A [2]
ID Inspection Efficiency	Union vs. Danbury	0.80	0.1520
	Union vs. Middletown	0.98	0.9246
	Greenwich vs. Danbury	1.11	0.5380
	Greenwich vs. Middletown	1.38	0.0701
	Union/Greenwich vs. Danbury/Middletown	0.95 [2]	N/A [2]

1 A ratio greater than one indicates that the site on the left has a greater observed efficiency. A ratio less than one indicates that the site on the right has a greater efficiency.
2 No measure of statistical significance is associated with these figures as they are pooled across analyses.
* Significantly different from 1 at the 0.05 level.
** Significantly different from 1 at the 0.01 level.

Table C-6: Inspection Efficiency by Site and ISS Usage in Connecticut (DMV Only)

Site		HR	ID	ML	Total	Total (Non-HR)	P(HR)	P(ID | Not HR)
Union	Inspected	372	625	2558	3555	3183	10.46%	19.64%
	Population	181	546	2815	3542	3361	5.11%	16.25%
	Inspected ÷ Population						2.05 **	1.21 **
Greenwich	Inspected	19	42	132	193	174	9.84%	24.14%
	Population	62	190	774	1026	964	6.04%	19.71%
	Inspected ÷ Population						1.63	1.22
ISS (Union and Greenwich)	Inspected ÷ Population (Weighted Average[1] of Union and Greenwich Efficiencies)						2.03 [2]	1.21 [2]
Danbury	Inspected	34	75	240	349	315	9.74%	23.81%
	Population	37	45	297	379	342	9.76%	13.16%
	Inspected ÷ Population						1.00	1.81 **
Middletown	Inspected	58	119	464	641	583	9.05%	20.41%
	Population	11	41	208	260	249	4.23%	16.47%
	Inspected ÷ Population						2.14 *	1.24
Non-ISS (Danbury and Middletown)	Inspected ÷ Population (Weighted Average[1] of Union and Greenwich Efficiencies)						1.74 [2]	1.44 [2]

1 Each site's efficiency is weighted by the proportion of the total inspections performed at that site. For the Insufficient Data Efficiency, the total is the total number of non-HR inspections.
2 No measure of statistical significance is associated with these figures as they are pooled across analyses.
* Significantly different from 1 at the 0.05 level.
** Significantly different from 1 at the 0.01 level.

Table C-7: Comparison of Inspection Efficiencies between ISS and Non-ISS Sites in Connecticut (DMV Only)

Comparison (ISS vs. Non-ISS)		Ratio [1]	P-value
HR Inspection Efficiency	Union vs. Danbury	2.05 **	0.0030
	Union vs. Middletown	0.96	0.8959
	Greenwich vs. Danbury	1.63	0.1458
	Greenwich vs. Middletown	0.76	0.5033
	Union/Greenwich vs. Danbury/Middletown	1.17 [2]	N/A [2]
ID Inspection Efficiency	Union vs. Danbury	0.67 *	0.0247
	Union vs. Middletown	0.98	0.8838
	Greenwich vs. Danbury	0.68	0.0861
	Greenwich vs. Middletown	0.99	0.9564
	Union/Greenwich vs. Danbury/Middletown	0.84 [2]	N/A [2]

[1] A ratio greater than one indicates that the site on the left has a greater observed efficiency. A ratio less than one indicates that the site on the right has a greater efficiency.7

[2] No measure of statistical significance is associated with these figures as they are pooled across analyses.

* Significantly different from 1 at the 0.05 level.

** Significantly different from 1 at the 0.01 level.

Table C-8: Inspection Efficiency by Site and ISS Usage in Connecticut (DPS Only)

Site		HR	ID	ML	Total	Total (Non-HR)	P(HR)	P(ID | Not HR)
Union	Inspected	58	81	342	481	423	12.06%	19.15%
	Population	181	546	2815	3542	3361	5.11%	16.25%
	Inspected ÷ Population						2.36 **	1.18
Greenwich	Inspected	89	321	599	1009	920	8.82%	34.89%
	Population	62	190	774	1026	964	6.04%	19.71%
	Inspected ÷ Population						1.46 *	1.77 **
ISS (Union and Greenwich)	Inspected ÷ Population (Weighted Average[1] of Union and Greenwich Efficiencies)						1.75 [2]	1.58 [2]
Danbury	Inspected	124	144	639	907	783	13.67%	18.39%
	Population	37	45	297	379	342	9.76%	13.16%
	Inspected ÷ Population						1.40	1.40 *
Middletown	Inspected	25	59	241	325	300	7.69%	19.67%
	Population	11	41	208	260	249	4.23%	16.47%
	Inspected ÷ Population						1.82	1.19
Non-ISS (Danbury and Middletown)	Inspected ÷ Population (Weighted Average[1] of Union and Greenwich Efficiencies)						1.51 [2]	1.34 [2]

1 Each site's efficiency is weighted by the proportion of the total inspections performed at that site. For the Insufficient Data Efficiency, the total is the total number of non-HR inspections.

2 No measure of statistical significance is associated with these figures as they are pooled across analyses.

* Significantly different from 1 at the 0.05 level.

** Significantly different from 1 at the 0.01 level.

Table C-9: Comparison of Inspection Efficiencies between ISS and Non-ISS Sites in Connecticut (DPS Only)

Comparison (ISS vs. Non-ISS)		Ratio [1]	P-value
HR Inspection Efficiency	Union vs. Danbury	1.69 *	0.0218
	Union vs. Middletown	1.30	0.4927
	Greenwich vs. Danbury	1.04	0.8619
	Greenwich vs. Middletown	0.80	0.5699
	Union/Greenwich vs. Danbury/Middletown	1.16 [2]	N/A [2]
ID Inspection Efficiency	Union vs. Danbury	0.84	0.3724
	Union vs. Middletown	0.99	0.9507
	Greenwich vs. Danbury	1.27	0.1811
	Greenwich vs. Middletown	1.48 *	0.0498
	Union/Greenwich vs. Danbury/Middletown	1.18 [2]	N/A [2]

1 A ratio greater than one indicates that the site on the left has a greater observed efficiency. A ratio less than one indicates that the site on the right has a greater efficiency.7

2 No measure of statistical significance is associated with these figures as they are pooled across analyses.

* Significantly different from 1 at the 0.05 level.

** Significantly different from 1 at the 0.01 level.

3.2.2 Comparison of Screening Effectiveness Within the Three Phases

The second analysis assessed the utility of ISS via comparisons of agencies within each of the three deployment phases. A comparison of DMV versus DPS acts, in Phase 1, as a surrogate for an ISS versus non-ISS comparison, in Phase 2, as a surrogate for an ISS versus “Transitioning into ISS” comparison, and in Phase 3, as a comparison of agencies that both use ISS. The Phase 3 comparison was a control comparison against which we may compare the results of Phases 1 and 2 to see if agency differences are related to ISS usage or to other unquantified differences between agencies.

Here, only inspections from Greenwich and Union (ISS sites) are used, because the ISS vs. Non-ISS comparison is made between agencies rather than between sites. Comparing agencies within Danbury and Middletown would be a Non-ISS versus Non-ISS comparison, which would not aid in the evaluation of ISS. As comparisons are made within sites, there is no need to control for population differences. Again, the two-stage model in Figure C-2 was employed. The first stage estimated the proportion of HR vehicles inspected by each agency. The second stage estimated the proportion of non-HR vehicles inspected by each agency that had insufficient data for assignment of a risk classification. The probability ratios of interest are

$$P(HR \mid DMV) \div P(HR \mid DPS)$$

and

$$P(ID \mid \text{not } HR, DMV) \div P(ID \mid \text{not } HR, DPS).$$

During Phases 1 and 2, we were unable to identify carriers with insufficient data. Thus, the second ratio is calculated for Phase 3 only. Table C-10 presents the results of Analysis 2.

Conclusions about ISS vs. Non-ISS are limited because screening efficiencies for trucks with insufficient data can only be determined in Phase 3. However, we may conclude that the DPS at Greenwich had a significantly higher ID inspection efficiency than did the DMV at Greenwich during Phase 3.

During Phase 1, the differences between inspections conducted by DMV and DPS were insignificant. (A limited number of inspections were reported for the DPS.) During Phase 2, the DMV performed significantly better at selecting HR vehicles than the DPS at Greenwich. (The two agencies performed similarly at Union.) Thus, when considering HR efficiency, the only significant result supports the hypothesis that ISS improves selection efficiency.

3.3 Comparison of SAFER Data Mailbox Configurations

At present, Connecticut has two different SAFER Data Mailbox system configurations available for use. They currently use the CDPD configuration, although the Motorola 800 MHz system has been tested and will become more integrated given that the CT DPS currently is deploying the Motorola system to all State Police. Figures C-3 and C-4 illustrate the two configurations as they are used in Connecticut.

Figure C-3 shows the CDPD configuration. In this configuration:

- the inspector (mobile patrol or fixed site) completes an inspection using ASPEN and uploads the data via CDPD to the SCA server. Inspections are uploaded after each inspection is completed;
- the SCA server transmits the data to Blizzard-32;
- Blizzard-32 uploads inspection data to the SDMB on a two-minute interval where it becomes immediately available for queries conducted by roadside inspectors across the country;
- Blizzard-32 uploads inspection data to SAFETYNET;
- the data are uploaded from the inspection manager to the SAFETYNET database where they are cleaned and prepared for upload to MCMIS;
- the State uploads data to MCMIS daily;
- the roadside queries conducted as part of an inspection are sent directly to the SDMB via CDPD.

Table C-10: ISS Evaluation Via Agency Comparison: Phases 1 to 3, Connecticut

Site	Agency	HR	Not HR	Total	P(HR)
Phase 1 (June 1996 to May 1997)					
Union	DMV	3	30	33	9.09%
	DPS	0	0	0	--
	DMV ÷ DPS (ISS vs. Non-ISS)				--
Greenwich	DMV	126	716	842	14.96%
	DPS	12	52	64	18.75%
	DMV ÷ DPS (ISS vs. Non-ISS)				0.80
Phase 2 (June 1997 to May 1998)					
Union	DMV	208	2036	2244	9.27%
	DPS	33	319	352	9.38%
	DMV ÷ DPS (ISS vs. Non-ISS)				0.99
Greenwich	DMV	98	511	609	16.09%
	DPS	40	482	522	7.66%
	DMV ÷ DPS (ISS vs. Non-ISS)				2.10 **
Pooled over Sites (ISS vs. Transition into ISS)					1.33

Site	Agency	HR	ID	ML	Total	Total (Non-HR)	P(HR)	P(ID | Not HR)
Phase 3 (June 1998 to May 1999)								
Union	DMV	372	625	2784	3781	3409	9.84%	18.33%
	DPS	58	81	342	481	423	12.06%	19.15%
	DMV ÷ DPS (ISS vs. ISS) (control)						0.82	0.96
Greenwich	DMV	19	42	132	193	174	9.84%	24.14%
	DPS	89	321	611	1021	932	8.72%	34.44%
	DMV ÷ DPS (ISS vs. ISS) (control)						1.13	0.70 *
Pooled							0.89	0.90

* Significantly different from 1 at the 0.05 level.
** Significantly different from 1 at the 0.01 level.

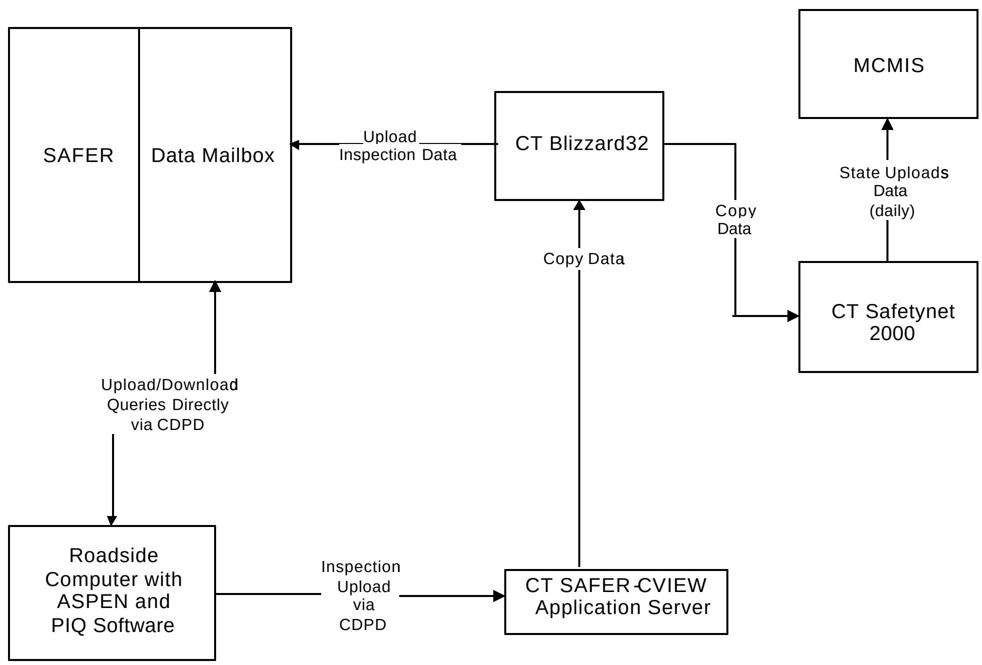

Figure C-3: Connecticut SAFER Configuration Using CDPD System

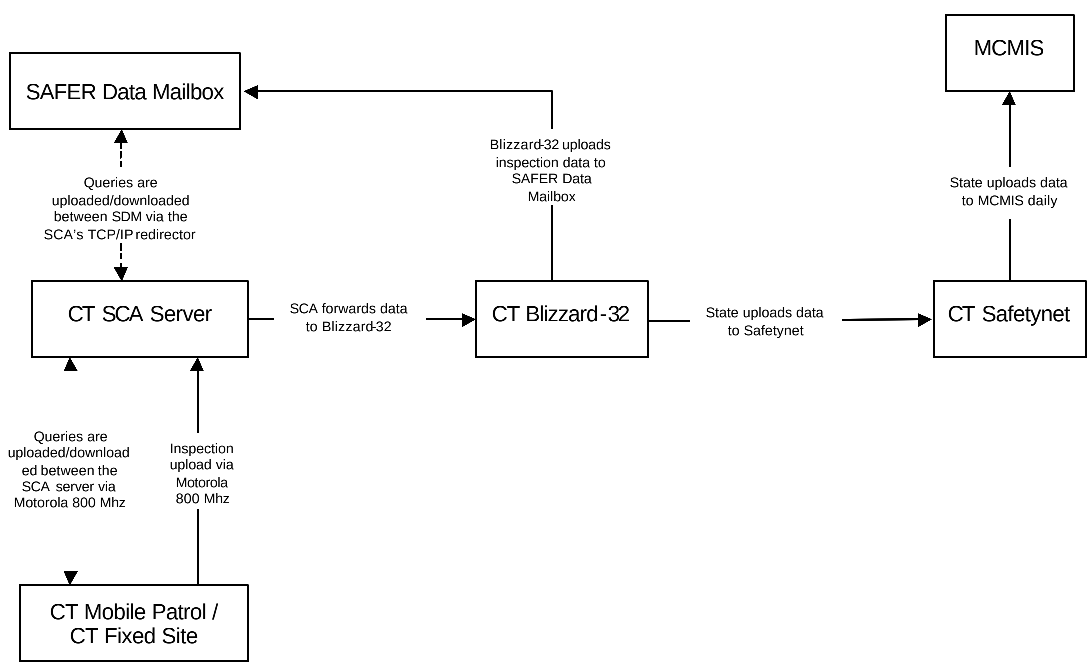

Figure C-4: SCA/Connecticut-Designed SAFER Configuration Using the Motorola 800 MHz System. To be implemented in Massachusetts in cooperation with Connecticut DMV and SCA.

Figure C-4 shows the Motorola 800 MHz Configuration. In this configuration:

- the inspector (mobile patrol or fixed site) completes an inspection using ASPEN and uploads the data via Motorola 800 MHz to the SCA server. Inspections are uploaded after each inspection is completed;
- the SCA server transmits the data to Blizzard-32;
- Blizzard-32 uploads inspection data to the SDMB on a two-minute interval where it becomes immediately available for queries conducted by roadside inspectors across the country;
- Blizzard-32 copies inspection data to the Blizzard-32 Inspection Manager for upload to SAFETYNET;
- the data are uploaded from the inspection manager to the SAFETYNET database where they are cleaned and prepared for upload to MCMIS;
- the State uploads data to MCMIS daily;
- the roadside queries conducted as part of an inspection are sent to the SDMB via the SCA server. The queries are transmitted to the server via the Motorola system and then sent to the SDMB via a TCP/IP redirector.

It should be noted that system changes with the deployment of SAFETYNET2000 should not affect the timeliness of data transmissions.

APPENDIX D:

SAFETY INFORMATION DEPLOYMENT PLANS FOR EASTERN STATES

APPENDIX D:

SAFETY INFORMATION DEPLOYMENT PLANS FOR EASTERN STATES

Main Question	Sub Questions	Responses by State								
		Connecticut	Delaware	Maine	Maryland	Massachusetts	New Jersey	New York	Pennsylvania	Virginia
Number of fixed and mobile inspection units	# of inspection sites statewide	5 fixed stations, 30 mobile units	1 fixed site 15 WIM stations (future)	31 sites	16 fixed sites	14 fixed sites 37 mobile units	Between 100 to 125 sites. 3 are fixed sites	Between 100 to 200 sites. 2 are fixed sites	1 permanent 37 semi-permanent	13 weigh stations, 4 or 5 pull-over sites, and rest all roadside
	Inspection locations	4 rest areas as well as roadside locations	Major artery (Route 13)	N/A	Major interstates, state highways, and by-pass routes	Major interstates, state highways, inner-city locations	Exit parking areas or 3 scale sites	40 rest areas or exit parking areas	Rest areas	Major interstates, and state highways
	Basis for inspection site selection	Safety considerations, available room, traffic volume, historical OOS rates	Safety considerations, available room, traffic volume, historical OOS rates	Truck traffic volume, vehicle and officer safety, space available	Safety considerations, available room, traffic volume, historical OOS rates, and known bypass routes	Safety, available room, traffic volume, historical OOS rates, known bypass routes	Safety considerations, available room, traffic volume, historical OOS rates	Safety considerations, available room, traffic volume, historical OOS rates	Safety considerations, available room, traffic volume, historical OOS rates	Safety considerations, available room, traffic volume, historical OOS rates
	Resources available for inspection (vehicles, trained personnel, equipment etc.,)	2 fixed sites with WIM scales, 30 mobile units, 58 pen-based laptops, 15 DPS SP officers equipped with laptops	4 SP troopers, 4 laptops, and 4 patrol vehicles	25 troopers with scales, 9 civilian inspectors, 2 investigators, 1 supervisor, 36 vehicles	100 troopers, 68 civilian inspectors, and 41 police cadets	37 troopers, 4 sergeants, 41 vehicles, 41 pen-based laptops	3 DOT vans, 21 DOT inspectors, 101 SP troopers, and 24 SP laptops	15 DOT vans, 35 DOT inspectors, 15 Motor carrier investigators, 100 SP troopers, and over 150 laptops	30 DOT vans, 55 DOT inspectors, 200 SP troopers, 50 PUC inspectors, 50 PUC vans, 50 SP laptops through FOT, 140 laptops through other sources	7 SP vans, 48 trained SP inspectors, 48 pen computers

Main Question	Sub Questions	Responses by State								
		Connecticut	Delaware	Maine	Maryland	Massachusetts	New Jersey	New York	Pennsylvania	Virginia
Protocols for screening/selecting trucks to be stopped and/or inspected	Typical inspection team comprises:	3 -5 inspectors for fixed stations, 1-3 inspectors for mobile operations	1-2 SP inspectors	1 or more troopers plus inspectors; indefinite number	3 inspectors	1 trooper, at fixed sites 5 to 10 troopers and 1 sergeant	2-4 SP inspectors	2-3 DOT inspectors and 1 SP trooper	2 DOT inspectors and 1 SP trooper	1 SP inspector
	Basis for selection or rejection of trucks for inspection	Trucks are not stopped for inspections except during special operations or studies which require all vehicles to be stopped	Selection based on observing possible violation. Trucks with current CVSA stickers not selected unless violation observed	Visible defects, possible OW, random selection	Random selection or based on observing possible violation. Trucks with current CVSA stickers not selected unless violation observed	Observing possible violations, trucks with CVSA stickers not selected unless violation is observed	Selection based on observing possible violation. Trucks with current CVSA stickers not selected (may do Level III)	Selection based on observing possible violation. Trucks with current CVSA stickers not selected	Selection based on observing possible violation	Selection based on observing possible violation. Trucks with current CVSA stickers not selected
	Basis for screening of trucks for inspection	Use ISS ratings to focus inspection areas	Use ISS ratings to focus inspection areas	N/A	Use ISS ratings to focus inspection areas	Use ISS ratings to focus inspection areas	Use ISS ratings to focus inspection areas	Use ISS ratings to focus inspection areas	Use ISS ratings to focus inspection areas	Use ISS ratings to focus inspection areas
Types of screening/checks/ inspections performed	Types of checks and inspections performed	Influenced by carrier reputation, ISS information, and inspector's experience. Pre-stop screening for vehicle weight, required decals, and carrier-vehicle-driver safety information. When vehicles are stopped, check vehicle weight, credential/ permits (IRP, IFTA, SSRS, OS/OW), and driver safety status, NCIC, and CDLIS	Influenced by carrier reputation, ISS information, and inspector's experience. Check driver's license, registration, IFTA stickers, IRP registration card. No CDLIS check	Driver/vehicle inspection, regulatory compliance, safety, multi-state driver license history	Levels I, II, & III inspections, driver's license, registration, fuel tax, weight and permits	Carrier reputation, ISS information, trooper's experience, check driver license, registration, IFTA, IRP	Influenced by carrier reputation, ISS information, hazmat, and inspector's experience. Check IRP, SSRS, driver's license. No CDLIS check. No OS/OW screening	Influenced by carrier reputation, ISS information, hazmat, and inspector's experience. Check IRP, SSRS, driver's license. No CDLIS check. OS/OW screened separately, but typically not during safety inspection.	Check IRP, driver's license. No CDLIS check. Conduct OS/OW screening	Influenced by carrier reputation, ISS information, hazmat, and inspector's experience. Check IRP, SSRS, driver's license. Do some CDLIS check. Conduct OS/OW screening
Description of safety/registration/ tax data currently used in roadside screening processes (i.e., carrier safety profiles, list of violators, etc.)	Data sets currently used for inspection purposes	ISS data from ASPEN, NLETS, CDLIS, NCIC, past inspection queries, and WIM	ISS data	Carrier reputation, IFTA suspension list, local law enforcement knowledge	ISS data from ASPEN, registration, driver's license, and NLETS information	ISS data from ASPEN, driver license and NLETS information	ISS, registration, tax, and driver's license data	ISS, registration, tax, and driver's license data	ISS, registration, tax, and driver's license data	ISS data from ASPEN, registration, driver's license, and NLETS information

Main Question	Sub Questions	Responses by State								
		Connecticut	Delaware	Maine	Maryland	Massachusetts	New Jersey	New York	Pennsylvania	Virginia
Methods of providing safety/registration/ tax data to roadside (e.g., hard copy, call-in, diskette for roadside computer, phone lines)	Data obtained via roadside computer	ASPEN, ISS data, NCIC, NLETS, CDLIS, and past inspection queries	ASPEN, ISS data	Hard copies of IFTA suspension lists	ASPEN, ISS data	ASPEN, ISS data	ASPEN, ISS data	ASPEN, ISS data	ASPEN, ISS data	ASPEN, ISS data
	Data obtained by calling in	OS/OW, HAZWASTE	All other data	Carrier and driver violation history via local BMV	All other data	All other data	All other data	All other data	All other data	All other data
	Data currently not available that would be useful	Safety information on in-state carriers not available at roadside.	Carrier safety profiles	ISS and CDLIS via CDPD	Intra-state carrier information not available at roadside	Safety information on in-state carriers not available at roadside, no way of verifying registration of carrier to operate in state	Safety information on in-state carriers not available at roadside. No way of knowing if the carrier is registered to operate in the state	Safety information on in-state carriers not available at roadside. No way of knowing if the carrier is registered to operate in the state	Safety information on in-state carriers not available at roadside. No way of knowing if the carrier is registered to operate in the state	Safety information on in-state carriers not available at roadside. No way of knowing if the carrier is registered to operate in the state
Provision of roadside inspection data to SAFETYNET site and MCMIS	Documentation of inspection data (e.g., ASPEN)	Data entered into ASPEN	Data entered into ASPEN	N/A	Data entered into ASPEN	Data entered into ASPEN	Data entered into ASPEN	Data entered into ASPEN	Data entered into ASPEN	Data entered into ASPEN
	Medium for transmission of inspection data to SAFETYNET site (e.g., hard copy, diskette, phone lines, wireless)	CDPD technology	Wireless	N/A	Telephone lines	Telephone lines	Diskette	Telephone lines	Telephone lines and mail	Mailed weekly on a diskette
	Frequency of uploading of data from SAFETYNET site to MCMIS	Almost real-time	Once in a week	N/A	Once in a week	Once per week	2 times per week	2 times per week	Once every two weeks	Once in a week
Current methods for catching OOS violators	Current methods for catching OOS violators	Limited covert operations. Began using SAFER Data Mailbox	Occasional covert operations	Covert operations via air and ground, terminal audits	Occasional covert operations	Occasional covert operations	Covert operations	Covert operations	Covert operations	Almost round-the-clock enforcement operations
	% of OOS violators	Very minimal	Very minimal	Very minimal	Very minimal	Estimated 8%	Very minimal	On average, 22% of the rechecked vehicles and/or drivers within the last 6 quarters	Very minimal	Very minimal

Main Question	Sub Questions	Responses by State								
		Connecticut	Delaware	Maine	Maryland	Massachusetts	New Jersey	New York	Pennsylvania	Virginia
Historical enforcement data (e.g., no. inspections by level, type violations, in-state carrier safety profiles)	# of inspections conducted per year	15,000	6400 (3200 level 1, 3200 level 2)	6,000	99,692	25,000	47,000	52,110	50,000	42,000
	Rates of violations	Vehicle OOS rate 40%. Driver OOS rate 11.9%	Vehicle OOS rate 27%. Driver OOS rate 10%. (average of level 1 & level 2)	Vehicle OOS rate 30%, driver OOS rate 15%	Vehicle OOS rate 36%. Driver OOS rate 6.3%	Vehicle OOS rate 24%, driver OOS rate 4.9%	40-45%	Vehicle OOS rate 30-35%. Driver OOS rate 8%.	Vehicle OOS rate 26%. Driver OOS rate 8%	Vehicle OOS rate 20%. Driver OOS rate 8%
Specific plans for using SAFER mailbox (i.e., no. of laptops, means of data transmission, selection of deployment locations)	New equipment to be used	All CTDMV (and possibly State Police) mobile units are to be equipped with CDPD	4 laptops	Laptop for each field unit & sergeants	24 laptops, 13 CDPD units, and 3 file servers	40 pen-based laptop computers, CDPD, 800 wireless equipment	2 file servers	9 file servers, 26 portable CDPD units, hand-held devices	206 laptops	48 pen computers
	Methods of data transmission and communication	Continue existing, CDPD wireless connections	CDPD, 800 MHz wireless	CDPD or satellite uplink	CDPD and land line links	CDPD, 800 MHz wireless	CDPD	CDPD and other functional wireless communication, such as DCMA, etc.	Western PA - satellite comms & Eastern PA - CDPD	Telephone lines and CDPD
	Functionality	Continue the existing upload of inspection data to SDM real-time and daily to SAFETYNET/ MCMIS.	Upload the inspection data to SDM. Subsequent upload to SAFETYNET using a modem. Send and receive inspection data from SDM.	As available throughout 1999	Phase I - send inspection data to SDM. Phase II - receive inspection data from SDM	Send inspection to SafetyNet, receive information back	Phase I - send inspection data to SDM. Phase II - receive inspection data from SDM	Phase I - send inspection data to SDM. Phase II - receive inspection data from SDM	Send and receive inspection data from SDM	Send and receive inspection data from SDM

APPENDIX E:

COSTS AND INSTITUTIONAL ISSUES

SAFER DATA MAILBOX EVALUATION

COSTS AND INSTITUTIONAL ISSUES

DRAFT

June 15, 2000

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1.0 INTRODUCTION

The cost analysis and institutional issues study component of Safety and Fitness Electronic Records (SAFER) Data Mailbox (SDM) evaluation is designed to evaluate the time, cost, and institutional issues associated with implementation of SDM in the I-95 corridor coalition states. SDM is a real-time data exchange system that enables roadside enforcement staff to submit commercial vehicle inspection results to a centralized database (SAFER) and conversely obtain prior inspection reports collected at other locations including those in other states. The SAFER system uses a variety of advanced database and electronic communication technologies to provide up-to-date motor carrier and vehicle specific safety information to enforcement officers at the roadside.

The cost analysis is directed at evaluating the cost impacts of implementing SDM. Costs associated with the purchase, maintenance, and operations of SDM components are captured and documented in this report. The SDM components include computer hardware, supporting software, data processing, communications, testing and development, and training. In addition, this report documents information that could help answer the following questions:

- What are institutional benefits of SDM?
- Are there other institutional or non-technical/non-cost impediments or supports to the SDM?
- What are the institutional arrangements that need to change or be modified to facilitate SDM deployment?

Study Goals

The goals of the costs analysis and institutional issues study are to:

Goal 1: Evaluate time, cost, and other impacts of having real-time prior inspection data

The goal has three distinct parts. The first part involves determining the impact of SAFER on the amount of time for inspection or screening activities. The second part involves evaluating any cost changes in utilizing the SAFER system for acquiring timely inspection data. The third part involves evaluating any other impacts that SAFER may have on the inspection and screening process.

In addition to documenting the basic cost elements described above, information was collected to answer the following questions:

- What are the costs of purchasing, maintaining, and using the equipment?
- How much and what type of training is required for enforcement officers to be proficient on use of equipment?

- How are inspection procedures at roadside affected by the need to electronically enter data? Is it feasible to do so?
- Are there other cost implications of real-time data access?

Goal 2: Document institutional issues and benefits of assigning laptop computers to roadside enforcement officers

There are a substantial number of organizations involved in and affected by innovations in roadside enforcement practices. The success of SDM deployment will likely depend on cooperation among these organizations. The organizations include state agencies with commercial vehicle operations (CVO) responsibilities, federal agencies, contractors supporting these agencies, motor carriers, drivers, and regional and national CVO-related associations. Each has its own objectives, priorities, and abilities. This study seeks to identify the institutional issues associated with these organizations and their anticipated impact on the success of the SDM project. Issues such as "probable cause," data privacy, multi-agency responsibilities and communications, and outreach to carriers are identified and documented. Many of these issues are common to participating states, but some issues may be unique. Differences among states are also explored.

2.0 DEPLOYMENT OF SAFER DATA MAILBOX

To appreciate how SDM technology will affect the commercial vehicle enforcement practices, it is important to understand current enforcement practices in the states participating in the SDM project. The following sections summarize the current commercial vehicle enforcement practices and provide an overview of the SDM configuration and operation.

2.1 Current Commercial Vehicle Enforcement Practices

All participating states (Virginia, Maryland, Pennsylvania, Delaware, New York, New Jersey, Rhode Island, Maine, and Connecticut) have fixed sites and mobile units for conducting commercial vehicle enforcement. A majority of the safety enforcement inspections are performed along major interstates and state highways at rest areas, exit parking areas, or other suitable roadside locations. States utilize various resources such as trained personnel (safety inspectors, State Police officers, etc.), vehicles (mobile vans, State Police patrol cars, etc.), and computer equipment (file servers, laptops, pen-based computers, etc.) to assist in conducting commercial vehicle inspections.

Typically, an inspection team comprises two or three inspectors. The inspectors usually select trucks for inspection randomly or based on reasonable cause (i.e., observe possible violation) or based on recommendations of the Inspection Selection System (ISS). In general, vehicles displaying current CVSA stickers are not selected unless a visible and obvious violation is noted. Inspectors equipped with laptop computers use ISS ratings and related safety information (available on laptops) to focus the inspection on certain areas. For example, an inspector may focus his or her inspection on a vehicle's brakes if its carrier has a history of brake violations.

The level of inspection performed is influenced by carrier reputation, ISS rating information, hazmat, and inspector's experience. A roadside safety inspection typically involves checking driver's license, vehicle, vehicle weight, and credentials/permits (IRP, IFTA, SSRS, etc.). While Virginia, Maryland, Pennsylvania, and Connecticut conduct OS/OW screening as part of the safety inspections, Delaware, New York and New Jersey conduct the same as a separate process. Also, Delaware, New Jersey, New York, and Pennsylvania do not conduct a commercial drivers license information system (CDLIS) check, while Virginia conducts some CDLIS checks as part of the safety inspections. Most states perform NLETS and NCIC checks as part of the safety inspection process. Connecticut also performs past inspection queries as part of all safety inspections.

For roadside screening processes, safety inspectors use ISS data (available through ASPEN), which is downloaded from MCMIS and is provided to them on CDs or diskettes prior to SDM deployment. Inspectors in Delaware do not use any carrier safety profiles due to lack of enough data through the ASPEN program. Registration, tax, and driver license data are all available through call-in when the inspectors require additional driver and vehicle information. In the case of Connecticut, ISS is updated weekly, wirelessly, from SAFER, and all mobile inspection units can access CDLIS, NLETS, and NCIC data in real-time via Cellular Digital Packet Data (CDPC) mobile data terminal. Most of the participating states in the SDM project indicated that safety information on in-state carriers is not currently available at the roadside. New York has recently begun to collect this information.

Transfers of inspection data from the roadside to the SAFETYNET and MCMIS typically takes place in three stages. In cases where the inspectors are equipped with laptops, they enter the inspection data into the ASPEN. The inspection data are then transmitted to the SAFETYNET using telephone lines or uploaded onto diskettes and mailed to the state SAFETYNET sites. Thereafter, the states periodically upload the inspection data to the MCMIS. Inspectors who are not equipped with laptops mail the inspection data to the respective state SAFETYNET sites. At the state SAFETYNET site, data are manually entered into SAFETYNET and periodically uploaded to MCMIS. In Connecticut, once entered into ASPEN, the inspection data are transmitted to AVALANCHE via CDPD, then to SAFETYNET using a LAN connection. The inspection data are then uploaded to MCMIS via dial-up on a daily basis.

2.2 Overview of SDM

The SAFER system is intended to provide carrier, vehicle, and driver safety and credential information to fixed and mobile roadside inspection stations. This information will allow the roadside inspector to select vehicles and/or drivers for inspection based on the number of prior carrier inspections, as well as carrier, vehicle, and driver safety and credential historical information. The SDM project is intended to test the effectiveness of the SAFER system and mobile communications technologies to enhance the inspection selection process and identify out-of-service violations. The project includes inspections at fixed weigh scale sites, mobile inspection sites using vans and wireless local area networks, and fully portable wireless units used in police cruisers.

SDM is an online e-mail system that maintains an individual mailbox for each enrolled SAFER user for the purpose of receiving information from SAFER. SAFER allows roadside inspectors to store inspection reports, generated electronically by ASPEN software, in the SAFER system. It also provides inspectors operating anywhere in the U.S. the ability to retrieve inspection reports from SAFER that were stored during the previous 45-day period.

The basic components of SDM systems are: Sierra Wireless MP210, personal computer with a modem and serial ports, printer, Windows 95 or higher operating systems with dial-up networking facility, and ASPEN and PIQ software. The essential component is the Sierra Wireless MP210 modem for portable operations that supports CDPD and circuit-switched dial-up (AMPS) communications.

Inspection reports generated by ASPEN 1.4 or uploaded to SAFER from AVALANCHE 1.4 are stored in the SAFER database for a total of 45 days. The ASPEN software includes a program called past inspection query (PIQ) that enables an inspector to query the SAFER database using a license plate and state ID. ASPEN then presents all of the inspection reports that have been performed on that vehicle over the last 45 days. The details of each report can be studied to determine if a particular vehicle is operating safely and legally.

Significant changes to the ASPEN inspection software and the SAFER hardware and software have been implemented to support this project. These include methods for inspection uploads, storage, and past inspection queries, regular update procedures for the carrier data used by ISS, and digital modem banks (in progress) and CDPD network connections to handle the communications protocols.

3.0 EVALUATION APPROACH

The goals and measures for the cost analysis and institutional issues study are based on certain hypotheses. These hypotheses help develop an evaluation strategy and test plan. The cost analysis component of the study is based on the following hypotheses:

- The costs of purchasing, maintaining, and operating the equipment for SAFER Data Mailbox are minimal
- Time required to enter vehicle/carrier IDs, perform queries, and access inspection reports is negligible
- Beyond cost and time, there are other impacts of real-time data access, such as:
  - New enforcement

- Improved morale
- Increased productivity.

The institutional issues component of the study is based on the following hypotheses:

! There are institutional or other non-technical impediments to using this technology
! There are institutional factors that improve the use of this technology
! Laws such as "probable cause" affect the use of prior inspection reports in making screening decisions.

The data required to estimate the costs to deploy and operate SDM and to assess the institutional issues and benefits associated with its implementation were collected through surveys. A questionnaire was developed to capture sufficient information that would help estimate the costs of hardware, software, labor, training, and communication and to identify all potential institutional issues and benefits. The questionnaire (Attachment 1) was divided into three major sections:

1. Costs – for purchase, operation, and maintenance of equipment
2. Technology solutions – configurations necessary to implement SDM
3. Institutional issues and benefits – non-technical issues supporting or impeding deployment, policy, and procedural changes.

The questionnaire was distributed to representatives of all 10 states participating in the SDM test and I-95 Corridor Coalition. The discussions presented in the following sections are based on responses received from Maryland, Virginia, Pennsylvania, New York, Rhode Island, Maine, and Connecticut. The SDM evaluation is being conducted in concert with the evaluations of the CVISN Model Deployment Initiative and the I-95 Corridor Coalition CVO Safety Field Operation tests.

4.0 COSTS

4.1 Equipment Costs

The degree of deployment of SDM at the time of evaluation varies from state to state. While the type of equipment is generally uniform, the number of units deployed varies widely among the participating states. The differences in the number of units deployed can be attributed to technological and financial factors. In terms of technology, deployment was not initiated at the same time in all states. Secondly, some states have deployed certain pieces of equipment and technologies that are compatible with SDM systems prior to the SDM project. In terms of finances, not all states participating in the SDM project have access to sufficient funds to make any significant progress with SDM deployment, which is therefore delayed.

Table E-1 summarizes the number and unit costs of SDM system components in each state under the SDM project. Table E-1 also shows the projected number of units for long-term statewide deployment. The average unit costs of the components of the SDM system listed below are in 1999 US dollars. It is noted that Connecticut's participation in the SDM evaluation was not funded through the Eastern States coalition grant.

Sierra Wireless MP210	$800 – 1,615
Desktop PC plus internal modem	$1,200 – 1,600
Brayley box	$2,300
Laptop PC	$3,000 – 3,360
Printer	$200 – 300

PCs normally come loaded with the operating systems (Windows 95 or 98). Other pieces of equipment include power converter, mounting hardware and docking stations. Table E-2 shows the total equipment cost under the SDM project and the total estimated equipment costs for long-term statewide deployment. None of the participating states use satellite terminals for data transfer. Only Maryland and New York indicated the use of Brayley boxes as part of the system configuration. Connecticut indicated that Brayley boxes are not effective.

4.2 Operating Costs

The primary driver of operating costs for SDM deployment is the communication cost. Under the SDM project, an agreement was worked out with a service provider, Bell Atlantic. States are expected to develop their own pricing plans with communication service providers at the conclusion of the project. These pricing plans will be negotiated after each state has evaluated its data needs. The communication cost will also depend on the type of service (or connectivity) with Sierra Wireless MP210, i.e., either CDPD or AMPS.

All states interviewed anticipate different communication pricing agreements. New York anticipates multiple arrangements in order to ensure full coverage of the state. Both CDPD and AMPS connectivity are being considered in New York state. Some states have not considered any specific system at the time of evaluation data collection. Most states are in the process of evaluating the data needs or negotiating pricing contracts with the service providers. Rhode Island has a yearly agreement with Bell Atlantic at the cost of $37.05 per unit per month. Connecticut is considering Bell Atlantic and Motorola as potential service providers. The Department of State Police in Connecticut installed Motorola 800 MHz systems statewide that are expected to have data functionality by early 2000.

Communication costs under the SDM project were $55 per unit per month. This amount is the connectivity charge only and does not include air time communication charges. The states, however, anticipate higher communication and other operating costs beyond the SDM project costs.

4.3 Maintenance Cost and Program

States are unable to provide information on the costs of maintaining the equipment. This may be due in part to the fact that in some of the states, deployment was not advanced enough to provide data for evaluation, and in other states, the maintenance was covered by the SDM project. Therefore, the states do not have a good knowledge of how much it costs to maintain the systems.

Table E-1. Summary of costs of system SDM system components

State	Phase of Implementation	Number of units and unit costs	Sierra wireles s MP210	Desktop PC with serial ports & internal modem	Printer	Laptops (for mobile inspectors)	Brayle y box	Satellite terminal
MD	SDM project	# of units	13	3	10	24	13	
		Cost per unit ($)	1615	1570	240	2985		
	Statewide	# of units	TBD	TBD		50+		
		Cost per unit ($)	TBD	1570				
	SDM project	# of units	2	1	10			
		Cost per unit ($)	800	1500	211	3250		
	Statewide	# of units	40		40	40		
		Cost per unit ($)	800			4000		
NY	SDM project	# of units	4	4	0	0	6	
		Cost per unit ($)	1500	1200			2300	
	statewide	# of units	10	1	150	150	26	
		Cost per unit ($)	1500	1200	288	3000	2300	
PA	SDM Project	# of units						
		Cost per unit ($)						
	Statewide	# of units	0	2	1	250		
		Cost per unit ($)		3000	400	3300		
RI	SDM Project	# of units	10		10	10		
		Cost per unit ($)	900		350	6000		
	Statewide	# of units	10		10	10		
		Cost per units	900		350	6000		
VA	SDM Project	# of units			2	3		
		Cost per unit ($)			400	2271		
	Statewide	# of units			1	0		
		Cost per unit ($)						
CT	SDM Project	# of units	48	4	48	48		
		Cost per unit ($)	1000	1600	260	3360		
	Statewide	# of units	48	5		60		
		Cost per unit ($)	900	1600		3360		

Table E-2. Total equipment costs

State	SDM project	Long-term statewide deployment
MD	$106,545	TBD
ME	$16,210	$232,000
NY	$24,600	$574,300
PA	$0	$831,400
RI	$72,500	$72,500
VA	$7,613	TBD
CT	$216,570	$253,660

With regards to the maintenance program, internal maintenance support appears to be the most common approach after the warranties covering the equipment have expired. Normally, states have maintenance agreements with the vendors. It is also noted that, for some types of equipment, such as desktop and laptop computers, by the time the warranty expires the equipment may be ready for replacement. Under these circumstances, no separate maintenance programs are necessary. Also, some states (e.g., Connecticut) include maintenance of equipment under a general umbrella that does not have discrete line items for SDM equipment. In Connecticut, the laptop computers are purchased for general use and not specifically for SDM only. Full time technical support is available to maintain these and other equipment at a cost of around $60,000 per year. Rhode Island spends $500 a year to repair four HP printers.

4.4 Training Costs

All participating states agree that specialized expertise is required to maintain the SDM system. However, the kind and cost of training for specialized expertise is not known. Training is generally provided to inspectors to cover the use of the software and equipment for SDM. In Connecticut, new hires receive a 16-hour training course. The cost of this training is estimated based on a labor rate of $19.25 per hour per officer in Connecticut.

4.5 Labor Costs and Time

Labor rates for staff performing roadside inspections have not changed with the use of SDM technology. The average time taken to perform queries and access inspection reports with SDM technology is approximately 2 to 5 minutes. However, in Connecticut, this process is completed in 25 to 45 seconds. The number of inspections performed has not changed with SDM technology.

5.0 INSTITUTIONAL ISSUES

5.1 General

State agencies responsible for coordinating SDM activities vary from state to state. A few states have shared responsibility between state DOT and the state Police. The general approach is that the agencies responsible for law enforcement, vehicle size and weight enforcement, and economic regulations are in charge of SDM deployment.

During the deployment of SDM, limited institutional issues such as competing budgets and priorities were noted. In states where shared responsibility between state agencies exists, the question of which agency should become the lead agency was identified as a potential institutional issue. This is more relevant to operating and maintenance costs, and the responsibility for network communication charges. In general, budget limitation was identified as the potential institutional issue that should be addressed in long-term statewide deployment of SDM technology.

It was noted that no state laws (e.g., requirement for probable cause to inspect, data privacy) are likely to be affected by SDM implementation. The following sections identify various institutional issues related to SDM implementation.

5.2 Impediments to SDM

Some potential institutional impediments to SDM implementation were identified to include:

- Concerns about information security / data privacy
- The need to implement firewalls to ensure data security
- Concerns about reliability of data**.**

5.3 Support for SDM

Some potential institutional issues that support SDM implementation include:

- SDM implementation enhances identification of high-risk carriers. This results in more efficient use of enforcement resources and helps improve safety. Ultimately, safety improvements attributed to SDM implementation are expected to alleviate political and public pressure to improve truck safety.
- SDM implementation provides faster and more accurate roadside reporting; faster and more efficient data access to mobile operation – this then results in more efficient commercial vehicle enforcement processes.
- SDM implementation enhances prosecution of OOS violations.

- SDM implementation provides the capability to share enforcement data with other states and jurisdictions in a timely fashion.

5.4 Policies and Procedures

The following policies or procedures are likely to be changed as a result of SDM implementation:

- Frequency of updating inspection data (because of expected daily uploads and real-time access to safety information)
- Storage and retrieval protocols (because of real-time access and changes in frequency of uploads)
- Quality improvements in roadside inspections and the resulting data (because of ready access to prior data)
- Screening protocols (because of the potential for use of SDM for mainline screening for previous inspections)
- Management of roadside operations.

5.5 Organizational Structure

With SDM implementation, changes in certain inter-agency relationships are also expected. However, the organizational structure of the individual agencies affected by SDM implementation are not expected to change. For example, close working relationships are expected among agencies given that all agencies must share data and pool resources to facilitate SDM implementation. Thus, closer communication among agencies is expected with SDM implementation. Also, newer communication links will be opened which hitherto were not used.

5.6 Lessons Learned

The following are some lessons learned from the SDM project. These lessons are expected to provide guidance for long-term implementation of SDM statewide, in other states, and implementation of similar projects in the future.

- The scope of the SDM project was too broad to be accomplished as proposed; smaller, more targeted projects within a larger conceptual plan are recommended.
- Establish project requirements and stick to them consistently throughout the implementation of the project.
- Inability of consultants to deliver promised products was identified as a setback in implementing the project. It is suggested that states be included in the consultant selection process.
- Closer coordination among participating states and better technical support are recommended.

- All team members should be included at all stages from the start through design, funding, testing, and application.
- In order to ensure full participation, project responsibilities should be shared among all participating states instead of relying on a select few participants to carry the burden of the project.
- Identify features unique to a state and take those into account in designing and implementing the project. Information exchange and other things that work in one state may not necessarily work with other agencies or states.
- Redesign the Brayley box with commercial vehicle inspectors and their working environment in mind. Brayley boxes are not considered effective by some states. The laptop (MDT) configuration was found to be more flexible compared to Brayley boxes.
- In implementing SDM systems, the impact of communication costs should not be underestimated.

ATTACHMENT E1:

QUESTIONNAIRE: SAFER DATA MAILBOX COSTS, TECHNOLOGY SOLUTIONS, AND INSTITUTIONAL ISSUES/BENEFITS

Attachment E1:
Questionnaire: Safer Data Mailbox Costs, Technology Solutions, and Institutional Issues/Benefits

This questionnaire was developed as part of the evaluation projects for the SAFER Data Mailbox (SDM) and I-95 Roadside Safety (FOT 7) field operational tests. The purpose of the questionnaire is to provide a means of sharing information among participating states on the costs, technology solutions, and institutional issues and benefits of SAFER Data Mailbox and related roadside safety enforcement technologies.

State representatives are asked to complete the questionnaire as much as possible by Monday, March 29, 1999 and FAX a copy to Edward Fekpe at Battelle (FAX No. 614-424-5069). During the week of March 29, Edward will contact you by telephone to resolve any questions or fill in missing information. In the meantime, please call Edward at (614) 424-5343 if you have any questions. You can also call John Orban, Battelle's Evaluation Leader, at (614) 424-5773.

1.0 Costs

1.1 What are the costs of purchasing or lease rates of hardware and software for SDM?

Hardware/Software Component	**Purchased for SDM project***		**Near- and Long-term Statewide Deployment**		
	No. of Units	**Cost per Unit**	**No. of Units by 6/99**	**No. of Units at Full Deployment**	**Cost per Unit**
Sierra wireless MP210					
Satellite terminal					
Desktop PC with serial ports and internal modem					
Printer					
Laptops (for mobile inspectors)					
Windows 95 or higher operating system					
Brayley Box					
Others (specify)					
Others (specify)					
Others (specify)					

* Stewart Kinner will provide cost information on components purchased on SDM project.

1.2 What agreements with communication carriers are you currently enrolled in, or anticipate enrolling in 1999?

		Current Agreement Under SDM project	Anticipated Agreement for Statewide deployment
Mode of connectivity (CDPD, AMPS)		CDPD	
Name of service provider		Bell Atlantic	
Pricing plan / agreement	$/unit/month	55	
	Length of agreement	______ years	
	Usage costs	None	

Comments:____

____

____

1.3 What are the costs of maintaining equipment for SDM?

Maintenance Cost/Unit (Specify Time Period)

a) Sierra wireless MP210 ____

b) Satellite terminal ____

c) Desktop PC ______________________________________

d) Laptops ______________________________________

e) Other ____

f) Other ____

1.4 Describe the maintenance program (e.g., internal support, maintenance agreement with vendor)

____

____

____

1.5 Do any of these components require specialized expertise to maintain? If yes, what kind of expertise?

____

____

____

1.6 What is the training cost for specialized expertise (if required)?

____

____

1.7 What are the labor costs (hourly rates) of officers that use SDM technology?

Designation (e.g., officer) ____________________ Hourly rate $______ /hr

Designation ______________________ Hourly rate $______/hr

1.8 How long does it take an officer to enter vehicle/carrier IDs, perform queries and access inspections reports.

Average time _____________minutes

1.9 Does the SDM technology reduce or increase the number of vehicles screened per enforcement officer? By how much?

Reduced ___________ by _____________ per day

Increased ___________ by _____________ per day

1.10 What are other cost implications of real-time access? (e.g., increased communication costs etc)

____

____

____

____

2.0 Technology Solutions

Please describe the software/hardware configuration used in you state to implement SAFER Data Mailbox. Attach a drawing similar to Figure E-1 in the SDM Evaluation Plan (March 2, 1999). Describe how the system may be different for fixed and mobile units. Be sure to specify the method(s) of communication between components and describe any special software systems that you developed to make the system work. Provide specifications (e.g., processing speed, data storage capacity) for hardware components such as laptops, servers, printers, or modems.

3.0 Institutional Issues/Benefits

3.1 Which agency (DOT, DMV, PVC, Police) is responsible for coordinating the deployment of SDM?

3.2 What other (local or state) agencies are affected?

3.3 What institutional issues (e.g., competing budgets, priorities etc) have arisen between agencies during the deployment of SDM?

3.4 What state laws (e.g., requirement for probable cause to inspect, data privacy etc) affect the way SDM may be used in your state? Please provide specific information.

3.5 What are some institutional or non-technical/non-cost <u>impediments</u> to SDM (e.g., data privacy, data security, agreements with motor carriers etc)?

3.6 What are some institutional or non-technical/non-cost issues that <u>support</u> SDM (e.g., political pressure to stop OOS violators)?

3.7 What agency policies or procedures are likely to change or be modified over time due to SDM implementation (e.g., frequency of data uploads and downloads)?

3.8 How is SDM project coordinated with other projects such as CVISN (e.g., integration with electronic screening or credentialing components)?

3.9 How is the organizational structure likely to be affected by SDM implementation (e.g., coordination/consolidation of activities between agencies or departments)?

3.10 Please describe "lessons learned" to be shared with other states deploying SDM or related technologies.